



SoftwarePolish

Rick Groszkiewicz
2974 Nestle Creek Drive
Marietta, GA 30062-4857

Voice/fax (770) 971-8913
email: rickg@softwarepolish.com
<http://www.softwarepolish.com>

FALL 2008 EA-2A EXAM SOLUTIONS

These solutions DO reflect changes
due to passage of WREERA (12/2008)

Copyright © 2009 by
Rick Groszkiewicz FSA EA

Fall 2008 EA-2A Exam Solutions

These solutions were prepared based on the law as in effect at June 30, 2008. The Pension Protection Act of 2006 (PPA 2006) was included on the syllabus for the first time on the 2007 exam. Since the PPA 2006 minimum funding rules become effective at 01/01/2008, some exam problems have future valuation dates (in 2009 and 2010).

This exam was given in November of 2008. These solutions reflect changes due to passage of WRERA in December of 2008. As such, the answers for certain problems are different than the answers based on the "official" solutions.

These solutions have been compared with those produced by other technical actuaries, and they represent my best understanding of the correct way to solve these problems. As usual, it seems easy to get an answer in the correct range as long as you are not actually taking the exam!

Revision History:

June 10, 2011	Corrected solutions for problems 22 and 34
October 17, 2010	Corrected solutions for problems 4, 31, 39 and 42
October 17, 2009	Corrected solution for problem 6
September 5, 2009	Corrected solution for problem 25
August 31, 2009	Original solutions

NOTES on 2008 exam

Exam Year	Pass Mark	Percentage Who passed	
2008	112	58.2	
2007	112	53.3	
2006	113	58.6	(not a typo!)
2005	99	43.0	
2004	104	44.6	
2003	102	41.4	
2002	112	44.1	

Fall 2008 EA-2A Exam Solutions

For single employer exam problems involving the minimum contribution, you should use the following sequence of steps:

1. Calculate the Funding shortfall, which is defined as the Funding target less the AAV (after reduction for both the carryover balance (CB) and the prefunding balance (PB)).
2. If the Funding shortfall is greater than zero, you should check the Shortfall base exemption. If the Funding shortfall is limited to zero, then you can skip the Shortfall base exemption - all the shortfall and waiver bases are considered fully amortized.
3. The shortfall base exemption is a messy calculation. Define the “modified funding shortfall” as the modified funding target less the modified assets. If the “modified funding shortfall” is less than or equal to zero, then you would not have to set up the Shortfall base.

Modified assets

If any part of the prefunding balance is used to reduce the minimum required contribution, the modified assets equals AAV - PB. Otherwise, the modified assets equal the AAV with no reduction.

Based on exam conditions 30 and 31, the plan sponsor does elect to apply both the CB and the PB against the MRC. As a result, you should set up the modified asset as AAV - PB. In general, the only time you should not do this is when the problem states that the plan sponsor does not elect to apply the CB and the PB against the MRC, or when the plan's funding ratio for the prior year is less than 80% (see note 6 on next page).

Modified funding target

This is equal to the "applicable percentage" times the funding target. WRERA was passed in December of 2008, and it changed the conditions to use values of the applicable percentage less than 100%. ***It is no longer a requirement that a plan have no prior shortfall bases.***

The applicable percentage is equal to 100% for certain plans:

- Plans that were subject to IRC 412(l) in 2007
- Plans that were established after 2007

Here is the table of values for the applicable percentage for all other plans:

Year	2008	2009	2010	2011
Applicable percentage	92%	94%	96%	100%

(next page)

Fall 2008 EA-2A Exam Solutions

Single employer minimum contribution steps - continued:

4. If the plan does satisfy the Shortfall base exemption, the Shortfall amortization installment for the year is zero. If the plan does not satisfy the Shortfall base exemption, you must calculate the amount of the Shortfall base, as well as the Shortfall amortization installment.

The new shortfall base is equal to

- The Applicable percentage times the Funding target
- Minus the Actuarial asset value reduced by both CB and PB
- Minus the present value of prior years' shortfall and waiver amortization installments

$$\text{S/F Amort base} = (\text{Applicable \%})(\text{Funding target}) - (\text{AAV}-\text{CB}-\text{PB}) - (\text{PV of PY Amort})$$

WRERA was passed in December of 2008, and it changed the definition of the Shortfall amortization base to use the applicable percentage. The "official" solutions to exam problems in 2007 and 2008 did not use the same definition.

5. If the Funding shortfall is greater than zero, then the Minimum required contribution (MRC) is equal to the sum of the Target normal cost, the shortfall amortizations, and the waiver amortization. If the Funding shortfall is limited to zero, then the Minimum required contribution is equal to the Target normal cost, plus the Funding target less the AAV (after reduction for both the CB and the PB).
6. If the problem asks for the "smallest amount that satisfies the minimum funding standard", you should apply both the CB and the PB towards the MRC. If the problem asks for the "Minimum required contribution", you do not reflect the CB and PB.

Funding ratio

Exam condition 30 states that the plan sponsor's funding ratio for the prior year was at least 80%, so they are eligible to apply both the CB and the PB against the MRC. If a problem gives you the prior year's valuation results, you should not rely on exam condition 30. You should check the "funding ratio" for the prior year to be sure that the plan can apply the CB and the PB towards the MRC.

Fall 2008 EA-2A Exam Solutions

For multiemployer exam problems involving the deductible limit, you should use the following sequence of steps:

1. Calculate the normal cost plus limit adjustments with interest to the earlier of the end of the plan year or the end of the tax year.
2. Calculate the Full Funding Limitation under Section 404 with interest to the end of the plan year. If this is less than the result of step one, then you can skip to step four.
3. Calculate the absolute minimum amount necessary to produce a non-negative credit balance in the Minimum Funding Standard Account. This is the "smallest amount to satisfy the minimum funding standard" as defined in exam condition 35. This may be increased by the amount of any "includible employer contribution."
4. The maximum deductible limit is the greater of (1) and (3), but not greater than (2).
5. The UCL limit is equal to $140\% \times (\text{Current Liability})$ minus AAV. If this exceeds the deductible limit in step 4, then the final deductible limit will equal the UCL limit. This UCL limit ignores recent benefit improvements for small plans with highly compensated employees.

Fall 2008 EA-2A Exam Solutions

Problem 1

This is a basic question on handling of prior year receivable contributions. In IRC Section 430(g)(4), it states that the actuarial value of assets should include the discounted value of any receivable prior plan year contributions.

The interest rate used for discounting is the effective interest rate for the prior plan year. The effective interest rate is the single rate of interest that reproduces the value of the Funding Target.

You can do the calculation using either simple interest, or compound interest. Both approaches are reasonable, so they must fall within the same answer range.

Compound interest:

$$\begin{aligned} \text{AAV} &= 200,000 + 40,000(1.065)^{-8.5/12} \\ &= 238,255 \end{aligned}$$

Simple interest:

$$\begin{aligned} \text{AAV} &= 200,000 + 40,000[1 + 6.5\% * (8.5/12)]^{-1} \\ &= 238,239 \end{aligned}$$

Answer is B

NOTE:

The rule in IRC 430(g)(4) for discounting the prior year contributions does not apply for the 2008 valuation. The reason is that the Effective rate of interest for 2007 is undefined.

Fall 2008 EA-2A Exam Solutions

Problem 2 – Page 1

Similar to 2007 #18

The key to this problem is knowing how to calculate the Funding target, Target normal cost and the Shortfall amortization base at 01/01/2008 under IRC Section 430. The plan had a 4,000 funding standard carryover balance (CB) at 01/01/2008. All plans start with a zero prefunding balance (PB) in 2008.

Another key to this problem is knowing how to calculate the minimum required contribution (MRC) under IRC Section 430. In general, the MRC is defined as the target normal cost plus the shortfall amortization charge and the waiver amortization charge, all at the valuation date. Exam condition 34 clarifies that “minimum required contribution” means the contribution calculated prior to reflecting the carryover balance or prefunding balance.

The problem tells you that the plan sponsor does not elect to offset both the CB and the PB against the minimum contribution under IRC 430. This overrides exam conditions 30 and 31.

Valuation calculations

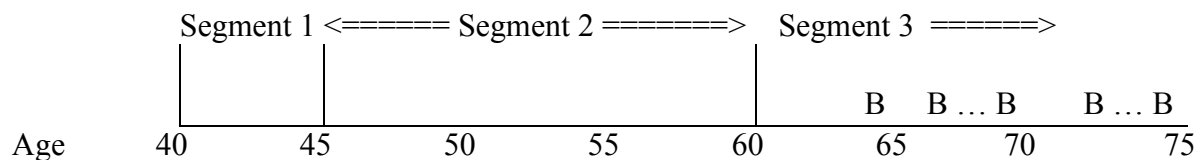
You need to calculate both the Funding target and the Target normal cost at 01/01/2008. These items are the Unit Credit accrued liability and the Unit Credit normal cost, respectively.

The first step is to determine the accrued benefit at the valuation date, and the benefit accrual during 2008. One trick is to allow for the salary increase during 2008:

Valuation date	01/01/2008	01/01/2009
Age	40	41
Past service	12	13
Valuation pay	120,000	120,000*1.06
Accrued benefit	3%(12)(120,000) = 43,200	3%(13)(127,200) = 49,608

$$\Delta AB = 6,408$$

The participant is currently 25 years from retirement, so their benefit payments will be valued using the third segment rate:



Fall 2008 EA-2A Exam Solutions

Problem 2 – Page 2

$$\begin{aligned}AL &= \text{PV of AB} \\&= 43,200(D_{65} / D_{40}) \ddot{a}_{65}^{(12)} \\&= 43,200(1+i)^{-25}({}_{25}p_{40}) \ddot{a}_{65}^{(12)} \\&= 43,200(1.07)^{-25}(8.0) \\&= 63,677 = \text{Funding target}\end{aligned}$$

There are three segment interest rates, but the benefit payments are discounted back to the valuation date using a single rate, based on which segment they fall into. The present value of the benefit payments at 65 is calculated using the third segment rate of 7%, and they are all discounted to the valuation date at 7%. With no pre-retirement decrements, the D/D terms are only based on the 7% interest rate.

$$\begin{aligned}NC &= \text{PV of } (\Delta AB) \\&= 6,408(D_{65} / D_{40}) \ddot{a}_{65}^{(12)} \\&= 6,408(1.07)^{-25}(8.0) \\&= 9,445 = \text{Target normal cost}\end{aligned}$$

Funding Shortfall

The funding shortfall is defined as the excess of the funding target over the 430(f)(4)(B) assets, which equals the actuarial value of assets less the prefunding balance and the carryover balance.

$$\begin{aligned}\text{Funding S/F} &= \text{Funding target} - (\text{AAV} - \text{CB} - \text{PB}) \\&= 63,677 - (60,000 - 4,000 - 0) \\&= 7,677\end{aligned}$$

Shortfall Base Exemption

You should think about whether this plan satisfies the shortfall base exemption. I will define the “modified funding shortfall” as the modified funding target less the modified assets. If the “modified funding shortfall” is less than or equal to zero, then you would not have to set up the Shortfall base for 2008:

- Modified funding target: the applicable percentage times the funding target
- In the absence of any information to the contrary, you can assume the applicable percentage is 92%
- Modified assets: if any portion of any portion of the prefunding balance is applied toward the minimum required contribution, the modified assets equal AAV - PB. Otherwise, the modified assets equal the AAV with no reduction.

Fall 2008 EA-2A Exam Solutions

Problem 2 – Page 3

$$\begin{aligned}\text{Modified S/F} &= 92\% * (\text{Funding target}) - (\text{AAV} - 0) \\ &= .92 * 63,677 - 60,000 \\ &= -1,418\end{aligned}$$

The modified shortfall calculation above does not offset the PB against the AAV. The reason is that the problem states that the plan sponsor does not elect to apply the CB and the PB against the MRC.

Shortfall amortization installment

Since the modified shortfall is less than zero, the plan is eligible for the shortfall base exemption. You do not have to set up the 2008 shortfall amortization base.

Minimum Required Contribution

In general, the minimum required contribution (MRC) is defined as the target normal cost plus the shortfall amortization charge and the waiver amortization charge, all at the valuation date.

$$\begin{aligned}\text{MRC} &= \text{TNC} + \text{Shortfall amort charge} + \text{Waiver amort charge} \\ &= 9,445 + 0 + 0 \\ &= 9,445\end{aligned}$$

01/01/09 Prefunding balance

You are told that the employer contributes 30,000 at 01/01/2008, and that the plan sponsor does not apply the CB to meet the minimum funding standard.

Exam condition 29 states that the plan sponsor elects to credit all contributions in excess of the MRC towards the PB. The excess of the present value of the contribution at 01/01/2008 over the MRC at 01/01/2008 will create a prefunding balance at 01/01/2009. You need to adjust the excess contribution to 01/01/2009. Since the contribution is paid for the 2008 plan year, you use the 2008 effective interest rate to make the adjustment.

One key to this problem is knowing the definition for the effective rate of interest. It is the single rate of interest that reproduces the value of the Funding target. Smith is the sole plan participant, and their Funding target is calculated using the third segment rate of 7%. That means the effective rate of interest is also 7%.

$$\begin{aligned}\text{Excess contrib} &= 30,000 - 9,445 \\ &= 20,555\end{aligned}$$

$$\begin{aligned}01/01/09 \text{ PB} &= 20,555 * (1.07) \\ &= 21,993\end{aligned}$$

Answer is B

NOTE

This is the same answer as under the pre-WRERA rules.

Fall 2008 EA-2A Exam Solutions

Problem 3 – Page 1

The key to this problem is knowing how to calculate the deductible limit under IRC 404(o). You need to know the definition of the cushion amount.

Deductible Limit

The deductible limit is defined as the greater of the minimum contribution required under IRC 430 and the amount under 404(o)(2). IRC 430 defines “the minimum required contribution” as the amount prior to reduction by the carryover balance or the prefunding balance. You don’t have enough information to calculate the shortfall amortization installment in this problem, so you should ignore the minimum contribution.

Here is the maximum deductible contribution under 404(o)(2):

Target normal cost + Funding target + Cushion amount - Actuarial asset value

The Cushion amount is defined as the sum of two pieces: (1) 50% of the Funding target, and (2) the increase in the Funding target due to allowing for future pay increases. You can think of the second item as the excess of the Projected Unit Credit accrued liability over the Traditional Unit Credit accrued liability.

Valuation calculations

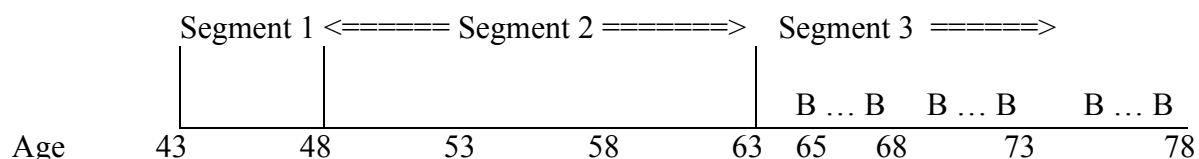
You need to calculate the Funding target and the Target normal cost at 01/01/2009. These items are the Unit Credit accrued liability and the Unit Credit normal cost, respectively. In addition, you need to calculate the Projected Unit Credit accrued liability for the cushion amount.

The first step is to determine the accrued benefit at the valuation date, and the benefit accrual during 2009. One trick is to allow for the salary increase during 2009:

Valuation date	01/01/2009	01/01/2010
Age	43	44
Past service	16	17
Prior year pay	60,000	60,000*1.02
Accrued benefit	$2.5\%(16)(60,000)$ = 24,000	$2.5\%(17)(61,200)$ = 26,010

$$\Delta AB = 2,010$$

The participant is currently 22 years from retirement, so their benefit payments will be valued using the third segment rate of 8%:



Fall 2008 EA-2A Exam Solutions

Problem 3 – Page 2

$$\begin{aligned} \text{AL} &= \text{PV of AB} \\ &= 24,000(D_{65} / D_{43}) \ddot{a}_{65}^{(12)} \\ &= 24,000(1+i)^{-22}({}_{22}p_{43}) \ddot{a}_{65}^{(12)} \\ &= 24,000(1.08)^{-22}(8.0) \\ &= 35,317 = \text{Funding target} \end{aligned}$$

There are three segment interest rates, but the benefit payments are discounted back to the valuation date using a single rate, based on which segment they fall into. The present value of the benefit payments at 65 is calculated using the third segment rate of 8%, and they are all discounted to the valuation date at 8%. With no pre-retirement decrements, the D/D terms are only based on the 8% interest rate.

$$\begin{aligned} \text{NC} &= \text{PV of } (\Delta \text{ AB}) \\ &= 2,010(D_{65} / D_{43}) \ddot{a}_{65}^{(12)} \\ &= 2,010(1.08)^{-22}(8.0) \\ &= 2,958 = \text{Target normal cost} \end{aligned}$$

You need to calculate the PUC accrued liability at 01/01/2009. Under PUC, the accrued liability is defined as the present value of the “funding accrued benefit” (FAB):

$$\text{PUC AL} = \text{PV (FAB)}$$

The 1.412(c)(3)-1 regulation defines "funding accrued benefit":

1. Project pay to retirement age
 2. Calculate the projected benefit
 3. Pro-rate the projected benefit based on service today versus service at retirement.
- This pro-rata calculation must reflect each year's rate of benefit accrual.

For a final average pay plan, you get the same value for the FAB if you apply the benefit formula to past service, but use projected earnings. For a career average pay plan, you must do the calculation as described in the regulations.

$$\begin{aligned} \text{Valuation pay at age 42} &= 60,000 \\ \text{Projected pay at age 64} &= 60,000 * (1.02)^{22} \\ &= 92,759 \end{aligned}$$

$$\begin{aligned} \text{Funding accrued ben} &= 2.5\%(16)(92,759) \\ &= 37,103 \end{aligned}$$

$$\begin{aligned} \text{PUC AL} &= 37,103(D_{65} / D_{43}) \ddot{a}_{65}^{(12)} \\ &= (37,103/24,000)(35,317) \\ &= 54,599 \end{aligned}$$

Fall 2008 EA-2A Exam Solutions

Problem 3 – Page 3

$$\begin{aligned}\text{Cushion amount} &= 50\%(\text{Funding target}) + (\text{PUC AL} - \text{Funding target}) \\ &= \text{PUC AL} - 50\%(\text{Funding target}) \\ &= 54,599 - .5(35,317) \\ &= 36,940\end{aligned}$$

Now you can calculate the deductible limit:

Unit Credit normal cost	2,958
+ Funding target	35,317
+ Cushion amount	36,940
Sub-total	<hr/> 75,215
Less unreduced AAV	40,000
Deductible limit	<hr/> 35,215

Alternative Deductible Limit: At-Risk

For plans that are not At-Risk, there is an alternate definition of the deductible limit in 404(o)(2)(B):

“Final” At-Risk Target normal cost + “Final” At-Risk Funding target - Actuarial asset value

If this plan had some type of subsidized early retirement benefit, or optional forms of payment, then you would need to calculate the At-Risk values of the Funding target and the Target normal cost. Since there is no early retirement benefit, or optional forms of payment, the At-Risk values are the same as the non-At-risk values. The value of the alternate deductible limit assuming the plan is At-Risk will be lower than the value calculated above (by the cushion amount).

The final deductible limit is 35,215.

Answer is E

Fall 2008 EA-2A Exam Solutions

Problem 4 – Page 1

The key to this problem is knowing how to calculate the Shortfall amortization base at 01/01/2009 under IRC Section 430. The plan had a 50,000 funding standard carryover balance (CB) at 01/01/2008. All plans start with a zero prefunding balance (PB) in 2008.

2008 Minimum required contribution

You are told that the plan was exempt from setting up a shortfall base for 2008. The minimum required contribution for 2008 is equal to the target normal cost of 200,000.

Carryover balance and Prefunding balance

You are told that the employer contributes 240,000 at 12/31/2008, and that the plan sponsor does not apply the CB to meet the minimum funding standard.

The carryover balance at 01/01/009 equals the 2008 CB brought forward at the plan's actual rate of return on assets for 2008:

$$\begin{aligned} 01/01/09 \text{ CB} &= 50,000 * (1 - 10.0\%) \\ &= 45,000 \end{aligned}$$

Exam condition 29 states that the plan sponsor elects to credit all contributions in excess of the MRC towards the PB. The excess of the present value of the contribution at 01/01/2008 over the MRC at 01/01/2008 will create a prefunding balance at 01/01/2009. You need to adjust the excess contribution to 01/01/2009. Since the contribution is paid for the 2008 plan year, you use the 2008 effective interest rate to make the adjustment.

$$\begin{aligned} \text{PV of contrib} &= 240,000 / 1.0625 \\ &= 225,882 \end{aligned}$$

$$\begin{aligned} \text{Excess contrib} &= 225,882 - 200,000 \text{ MRC} \\ &= 25,882 \end{aligned}$$

$$\begin{aligned} 01/01/09 \text{ PB} &= 25,882 * (1.0625) \\ &= 27,500 \end{aligned}$$

Funding Shortfall

The funding shortfall is defined as the excess of the funding target over the 430(f)(4)(B) assets, which equals the actuarial value of assets less the prefunding balance and the carryover balance.

$$\begin{aligned} \text{Funding S/F} &= \text{Funding target} - (\text{AAV} - \text{CB} - \text{PB}) \\ &= 3,200,000 - (2,900,000 - 45,000 - 27,500) \\ &= 372,500 \end{aligned}$$

Shortfall Base Exemption

You should think about whether this plan satisfies the shortfall base exemption. I will define the “modified funding shortfall” as the modified funding target less the modified assets. If the “modified funding shortfall” is less than or equal to zero, then you would not have to set up the Shortfall base for 2009:

- Modified funding target: the applicable percentage times the funding target
- In the absence of any information to the contrary, you can assume the applicable percentage is 94%
- Modified assets: if any portion of the prefunding balance is applied toward the minimum required contribution, the modified assets equal AAV - PB. Otherwise, the modified assets equal the AAV with no reduction.

$$\begin{aligned}\text{Modified S/F} &= 94\% * (\text{Funding target}) - (\text{AAV} - 0) \\ &= .94 * 3,200,000 - (2,900,000 - 0) \\ &= 108,000\end{aligned}$$

The modified shortfall calculation above does not offset the entire PB against the AAV. The reason is that the problem states that the plan sponsor does not elect to apply the CB against the MRC. This means that the plan sponsor can not apply the PB against the MRC.

Shortfall amortization installment

Since the modified shortfall is greater than zero, the plan is not eligible for the shortfall base exemption. You have to set up the 2009 shortfall amortization base, which is equal to

1. The Applicable percentage times the Funding target
2. Minus the Actuarial asset value reduced by both CB and PB
3. Minus the present value of prior years' shortfall and waiver amortization installments:

$$\text{S/F Amort base} = (\text{Applicable \%}) * (\text{Funding target}) - (\text{AAV} - \text{CB} - \text{PB}) - (\text{PV of PY Amortizations})$$

This plan was exempt from setting up a Shortfall base in 2008, so there are no prior years' shortfall amortization installments.

$$\begin{aligned}\text{S/F Amort base} &= 94\% * (\text{Funding target}) - (\text{AAV} - \text{CB} - \text{PB}) - \text{zero} \\ &= .94 * 3,200,000 - (2,900,000 - 45,000 - 27,500) - 0 \\ &= 180,500\end{aligned}$$

Answer is A**NOTE**

The official answer using the pre-WRERA rules was 372,500 in answer range D.

Fall 2008 EA-2A Exam Solutions

Problem 5 – Page 1

In general, the Top Heavy (T-H) determination date is the last day of the preceding plan year. An exception to this is the first plan year, when the determination date is the last day of the first plan year. To determine if the defined benefit plan is T-H for the 2009 plan year, the determination date would be December 31, 2008.

Based on questions T-24 and T-25 of the 1.416 regulation, the present value of accrued benefits for the DB plan (or account balance for the DC plan) is calculated as of the valuation date in the 12 month period ending on the determination date. This problem is a bit simpler than some others on IRC 416, since you are not given any information regarding valuation dates.

You should add together the present value of vested and non-vested accrued benefits and the account balances as of the determination date for all participants and the key employees. The amounts should exclude values for terminated employees who have not been employed in the 12 months ending on the determination date, or values for former key employees.

These amounts should include distributions (including benefit payments) within the 12 months ending on the determination date. These amounts should also include any in-service distributions within the 5 years ending on the determination date.

One of three definitions must be satisfied for an employee to be a key employee. They would have to satisfy at least one of these definitions within the 12 month period ending on the determination date:

- (i) Officer with 2008 compensation > 150,000 (2008 value)
- (ii) Someone with more than 5% of the stock ownership
- (iii) Someone with more than 1% of the stock ownership with pay > 150,000

Employee 1 and employee 2 are both key employees, based upon stock ownership. The fact that employees 1 and 2 are officers does not affect their status as a key employee.

Since employee 3 did not have any ownership during 2008, they are not a key employee. Employee 3 is a former key employee. As such, they should be excluded completely from the T-H ratio calculation. Even if they were not a former key employee they would still be excluded from the T-H ratio calculation since they terminated prior to 2008.

You are told that there are unrelated rollover account balances for several employees. The key point of the problem is whether you know how to handle this rollover information. This has never been tested on prior EA exam questions.

The handling of rollovers is covered in the 1.416 regulation, at question T-32. The general rule is that a plan which receives unrelated rollovers ignores the rollover accounts for T-H testing under IRC 416. The plan making the unrelated rollovers would include the rollover accounts for T-H testing under IRC 416.

Fall 2008 EA-2A Exam Solutions

Problem 5 – Page 2

If a plan receives related rollovers, then it includes the rollover account for T-H testing under IRC 416. The plan making the related rollovers would ignore the rollover accounts for T-H testing under IRC 416. Since the plan has an unrelated rollover, you can ignore the rollover information for T-H testing.

Any plan with a key employee must be part of a required aggregation group for T-H testing, so these plans must be aggregated for T-H testing.

	Key?	DB Plan PV of AB	DC Plan Acct balance	Total
Employee 1	Yes	300,000	400,000	700,000
Employee 2	Yes	0	350,000	350,000
Employee 3	No	N/A	N/A	N/A
Employee 4	No	100,000	180,000	280,000
Employee 5	No	60,000	80,000	140,000
Employee 6	No	10,000	30,000	40,000

The Top heavy ratio is

$$69.5\% = 1,050,000 / (1,050,000 + 460,000)$$

Answer is B

NOTES:

1. The fact that employees 1 and 2 are officers does not affect their status as a key employee in this problem. If they were not owners, then the problem would have to give you compensation values to determine if they were key employees.
2. In IRC 416(i), there is a limit on the number of officers counted as key employees. No more than 50 employees (or, if less, the greater of 3 employees or 10% of all employees) shall be treated as officers. This limit has never been tested on prior EA exams.

Fall 2008 EA-2A Exam Solutions

Problem 6 – Page 1

With an individual cost method, there are two things to be aware of. One is that you should check the Full Funding Limitation (FFL) if you have sufficient information. The other is that you should check for experience gains or losses each year.

You have to calculate the experience G/L during 2008. You must determine the expected UAL at 01/01/09, as well as the actual UAL at 01/01/09 before the plan amendment. The difference between those two values is the experience gain or loss base.

There is a trick to this problem. Notice that the contribution for 2008 is zero. In addition, the AAV of 2,800,000 exceeds the Accrued liability of 2,600,000 at 01/01/08. The trick is that you need to check the Full Funding Limitation for 2008. If the FFL applies for 2008, then all prior 431 MFSA bases would be eliminated at 01/01/09.

You need to complete the 2008 MFSA to see if there is a FFL credit for 2008. You are given the amount of the initial accrued liability, so you can calculate the amortization of the IAL. But you should not do that - it is a trap! The problem gives you the net amortization for 2008, which includes amortizations for the IAL, as well as for all prior gain / loss bases.

2008 Minimum Funding Standard Account			
Charges		Credits	
Normal Cost	200,000	Credit Balance	0
Net amortization	15,000	12/31/08 contribution	0
7% interest	15,050	7% interest	0
Total charges	230,050	Total credits	0

Next you should check the Full Funding Limitation. Since you have no current liability information, you must skip the RPA FFL calculation:

$$\begin{aligned}\$431 \text{ "ERISA" FFL} &= (1+i) \cdot (\text{NC} + \text{AL}) - (1+i) \cdot [\text{lesser}(\text{MVA}, \text{AAV}) - \text{CB}] \\ &= 1.07 \cdot (200,000 + 2,600,000) - 1.07 \cdot (2,800,000 - 0) \\ &= 0\end{aligned}$$

Since the FFL is less than the total MFSA charges less the amortization credits, there is a FFL credit for 2008. The amount of the FFL credit is the excess of the total MFSA charges less the amortization credits over the FFL, or 230,050. The resulting credit balance at 12/31/08 is zero.

Due to the FFL credit, all prior MFSA bases are eliminated at 01/01/09. You need to set up two new amortization bases at 01/01/09: one base for the experience loss, and one base for the plan change. As described in Revenue Ruling 81-213, you should set up the gain / loss base first. The gain / loss calculations would be done using the old \$65 benefit. You would handle any other bases afterwards.

Fall 2008 EA-2A Exam Solutions

Problem 6 – Page 2

Since the FFL applies for 2008, you do not calculate the experience gain or loss base as the difference between the expected and actual UAL values. Instead, you use the technique in Section 7 of Revenue Ruling 81-213. You define the 2008 loss base as the amount that satisfies the actuarial balance equation:

$$\begin{aligned} 01/01/09 \text{ UAL} &= \text{O/S 431 bases} - \text{CB} \\ 2008 \text{ Loss} &= 01/01/09 \text{ UAL} + \text{CB} \quad \text{(based on \$65 benefit)} \end{aligned}$$

Under pre-PPA 2006 rules, you had to determine the amount of each amortization base separately. This was required since the bases had different amortization periods. All bases set up after 2007 use 15 years for the amortization period. After PPA 2006 you can simply determine the total base that is established at 01/01/09.

Based on exam condition 37, you should assume that no extensions of amortization periods have been granted. You need to calculate the 2009 valuation results based on the new benefit level:

Benefit level	\$65	\$70
Accrued Liability	3,100,000	$*(70/65)$ $= 3,338,462$
Normal cost	250,000	$*(70/65)$ $= 269,231$

$$\begin{aligned} 01/01/09 \text{ UAL} &= \text{O/S 431 bases} - \text{CB} \\ &= \text{Loss} + \text{plan chg} - \text{CB} \end{aligned}$$

$$\begin{aligned} \text{Loss} + \text{plan chg} &= 01/01/09 \text{ UAL} + \text{CB} \\ &= 3,338,462 - 3,000,000 + 0 \\ &= 338,462 \end{aligned}$$

$$\begin{aligned} \text{Amortization} &= 338,462 \div \ddot{a}_{\overline{15}|.07} \\ &= 34,730 \end{aligned}$$

This problem asks for “the minimum required contribution”. Based on exam condition 34, this amount does not reflect a reduction for the funding standard account credit balance (CB).

2009 Minimum Funding Standard Account			
Charges		Credits	
Normal Cost	269,231	Credit Balance	zero
Total amortization	34,730		
7% interest	21,277	7% interest	zero
Total charges	<u>325,238</u>	Total credits	<u>X</u>

Next you should check the Full Funding Limitation. Since you have no current liability information, you must skip the RPA FFL calculation.

$$\begin{aligned}
 \S 431 \text{ "ERISA" FFL} &= (1+i) \cdot (\text{NC} + \text{AL}) - (1+i) \cdot [\text{lesser}(\text{MVA}, \text{AAV}) - \text{CB}] \\
 &= 1.07 \cdot (269,231 + 3,338,462) - 1.07 \cdot (3,000,000 - 0) \\
 &= 650,231
 \end{aligned}$$

Since the FFL is greater than the total MFSA charges less the amortization credits, there is no FFL credit for 2009. Now you can complete the MFSA for 2009.

2009 Minimum Funding Standard Account			
Charges		Credits	
Normal Cost	269,231	Credit Balance	N/A
Total amortization	34,730	01/01/09 contribution	X
7% interest	N/A	7% interest	N/A
Total charges	<u>303,961</u>	Total credits	<u>X</u>

The problem asks for the minimum required contribution at 01/01/09. That allows you to skip the interest calculations in the MFSA. The minimum required contribution is 303,961.

Answer is B

NOTE

You could determine the amounts of each amortization base separately:

$$\begin{aligned}
 \text{2008 Loss} &= 01/01/09 \text{ UAL} + \text{CB} \quad (\text{based on } \$65 \text{ benefit}) \\
 &= 3,100,000 - 3,000,000 + 0 \\
 &= 100,000
 \end{aligned}$$

$$\begin{aligned}
 \text{Plan change} &= 01/01/09 \text{ AL (on } \$70) \text{ minus } 01/01/09 \text{ AL (on } \$65) \\
 &= 3,338,462 - 3,100,000 \\
 &= 238,462
 \end{aligned}$$

Fall 2008 EA-2A Exam Solutions

Problem 7

FALSE

This is a simple question on IRC 414(l). When a plan is spun off, the assets are allocated based on the PBGC priority categories in ERISA Section 4044. Priority category 6 includes the non-vested portion of the accrued benefit.

Revenue Ruling 86-48 states that the accrued benefit includes future benefits, even if the participant has not yet satisfied the eligibility requirements.

Answer is B

Fall 2008 EA-2A Exam Solutions

Problem 8 – Page 1

This problem asks for “the smallest amount that satisfies the minimum funding standard”. Based on exam condition 35, this amount is calculated by offsetting both the funding standard carryover balance (CB) and the prefunding balance (PB) against the minimum contribution under IRC 430. Based on exam conditions 30 and 31, the plan sponsor does elect to offset both the CB and the PB.

The key to this problem is knowing how to calculate the Shortfall amortization base at 01/01/2009 under IRC Section 430. The plan had a funding standard carryover balance (CB) equal to zero at 01/01/2008. All plans start with a zero prefunding balance (PB) in 2008.

2008 Funding Shortfall

You are told that the plan was effective at 01/01/08. The problem gives you the 2008 Funding shortfall amount. The funding shortfall is defined as the excess of the funding target over the 430(f)(4)(B) assets, which equals the actuarial value of assets less the prefunding balance and the carryover balance.

$$\begin{aligned}\text{Funding S/F} &= \text{Funding target} - (\text{AAV} - \text{CB} - \text{PB}) \\ &= 300,000\end{aligned}$$

2008 Shortfall Base Exemption

You should think about whether this plan satisfies the shortfall base exemption. I will define the “modified funding shortfall” as the modified funding target less the modified assets. If the “modified funding shortfall” is less than or equal to zero, then you would not have to set up the Shortfall base for 2008:

- Modified funding target: the applicable percentage times the funding target
- Since this plan did not exist prior to 2008, the applicable percentage is 100%
- Modified assets: if any portion of the prefunding balance is applied toward the minimum required contribution, the modified assets equal AAV - PB. Otherwise, the modified assets equal the AAV with no reduction.

$$\begin{aligned}\text{Modified S/F} &= 100\% * (\text{Funding target}) - (\text{AAV} - \text{PB}) \\ &= 300,000\end{aligned}$$

Since the PB is equal to zero, the modified funding shortfall is equal to the value given in the data for the funding shortfall for 2008, or 300,000.

Fall 2008 EA-2A Exam Solutions

Problem 8 – Page 2

Shortfall amortization base

Since the modified shortfall is greater than zero, the plan is not eligible for the shortfall base exemption. You have to set up the 2008 shortfall amortization base, which is equal to

1. The Applicable percentage times the Funding target
2. Minus the Actuarial asset value reduced by both CB and PB
3. Minus the present value of prior years' shortfall and waiver amortization installments:

$$\text{S/F Amort base} = (\text{Applicable \%}) * (\text{Funding target}) - (\text{AAV} - \text{CB} - \text{PB}) - (\text{PV of PY Amortizations})$$

There are no prior amortizations at 01/01/08:

$$\text{S/F Amort base} = 100\% * (\text{Funding target}) - (\text{AAV} - \text{CB} - \text{PB}) - \text{zero}$$

Since the CB and PB are both equal to zero, the Shortfall amortization base is equal to the value given in the data for the funding shortfall for 2008, or 300,000.

Shortfall amortization installment

The problem gives you the 2008 segment rates and the amortization factor for the shortfall base:

$$\begin{aligned} 6.0363 &= \ddot{a}_{\overline{5}|.05} + (\ddot{a}_{\overline{7}|.055} - \ddot{a}_{\overline{5}|.055}) \\ &= \underbrace{1 + v^1 + v^2 + v^3 + v^4}_{\text{using } 5.0\%} + \underbrace{v^5 + v^6}_{\text{using } 5.5\%} \end{aligned}$$

$$\begin{aligned} \text{S/F amort} &= 300,000 / 6.0363 \\ &= 49,699 \end{aligned}$$

2009 Funding Shortfall

You are told that the employer paid the minimum required contribution for 2008. The problem also states that the carryover balance and the prefunding balance are both zero at 01/01/09.

The problem gives you the 2009 Funding shortfall amount. The funding shortfall is defined as the excess of the funding target over the 430(f)(4)(B) assets, which equals the actuarial value of assets less the prefunding balance and the carryover balance.

$$\begin{aligned} \text{Funding S/F} &= \text{Funding target} - (\text{AAV} - \text{CB} - \text{PB}) \\ &= 200,000 \end{aligned}$$

Fall 2008 EA-2A Exam Solutions

Problem 8 – Page 3

2009 Shortfall Base Exemption

You should think about whether this plan satisfies the shortfall base exemption. Based on how the exemption worked at 01/01/08, you do not need to waste time thinking about it. This plan does not satisfy the exemption.

Shortfall amortization installment

The plan is not eligible for the shortfall base exemption. You have to set up the 2009 shortfall amortization base, which is equal to

1. The Applicable percentage times the Funding target
2. Minus the Actuarial asset value reduced by both CB and PB
3. Minus the present value of prior years' shortfall and waiver amortization installments:

$$\text{S/F Amort base} = (\text{Applicable \%}) * (\text{Funding target}) - (\text{AAV-CB-PB}) - (\text{PV of PY Amortizations})$$

In this problem, you are given the amount of the 2009 Funding shortfall:

$$200,000 = \text{Funding target} - (\text{AAV} - \text{CB} - \text{PB})$$

$$\text{S/F Amort base} = 200,000 - (\text{PV of PY Amortizations})$$

You must allow for the 2008 amortization installment of 49,699. You need to calculate the 6 year annuity factor, using the new segment rates for 2009:

$$\begin{aligned} 5.1224 &= \ddot{a}_{\overline{5}|.065} + (\ddot{a}_{\overline{6}|.075} - \ddot{a}_{\overline{5}|.075}) \\ &= \underbrace{1 + v^1 + v^2 + v^3 + v^4 + v^5}_{\text{using } 6.5\%} + \underbrace{v^5}_{\text{using } 7.5\%} \end{aligned}$$

$$\begin{aligned} \text{PV of amort} &= 49,699 * 5.1224 \\ &= 254,578 \end{aligned}$$

$$\begin{aligned} \text{2009 S/F base} &= 200,000 - 254,578 \\ &= -54,578 \end{aligned}$$

This negative shortfall base implies that the plan experienced a gain during 2008. The problem gives you the 2009 segment rates and the amortization factor for the shortfall base:

$$\begin{aligned} 5.7703 &= \ddot{a}_{\overline{5}|.065} + (\ddot{a}_{\overline{7}|.075} - \ddot{a}_{\overline{5}|.075}) \\ &= \underbrace{1 + v^1 + v^2 + v^3 + v^4 + v^5 + v^6}_{\text{using } 6.5\%} + \underbrace{v^6}_{\text{using } 7.5\%} \end{aligned}$$

Fall 2008 EA-2A Exam Solutions

Problem 8 – Page 4

$$\begin{aligned}\text{S/F amort} &= -54,578 / 5.7703 \\ &= -9,458\end{aligned}$$

$$\begin{aligned}\text{S/F charge} &= 49,699 - 9,458 \\ &= 40,241\end{aligned}$$

The shortfall amortization charge is defined as the sum of all the shortfall amortizations. The shortfall amortization charge is limited so it is never less than zero. It is allowable for any individual shortfall amortization installment to be less than zero.

Minimum Required Contribution

In general, the minimum required contribution (MRC) is defined as the target normal cost plus the shortfall amortization charge and the waiver amortization charge, all at the valuation date.

$$\begin{aligned}\text{MRC} &= \text{TNC} + \text{Shortfall amort charge} + \text{Waiver amort charge} \\ &= 30,000 + 40,241 + 0 \\ &= 70,241\end{aligned}$$

Smallest amount

The problem asks for “the smallest amount that satisfies the minimum funding standard”:

$$\begin{aligned}\text{Smallest contr} &= \text{MRC} - \text{CB} - \text{PB} \\ &= 70,241 - 0 - 0 \\ &= 70,241\end{aligned}$$

Answer is D

NOTE

This is the same answer as under the pre-WRERA rules.

Fall 2008 EA-2A Exam Solutions

Problem 9

This problem is a simple one on minimum funding requirements.

ASSERTION

This is false. The IRC 404(o) deductible limit for single employer plans is based on the sum of the Funding target, the Target normal cost, and the Cushion amount.

REASON

This is true. The definition of current liability is in IRC 431(c)(6)(D), which only applies to multiemployer plans.

Answer is D

Fall 2008 EA-2A Exam Solutions

Problem 10

This problem is a simple one on quarterly contribution requirements.

TRUE

Quarterly contributions are required for a plan with a Funding shortfall in the prior year. The dates for the quarterly contributions are correct for a calendar year plan.

Answer is A

NOTE

Several students complained about this question being on the exam. Here is exam condition 44:

"The effect of the quarterly requirements and the liquidity shortfall on minimum funding shall be disregarded for the purposes of the November, 2008 examination."

Technically, this question did not ask about the effect of the quarterly contributions.

Fall 2008 EA-2A Exam Solutions

Problem 11 – Page 1

The key to this problem is knowing how to calculate the Funding target, Target normal cost and the Shortfall amortization base at 01/01/2009 under IRC Section 430. The plan had a zero funding standard carryover balance (CB) at 01/01/2008. All plans start with a zero prefunding balance (PB) in 2008.

Another key to this problem is knowing how to calculate the minimum required contribution (MRC) under IRC Section 430. In general, the MRC is defined as the target normal cost plus the shortfall amortization charge and the waiver amortization charge, all at the valuation date. Exam condition 34 clarifies that “minimum required contribution” means the contribution calculated prior to reflecting the carryover balance or prefunding balance.

This problem asks for “the smallest amount that satisfies the minimum funding standard”. Based on exam condition 35, this amount is calculated by offsetting both the funding standard carryover balance (CB) and the prefunding balance (PB) against the minimum contribution under IRC 430. Based on exam conditions 30 and 31, the plan sponsor does elect to offset both the CB and the PB.

Since the CB is zero at 01/01/2008, you know that it is also zero at 01/01/2009. If the employer contributed more than the minimum for 2008, this would potentially increase the PB at 01/01/2009. But this did not happen, since the problem tells you the PB is zero at 01/01/2009.

Valuation calculations

You need to calculate both the Funding target and the Target normal cost at 01/01/2009. These items are the Unit Credit accrued liability and the Unit Credit normal cost, respectively.

You are told that the population consists of 100 clones. You should do calculations for one participant, and then multiply the values by 100 for the total population.

The first step is to determine the accrued benefit at the valuation date, and the benefit accrual during 2009. One trick is to allow for the salary increase during 2009:

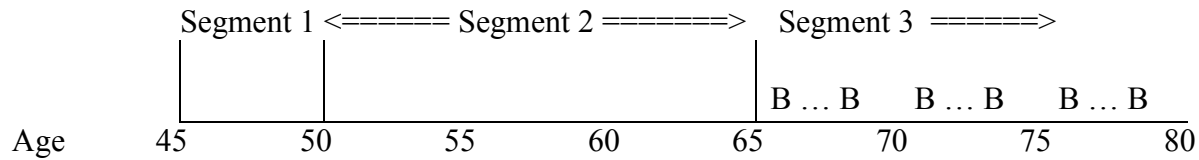
Valuation date	01/01/2009	01/01/2010
Age	45	46
Past service	20	21
Valuation pay	50,000	50,000*1.01
Accrued benefit	1.5%(20)(50,000) = 15,000	1.5%(21)(50,500) = 15,908

$$\Delta AB = 908$$

Fall 2008 EA-2A Exam Solutions

Problem 11 – Page 2

The participant is currently 20 years from retirement, so their benefit payments will be valued using the third segment rate:



$$\begin{aligned}AL &= \text{PV of AB} \\&= 15,000(D_{65} / D_{45}) \ddot{a}_{65}^{(12)} \\&= 15,000(1+i)^{-20}({}_{20}p_{45}) \ddot{a}_{65}^{(12)} \\&= 15,000(1.07)^{-20}(10.0) \\&= 38,763\end{aligned}$$

There are three segment interest rates, but the benefit payments are discounted back to the valuation date using a single rate, based on which segment they fall into. The present value of the benefit payments at 65 is calculated using the third segment rate of 7%, and they are all discounted to the valuation date at 7%. With no pre-retirement decrements, the D/D terms are only based on the 7% interest rate.

$$\begin{aligned}NC &= \text{PV of } (\Delta AB) \\&= 908(D_{65} / D_{45}) \ddot{a}_{65}^{(12)}\end{aligned}$$

$$\begin{aligned}NC &= 38,763 * (908/15,000) \\&= 2,345\end{aligned}$$

Multiply these values by 100 to get the Funding target and Target normal cost for the whole population:

$$\begin{aligned}FT &= 38,763 * 100 \\&= 3,876,285\end{aligned}$$

$$\begin{aligned}NC &= 2,345 * 100 \\&= 234,515\end{aligned}$$

Fall 2008 EA-2A Exam Solutions

Problem 11 – Page 3

Funding Shortfall

The funding shortfall is defined as the excess of the funding target over the 430(f)(4)(B) assets, which equals the actuarial value of assets less the prefunding balance and the carryover balance.

$$\begin{aligned}\text{Funding S/F} &= \text{Funding target} - (\text{AAV} - \text{CB} - \text{PB}) \\ &= 3,876,285 - (3,700,000 - 0 - 0) \\ &= 176,285\end{aligned}$$

Shortfall Base Exemption

You should think about whether this plan satisfies the shortfall base exemption. I will define the “modified funding shortfall” as the modified funding target less the modified assets. If the “modified funding shortfall” is less than or equal to zero, then you would not have to set up the Shortfall base for 2009:

- Modified funding target: the applicable percentage times the funding target
- In the absence of any information to the contrary, you can assume the applicable percentage is 94%
- Modified assets: if any portion of the prefunding balance is applied toward the minimum required contribution, the modified assets equal AAV - PB. Otherwise, the modified assets equal the AAV with no reduction.

$$\begin{aligned}\text{Modified S/F} &= 94\% * (\text{Funding target}) - (\text{AAV} - \text{PB}) \\ &= .94 * 3,876,285 - (3,700,000 - 0) \\ &= -56,292\end{aligned}$$

Shortfall amortization installment

Since the modified shortfall is less than zero, the plan is eligible for the shortfall base exemption. You do not have to set up the 2009 shortfall amortization base.

Minimum Required Contribution

In general, the minimum required contribution (MRC) is defined as the target normal cost plus the shortfall amortization charge and the waiver amortization charge, all at the valuation date. You are told that the shortfall amortization base for 2008 was zero:

$$\begin{aligned}\text{MRC} &= \text{TNC} + \text{Shortfall amort charge} + \text{Waiver amort charge} \\ &= 234,515 + 0 + 0 \\ &= 234,515\end{aligned}$$

Fall 2008 EA-2A Exam Solutions

Problem 11 – Page 4

The problem asks for “the smallest amount that satisfies the minimum funding standard”:

$$\begin{aligned}\text{Smallest contr} &= \text{MRC} - \text{CB} - \text{PB} \\ &= 234,515 - 0 - 0 \\ &= 234,515\end{aligned}$$

Answer is C

NOTES

1. This is the same answer as under the pre-WRERA rules.
2. If the Funding shortfall for a year is zero, then there is a different definition of the MRC. All existing shortfall and waiver amortization bases are considered fully amortized. In that case, the MRC is defined as the target normal cost plus the funding target minus the 430(f)(4)(B) assets, all at the valuation date:

$$\text{ALT MRC} = \text{TNC} + \text{Funding target} - (\text{AAV} - \text{CB} - \text{PB})$$

The resulting MRC is less than the target normal cost, since the 430(f)(4)(B) assets exceed the funding target.

Fall 2008 EA-2A Exam Solutions

Problem 12

This problem is a simple one on shortfall amortization installments.

FALSE

In general, the shortfall amortization installments never change. Once the amount is calculated, it remains constant, regardless of what the segment rates are in future years.

The only time a shortfall amortization installment changes is when it is eliminated. That could be due to two reasons:

- Valuation for a year more than six years after the date the shortfall base is established
- The funding shortfall for the year is zero, which wipes out all the prior shortfall bases, waiver bases, and all the corresponding amortization installments

Since the plan's Funding target attainment percentage is 80% at 01/01/09, you know that the plan has a non-zero Funding shortfall. That means that the 2008 shortfall amortization installment has not been eliminated at 01/01/09.

Answer is B

Fall 2008 EA-2A Exam Solutions

Problem 13 – Page 1

The key to this problem is that the retirement gain / loss calculation is simply the difference between two accrued liability values. One accrued liability is calculated as an active employee, and another is calculated as a retired employee.

Retired AL = PV of Early retirement benefit

Active AL = Funding target = PV of accrued benefit

This is a basic question on your understanding of segment interest rates. Under PPA 2006, you would calculate the present value of a stream of annual benefit payments for a life annuity payable to a person age x (currently in pay status) as follows:

$$\begin{aligned} \text{Present value} &= \sum_{t=0}^4 (1.0500)^{-t} {}_t p_x^{(T)} (\text{Benefit Payment}_{x+t}) \\ &+ \sum_{t=5}^{19} (1.0600)^{-t} {}_t p_x^{(T)} (\text{Benefit Payment}_{x+t}) \\ &+ \sum_{t=20}^{\infty-x} (1.0700)^{-t} {}_t p_x^{(T)} (\text{Benefit Payment}_{x+t}) \end{aligned}$$

You can write the present value formula in terms of annual annuities:

$$\text{Age } x \text{ PV} = \text{Benefit} \left\{ \ddot{a}_{x:\overline{5}|} \text{ at } 5.0\% + (1.06)^{-5} ({}_5 p_x) \ddot{a}_{x+5:\overline{15}|} \text{ at } 6.0\% + (1.07)^{-20} ({}_{20} p_x) \ddot{a}_{x+20} \text{ at } 7.0\% \right\}$$

Funding Target

The Funding Target is defined as the present value of the accrued benefit. It is similar to the traditional Unit Credit accrued liability.

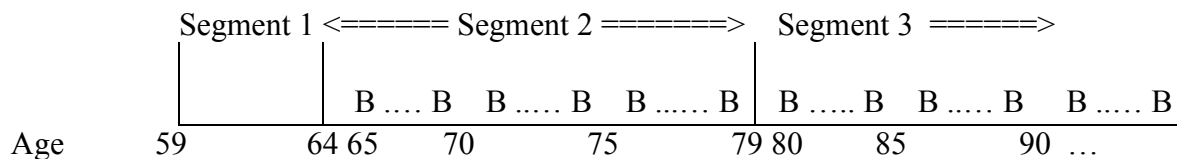
01/01/2009 Age 59

Past service 20

2008 pay (age 58) 100,000

Based on the default exam conditions, normal retirement age is 65, and the benefit is assumed payable monthly, starting at normal retirement age.

The participant is currently 6 years from retirement, so their benefit payments will be valued using the second and third segment rates:



Fall 2008 EA-2A Exam Solutions

Problem 13 – Page 2

The second segment covers benefit payments from age 64 up to age 79 (15 years). Since normal retirement age is 65, there are 14 years of benefit payments valued using the second segment rate. The third segment rate is used to value benefit payments at and after age 79.

Both the accrued benefit and the early retirement benefit are calculated based on the final pay at 01/01/2009:

$$\begin{aligned}\text{Accrued benefit} & \quad 1.0\%(20)(\text{Final pay}) \\ & \quad 1.0\%(20)(100,000) = 20,000\end{aligned}$$

The calculation of the Funding target uses the accrued benefit. Here is the formula for the Funding target using monthly annuity rates:

$$\begin{aligned}\text{Age 59 FT} &= 20,000 * [{}_6| \ddot{a}_{59:\overline{14}| \text{seg}_2}^{(12)} + {}_{20|} \ddot{a}_{59 \text{seg}_3}^{(12)}] \\ &= 20,000 * [(v^6 p_{59}) \ddot{a}_{65:\overline{14}| \text{seg}_2}^{(12)} + (v^{20} p_{59}) \ddot{a}_{79 \text{seg}_3}^{(12)}]\end{aligned}$$

Notice that the second annuity actually starts 20 years from the valuation date. Now you need to express these annuities in terms of commutation functions.

One important aspect of the problem is that the pre-retirement mortality and post-retirement mortality are the same. This means you can simply use the commutation functions to do all present value calculations, even prior to benefit commencement age.

$$\begin{aligned}{}_6| \ddot{a}_{59:\overline{14}| \text{seg}_2}^{(12)} &= (v^6 p_{59}) \ddot{a}_{65:\overline{14}| \text{seg}_2}^{(12)} && \text{all at segment 2 rate} \\ &= (D_{65} / D_{59}) * (N_{65}^{(12)} - N_{79}^{(12)}) / D_{65} && \text{all at segment 2 rate} \\ &= (N_{65}^{(12)} - N_{79}^{(12)}) / D_{59} && \text{all at segment 2 rate}\end{aligned}$$

$$\begin{aligned}{}_{20|} \ddot{a}_{59 \text{seg}_3}^{(12)} &= (v^{20} p_{59}) \ddot{a}_{79 \text{seg}_3}^{(12)} && \text{all at segment 3 rate} \\ &= (D_{79} / D_{59}) * (N_{79}^{(12)} / D_{79}) && \text{all at segment 3 rate} \\ &= N_{79}^{(12)} / D_{59} && \text{all at segment 3 rate}\end{aligned}$$

$$\begin{aligned}\text{Age 59 FT} &= 20,000 [\frac{(215,712 - 41,247)}{30,147} + \frac{18,721}{17,324}] \\ &= 20,000 [5.7871 + 1.0806] \\ &= 137,356\end{aligned}$$

Fall 2008 EA-2A Exam Solutions

Problem 13 – Page 3

Retired calculations

The PVB as a retiree is calculated using the early retirement benefit:

$$\text{Early retirement factor @ 59} \quad 1 - 5\%(65-59) = .70$$

$$\text{Early retirement benefit} \quad .70(20,000) = 14,000$$

Since benefits are assumed to start immediately, the PVB is calculated using all three segment rates. The first segment covers benefit payments from age 59 up to age 64 (5 years). The second segment covers benefit payments from age 64 up to age 79 (15 years). The third segment rate is used to value benefit payments at and after age 79.

Here is the formula for the PVB as a retiree using monthly annuity rates:

$$\begin{aligned} \text{Age 59 PVB} &= 14,000 * [\ddot{a}_{59:\overline{5}| \text{seg}_1}^{(12)} + {}_5|\ddot{a}_{59:\overline{15}| \text{seg}_2}^{(12)} + {}_{20}|\ddot{a}_{59 \text{seg}_3}^{(12)}] \\ &= 14,000 * [\ddot{a}_{59:\overline{5}| \text{seg}_1}^{(12)} + (v^5 {}_5p_{59}) \ddot{a}_{64:\overline{15}| \text{seg}_2}^{(12)} + (v^{20} {}_{20}p_{59}) \ddot{a}_{79 \text{seg}_3}^{(12)}] \end{aligned}$$

Now you need to express these annuities in terms of commutation functions:

$$\ddot{a}_{59:\overline{5}| \text{seg}_1}^{(12)} = (N_{59}^{(12)} - N_{64}^{(12)}) / D_{59} \quad \text{all at segment 1 rate}$$

$$\begin{aligned} {}_5|\ddot{a}_{59:\overline{15}| \text{seg}_2}^{(12)} &= (v^5 {}_5p_{59}) \ddot{a}_{64:\overline{15}| \text{seg}_2}^{(12)} && \text{all at segment 2 rate} \\ &= (D_{64} / D_{59}) * (N_{64}^{(12)} - N_{79}^{(12)}) / D_{64} && \text{all at segment 2 rate} \\ &= (N_{64}^{(12)} - N_{79}^{(12)}) / D_{59} && \text{all at segment 2 rate} \end{aligned}$$

$$\begin{aligned} {}_{20}|\ddot{a}_{59 \text{seg}_3}^{(12)} &= (v^{20} {}_{20}p_{59}) \ddot{a}_{79 \text{seg}_3}^{(12)} && \text{all at segment 3 rate} \\ &= (D_{79} / D_{59}) * (N_{79}^{(12)} / D_{79}) && \text{all at segment 3 rate} \\ &= N_{79}^{(12)} / D_{59} && \text{all at segment 3 rate} \end{aligned}$$

$$\begin{aligned} \text{Age 59 PVB} &= 14,000 [\frac{(702,264 - 471,496)}{52,739} + \frac{(236,751 - 41,247)}{30,147} + \frac{18,721}{17,324}] \\ &= 14,000 [4.3757 + 6.4850 + 1.0806] \\ &= 167,178 \end{aligned}$$

Fall 2008 EA-2A Exam Solutions

Problem 13 – Page 4

Gain / Loss calculation

The gain or loss on retirement is the difference between the PVB as a retiree and the Funding target as an active employee. Since the retiree PVB is greater, there is a loss:

$$\begin{aligned}\text{Ret loss} &= 167,178 - 137,356 \\ &= 29,823\end{aligned}$$

Answer is A

NOTES:

1. It was potentially confusing to see a gain / loss question for a single employer plan on this exam. Of course, this gets funded as part of the shortfall amortization base for the year, along with "everything else."
2. If there was no pre-retirement mortality in this problem, the Funding target calculations would be even trickier. The problem would have to give you the values of the segment interest rates. For the first 6 years, the discount would use interest only. After 6 years, there would be a discount for both interest and post-retirement mortality.

Fall 2008 EA-2A Exam Solutions

Problem 14

Similar to 2007 #34

The Unit Credit accrued liability is defined as the present value of the actual accrued benefit. The key to this problem is handling the multiple retirement decrements correctly in calculating the Accrued liability as an active employee.

Age 49 at 01/01/09

Past Service 18 years

There is only one retirement decrement at age 62. You need to allow for the probability of survival to retirement age. At each retirement age, you need to calculate the early retirement benefit.

With multiple retirement decrements, the accrued liability usually must be calculated as a complicated summation:

$$AL = \sum_{t=13}^{16} v^t p_{49}^{(T)} q_{49+t}^{(r)} (ER \text{ Ben})_{49+t} \ddot{a}_{49+t}^{(12)}$$

In this problem, you have an easier calculation due to the single early retirement decrement. You can calculate the accrued liability based on the 50% decrement at age 62, with the remaining 50% assumed to retire at NRA 65.

The Unit Credit accrued liability uses the participant's accrued benefit at the valuation date. For the exit assumed at age 62, you must calculate the early retirement factor at age 62:

$$ER \text{ factor at } 62 = .76 = [1 - 8\% \cdot (65 - 62)]$$

The benefit formula in this problem is a bit unusual. The participant has 9 years of service prior to 2000 (years 1991 through 1999) and 9 years of service after 1999 (years 2000 through 2008).

$$\begin{aligned} NRB \text{ at } 65 &= 12(40)(9) + 12(60)(9) \\ &= 10,800 \end{aligned}$$

$$\begin{aligned} AL &= v^{13} {}_{13}p_{49}^{(T)} q_{62}^{(r)} (ER \text{ Ben})_{62} \ddot{a}_{62}^{(12)} + v^{16} {}_{16}p_{49}^{(T)} q_{65}^{(r)} (NR \text{ Ben})_{65} \ddot{a}_{65}^{(12)} \\ &= (1.06)^{-13} (1.0)(.50)(10,800)(.76)(11.42) + (1.06)^{-16} (.50)(1.0)(10,800)(10.65) \\ &= 10,800[.50(4.0691) + .50(4.1923)] \\ &= 44,612 \end{aligned}$$

Answer is B

This seems way too easy for a 5 point problem!

Fall 2008 EA-2A Exam Solutions

Problem 15 – Page 1

Similar to 2007 #03

The key to this problem is knowing how to calculate the deductible limit under IRC 404(o). You need to know the definition of the cushion amount.

Deductible Limit

The deductible limit is defined as the greater of the minimum contribution required under IRC 430 and the amount under 404(o)(2). IRC 430 defines “the minimum required contribution” as the amount prior to reduction by the carryover balance or the prefunding balance. You don’t have enough information to calculate the shortfall amortization installment in this problem, so you should ignore the minimum contribution.

Here is the maximum deductible contribution under 404(o)(2):

Target normal cost + Funding target + Cushion amount - Actuarial asset value

The Cushion amount is defined as the sum of two pieces: (1) 50% of the Funding target, and (2) the increase in the Funding target due to allowing for future pay increases. You can think of the second item as the excess of the Projected Unit Credit accrued liability over the Traditional Unit Credit accrued liability:

$$\begin{aligned}\text{Cushion amount} &= 50\%(1,400,000) + (1,600,000 - 1,400,000) \\ &= 700,000 + 200,000 \\ &= 900,000\end{aligned}$$

Now you can calculate the deductible limit:

Target normal cost	100,000
+ Funding target	1,400,000
+ Cushion amount	900,000
Sub-total	2,400,000
Less unreduced AAV	1,200,000
Deductible limit	1,200,000

Alternative Deductible Limit: At-Risk

For plans that are not At-Risk, there is an alternate definition of the deductible limit in 404(o)(2)(B):

“Final” At-Risk Target normal cost + “Final” At-Risk Funding target - Actuarial asset value

I have added the descriptive term “Final” to the At-Risk items in this definition. The reason is due to exam condition 48. That condition states that the “At-Risk Funding target” and “At-Risk Target normal cost” given in the problem’s data refer to the values before applying the weighting factors shown in IRC 430(i)(5).

Fall 2008 EA-2A Exam Solutions

Problem 15 – Page 2

Alternative Deductible Limit: At-Risk

The IRS has not issued regulations clarifying calculations under IRC 404(o) for single employer plans. It is not clear exactly how the IRC 404 At-Risk values should be determined. Some actuaries think 100% of the At-Risk values of the Target normal cost and Funding Target should be used, with no weighting of the non At-Risk values. Some actuaries think the IRC 404 At-Risk values should reflect the weighting between the At-Risk values and the non At-Risk values, based on the number of consecutive years the plan has actually been At-Risk.

The description of the At-Risk values in this problem differs from that in exam condition 47. The best interpretation of "At-risk Funding target / Target normal cost for IRC section 404 purposes" is that one of the approaches outlined above has already been performed. You should simply use the values given to calculate the alternate definition of the deductible limit in 404(o)(2)(B):

"Final" At-Risk Target normal cost	160,000
"Final" At-Risk Funding target	2,500,000
Less unreduced AAV	1,200,000
Deductible limit	<u>1,460,000</u>

This is more than the previously calculated deductible limit of 1,200,000. The final deductible limit is 1,460,000.

Answer is D

NOTES:

1. Unlike 2007 exam problem #3, the impact of the At-Risk calculations in this problem is fairly large. If you decided to apply the weighting factors shown in IRC 430(i)(5), you would end up with a much smaller value for the At-Risk definition of the deductible limit. The final deductible limit would be 1,200,000, which falls in the wrong answer range.
2. The wording used for the At-Risk values in this problem was changed after the exam was given in November, 2008. The original wording did not include the phrase "for IRC Section 404 purposes". Both David Farber and I notified the Joint Board that they should give credit for both answer range A and answer range D.

In May of 2009, the phrase "for IRC Section 404 purposes" was added to the description of the At-Risk amounts given in the question. A revised Acrobat PDF file was published at the Joint Board web site. The Joint Board apparently gave credit for answer A at that time, even though that is not reflected on the answer sheet for the exam. Several candidates were informed in June of 2009 that they had passed the 2008 EA-2A exam.

Fall 2008 EA-2A Exam Solutions

Problem 16

This problem is a simple one on MFSA amortization payments for multiemployer plans. But it is easy to mis-read the problem.

FALSE

For MFSA bases that are set up for plan years starting in 2008, the amortization period is 15 years. In this question, the plan change base is set up in 2007, so the pre-PPA rules apply. The initial amortization period is 30 years.

There is only one point to this question. The new 15 year amortization period does not apply to pre-2008 bases. The outstanding base at 01/01/2008 would be amortized over 29 years, which is the remaining portion of the original period.

Answer is B

Fall 2008 EA-2A Exam Solutions

Problem 17 – Page 1

This problem is a simple one on funding status definitions for multiemployer plans.

FALSE

This plan's funding status would be "seriously endangered", except for the fact that it falls into the definition of critical status. A plan is in critical status if it satisfies one or more of the definitions in 432(b)(2)(A) through 432(b)(2)(D) at the start of the plan year.

These definitions range from fairly simple to ridiculously complicated:

- 432(b)(2)(A) - Funded percentage $< 65\%$, and for the current and the 6 succeeding plan years, the market value of assets plus PV of contributions $<$ PV of nonforfeitable benefit payments and expenses
- 432(b)(2)(B)(i) - Plan has accumulated funding deficiency for the current year, ignoring extension of amortization periods
- 432(b)(2)(B)(ii)
 - Funded percentage $> 65\%$, and plan is projected to have accumulated funding deficiency for any of the 3 succeeding plan years, ignoring extension of amortization periods, or
 - Funded percentage $< 65\%$, and plan is projected to have accumulated funding deficiency for any of the 4 succeeding plan years, ignoring extension of amortization periods
- 432(b)(2)(C)
 - The normal cost for the current year plus interest on the unfunded benefit liabilities (on the last day of prior plan year) exceeds the PV of expected employer and employee contributions for the current plan year, and
 - At the beginning of the year, PV of nonforfeitable benefits for inactive exceeds the PV of nonforfeitable benefits for active employees, and
 - Plan has accumulated funding deficiency, or is projected to have accumulated funding deficiency for any of the 4 succeeding plan years, ignoring extension of amortization periods
- 432(b)(2)(D) - For the current and the 4 succeeding plan years, the market value of assets plus PV of contributions $<$ PV of all benefit payments and expenses

The plan satisfies the definition in 432(b)(2)(B)(ii).

Answer is B

(see note on next page)

Fall 2008 EA-2A Exam Solutions

Problem 17 – Page 2

NOTE

A plan is in "endangered" status if it is not in critical status for plan year, and it satisfies either (1) or (2) below.

A plan is in "seriously endangered" status if it is not in critical status for plan year, and it satisfies both (1) and (2):

1. Plan's funded percentage < 80%
2. Plan has accumulated funding deficiency for plan year, or is projected to have one in any of the succeeding 6 plan years (allowing for amortization extensions under 431(d))

Fall 2008 EA-2A Exam Solutions

Problem 18 – Page 1

The key to this problem is knowing how to calculate the Funding shortfall at 01/01/2009 under IRC Section 430. All plans start with a zero prefunding balance (PB) in 2008. The problem tells you that the PB is zero at 01/01/2009, and the funding standard carryover balance (CB) is equal to 720,000 at 01/01/2009.

Another key to this problem is knowing how to calculate the minimum required contribution (MRC) under IRC Section 430. In general, the MRC is defined as the target normal cost plus the shortfall amortization charge and the waiver amortization charge, all at the valuation date. Exam condition 34 clarifies that “minimum required contribution” means the contribution calculated prior to reflecting the carryover balance or prefunding balance.

This problem asks for “the smallest amount that satisfies the minimum funding standard”. Based on exam condition 35, this amount is calculated by offsetting both the funding standard carryover balance (CB) and the prefunding balance (PB) against the minimum contribution under IRC 430. Based on exam conditions 30 and 31, the plan sponsor does elect to offset both the CB and the PB.

Funding Shortfall

The funding shortfall is defined as the excess of the funding target over the 430(f)(4)(B) assets, which equals the actuarial value of assets less the prefunding balance and the carryover balance.

$$\begin{aligned}\text{Funding S/F} &= \text{Funding target} - (\text{AAV} - \text{CB} - \text{PB}) \\ &= 12,000,000 - (13,500,000 - 720,000 - 0) \\ &= \text{zero}\end{aligned}$$

Minimum Required Contribution

In general, the minimum required contribution (MRC) is defined as the target normal cost plus the shortfall amortization charge and the waiver amortization charge, all at the valuation date.

Since the Funding shortfall for a year is zero, there is a different definition of the MRC. All existing shortfall and waiver amortization bases are considered fully amortized. In that case, the MRC is defined as the target normal cost plus the funding target minus the 430(f)(4)(B) assets, all at the valuation date:

$$\begin{aligned}\text{ALT MRC} &= \text{TNC} + \text{Funding target} - (\text{AAV} - \text{CB} - \text{PB}) \\ &= 2,100,000 + 12,000,000 - (13,500,000 - 720,000 - 0) \\ &= 1,320,000\end{aligned}$$

Fall 2008 EA-2A Exam Solutions

Problem 18 – Page 2

Smallest Amount for Minimum funding

The problem asks for “the smallest amount that satisfies the minimum funding standard”, payable at 01/01/2010. The first step is calculation of the "smallest amount" at 01/01/2009:

$$\begin{aligned}\text{Smallest contr} &= \text{MRC} - \text{CB} - \text{PB} \\ &= 1,320,000 - 720,000 - 0 \\ &= 600,000\end{aligned}$$

The plan sponsor paid 525,000 at 07/01/2009 for the 2009 plan year, and a contribution of X at 01/01/2010. The minimum required contribution is defined as of the valuation date. These contributions must be discounted back to 01/01/2009 using the 2009 effective interest rate (given as 7.0%).

$$\begin{aligned}\text{PV of contrib} &= X/1.07 + 525,000*(1.07)^{-1/2} && \text{(using compound interest)} \\ 600,000 &= X/1.07 + 507,537 \\ X &= 1.07(600,000 - 507,537) \\ &= 98,936\end{aligned}$$

Answer is E

NOTES

1. This is the same answer as under the pre-WRERA rules.
2. You will get the same answer range if you decided to use simple interest:

$$\begin{aligned}\text{PV of contrib} &= X/1.07 + 525,000*(1 + (6/12)*7\%)^{-1} && \text{(using simple interest)} \\ 600,000 &= X/1.07 + 507,246 \\ X &= 1.07(600,000 - 507,246) \\ &= 99,246\end{aligned}$$

Fall 2008 EA-2A Exam Solutions

Problem 19 – Page 1

This is a basic question on your understanding of segment interest rates. Under PPA 2006, you would calculate the present value of a stream of annual benefit payments for a life annuity payable to a person age x (currently in pay status) as follows:

$$\begin{aligned} \text{Present value} &= \sum_{t=0}^4 (1.0500)^{-t} {}_t p_x^{(T)} (\text{Benefit Payment}_{x+t}) \\ &+ \sum_{t=5}^{19} (1.0600)^{-t} {}_t p_x^{(T)} (\text{Benefit Payment}_{x+t}) \\ &+ \sum_{t=20}^{\omega-x} (1.0700)^{-t} {}_t p_x^{(T)} (\text{Benefit Payment}_{x+t}) \end{aligned}$$

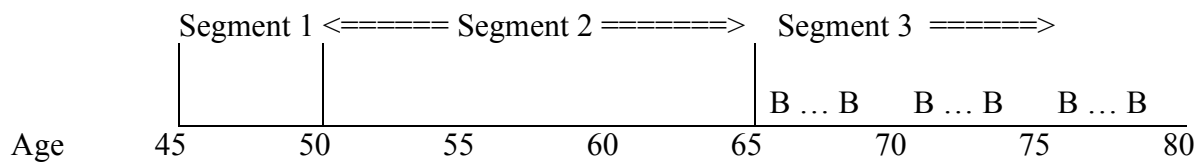
In this problem, you need to calculate the lump sum distribution. In general, you must do two lump sum calculations. One uses the plan assumptions, and the other uses the mandated assumptions in 417(e)(3). The final lump sum can't be less than the value under the mandated assumptions.

In this problem, the plan basis is the same as the mandated assumptions in 417(e)(3).

01/01/2009 Age 45
Vested benefit 36,000

Based on the default exam conditions, normal retirement age is 65, and the benefit is assumed payable monthly, starting at normal retirement age.

The participant is currently 20 years from retirement, so their benefit payments will be valued using the third segment rate:



$$\begin{aligned} \text{Lump sum} &= 36,000(v^{20} {}_{20}p_{45}) \ddot{a}_{65}^{(12)} \\ &= 36,000(1.060)^{-20}(10.87) && \text{(no pre-retirement mortality)} \\ &= 122,015 \end{aligned}$$

Answer is C

NOTE

In this problem, you are given the 417(e) segment rates after reflecting the phase-in from the 30 year Treasury rate to the three segment rates for the yield curve. It would be more difficult if you were given the unadjusted segment rates and the 30 year Treasury rate.

Fall 2008 EA-2A Exam Solutions

Problem 19 – Page 2

NOTE – continued

The first step would be to allow for the phase-in rule. The second step would be the lump sum calculation.

The phase-in rule grades in the effect of the yield curve by combining 20% of the segment rates with 80% of the 30 year Treasury rate for 2008. For each year from 2009 through 2011, the percentage weight for the segment rates increases by an additional 20%, and the weight for the Treasury rate decreases by 20%. In 2012, the transition rule is gone, and the present value calculation is solely based on the segment interest rates:

Year	Weight for Segment rate	Weight for 30 year Treasury
2008	20%	80%
2009	40%	60%
2010	60%	40%
2011	80%	20%
2012	100%	0%

Fall 2008 EA-2A Exam Solutions

Problem 20

This problem is a simple one on handling of the carryover balance and the prefunding balance for single employer plans.

FALSE

Under IRC 430(f), a plan sponsor may elect to apply the prefunding balance towards the minimum required contribution. If the plan also has a carryover balance, then they must eliminate the carryover balance before they can make any election regarding the prefunding balance.

They must first either

- Elect to arbitrarily reduce the carryover balance to zero, or
- Elect to apply the carryover balance towards the minimum required contribution

Answer is B

Fall 2008 EA-2A Exam Solutions

Problem 21 – Page 1

The key to this problem is knowing how to calculate the Shortfall amortization base at 01/01/2009 under IRC Section 430. The first thing you should do is to calculate the 2009 valuation results based on the new benefit level:

Benefit level	\$30	\$35
Funding target	1,000,000	*(35/30) = 1,166,667
Target normal cost	31,750	*(35/30) = 37,042

Funding Shortfall

The funding shortfall is defined as the excess of the funding target over the 430(f)(4)(B) assets, which equals the actuarial value of assets less the prefunding balance and the carryover balance.

$$\begin{aligned}\text{Funding S/F} &= \text{Funding target} - (\text{AAV} - \text{CB} - \text{PB}) \\ &= 1,166,667 - (950,000 - 0 - 0) \\ &= 216,667\end{aligned}$$

Shortfall Base Exemption

You should think about whether this plan satisfies the shortfall base exemption. I will define the “modified funding shortfall” as the modified funding target less the modified assets. If the “modified funding shortfall” is less than or equal to zero, then you would not have to set up the Shortfall base for 2009:

- Modified funding target: the applicable percentage times the funding target
- In the absence of any information to the contrary, you can assume the applicable percentage is 94%.
- Modified assets: if any portion of the prefunding balance is applied toward the minimum required contribution, the modified assets equal AAV - PB. Otherwise, the modified assets equal the AAV with no reduction.

$$\begin{aligned}\text{Modified S/F} &= 94\% * (\text{Funding target}) - (\text{AAV} - \text{PB}) \\ &= .94 * 1,166,667 - (950,000 - 0) \\ &= 146,667\end{aligned}$$

In this problem, they did not specify the effective date of the plan. I assumed that the plan is effective prior to 01/01/08, so the applicable percentage is 94%. Under WRERA, both the amount of the modified shortfall and the shortfall amortization base will be affected by this assumption. For exam problems in 2009 and later, the problem should specify the plan's effective date.

Fall 2008 EA-2A Exam Solutions

Problem 21 – Page 2

Shortfall amortization installment

Since the modified shortfall is greater than zero, the plan is not eligible for the shortfall base exemption. You have to set up the 2009 shortfall amortization base, which is equal to

1. The Applicable percentage times the Funding target
2. Minus the Actuarial asset value reduced by both CB and PB
3. Minus the present value of prior years' shortfall and waiver amortization installments:

$$\text{S/F Amort base} = (\text{Applicable \%}) * (\text{Funding target}) - (\text{AAV} - \text{CB} - \text{PB}) - (\text{PV of PY Amortizations})$$

This plan was exempt from setting up a Shortfall base in 2008, so there are no prior years' shortfall amortization installments.

$$\begin{aligned}\text{S/F Amort base} &= 94\% * (\text{Funding target}) - (\text{AAV} - \text{CB} - \text{PB}) - \text{zero} \\ &= .94 * 1,166,667 - (950,000 - 0 - 0) - 0 \\ &= 146,667\end{aligned}$$

$$\begin{aligned}\text{S/F amort} &= 146,667 / 5.9982 \\ &= 24,452\end{aligned}$$

Minimum Required Contribution

In general, the minimum required contribution (MRC) is defined as the target normal cost plus the shortfall amortization charge and the waiver amortization charge, all at the valuation date.

$$\begin{aligned}\text{MRC} &= \text{TNC} + \text{Shortfall amort charge} + \text{Waiver amort charge} \\ &= 37,042 + 24,452 + 0 \\ &= 61,494\end{aligned}$$

Smallest amount

The problem asks for “the smallest amount that satisfies the minimum funding standard”:

$$\begin{aligned}\text{Smallest contr} &= \text{MRC} - \text{CB} - \text{PB} \\ &= 61,494 - 0 - 0 \\ &= 61,494\end{aligned}$$

Answer is C

NOTE

The official answer using the pre-WRERA rules was 73,164 in answer range D.

Fall 2008 EA-2A Exam Solutions

Problem 22 – Page 1

This is not a typical §415 problem. It is unusual to have late retirement problems with §415 limits. One key point of the problem is the calculation of the actuarial increase in the §415 dollar limit after age 65. Another key point is the handling of the 401(a)(17) pay limit.

At 12/31/08

Age	70	Birth date	01/01/39
Service	6 years	Hire date	01/01/03
Participation	5 years	Effective date	01/01/04
		Normal retirement age	70

PLAN BENEFIT

The plan benefit is based on pay. The first step is to calculate the pay values, after allowing for the 401(a)(17) limit. Then you can calculate the accrued benefit payable at age 70.

Year	2003	2004	2005	2006	2007	2008
Pay	300,000	250,000	225,000	225,000	230,000	235,000
401(a)(17) limit	200,000	205,000	210,000	220,000	225,000	230,000
Limited pay	200,000	205,000	210,000	220,000	225,000	230,000

The high consecutive five years are 2004 through 2008:

$$\begin{aligned}\text{High 5 year average pay} &= (205,000 + 210,000 + 220,000 + 225,000 + 230,000) / 5 \\ &= 218,000\end{aligned}$$

$$\begin{aligned}\text{Accrued benefit} &= 218,000 * 11\% * 6 \\ &= 143,880\end{aligned}$$

415 COMP LIMIT

The §415(b)(1)(B) compensation limit is based on the high consecutive three years. It is reduced when service is less than ten years:

$$\begin{aligned}\text{High 3 year average pay} &= (220,000 + 225,000 + 230,000) / 3 \\ &= 225,000\end{aligned}$$

$$\begin{aligned}\text{100\% 3 year comp. §415 limit} &= 225,000 * (6/10) \\ &= 135,000\end{aligned}$$

Fall 2008 EA-2A Exam Solutions

Problem 22 – Page 2

415 DOLLAR LIMIT

Under §415(b)(1)(A), the dollar limit is reduced when participation is less than ten years. In §415(b)(5)(C), it states that the pro-rata reduction would never be less than 1/10:

$$\text{\$415 dollar limit during 2008} = 92,500 \text{ at age 65} = 185,000 * (5/10)$$

§415(b)(2)(E)(i) says to use the lesser of 5% and the interest rate specified in the plan to increase the §415 dollar limit after age 65, but here the code is misleading. The examples in the 1.415 regulation clarify the increases in the §415 dollar limit.

Mandated basis - Actuarial increase factor

Here is the short version of what you need to know. If you want to see the long version, check out the notes at the end of this solution.

Actuarial increase factor for 415 dollar limit, based on mandated 5%, applicable mortality:

Death benefit definition	Factor
Waived QPSA, or NO death benefit (complete forfeiture on death)	$N_{65}^{(12)} / N_X^{(12)}$
QPSA death benefit, and plan charges participants for cost of QPSA (default per exam condition 12)	$N_{65}^{(12)} / N_X^{(12)}$
100% of PV of accrued benefit (no forfeiture on death)	$v^{65-X} (\ddot{a}_{65}^{(12)} / \ddot{a}_X^{(12)})$
QPSA death benefit, and plan does NOT charge for cost of QPSA (treat as no forfeiture on death)	$v^{65-X} (\ddot{a}_{65}^{(12)} / \ddot{a}_X^{(12)})$

You are told that nothing about the death benefit under this plan. You should assume that the death benefit is the Qualified Pre-retirement Survivor Annuity (QPSA). Based on exam condition #12, you should assume that the plan charges the participants for the cost of the death benefit.

The late retirement actuarial increase on the mandated basis should be calculated using the ratio of $N_{65}^{(12)}$ to $N_{70}^{(12)}$. You are only given one set of commutation factors, which use 5% interest, but an unspecified mortality table. In the absence of any other information, you can only use the commutation factors based on 5% interest:

$$\begin{aligned} N_{65}^{(12)} / N_{70}^{(12)} &= 447,114 / 283,630 \\ &= 1.5764 \end{aligned}$$

Plan basis - Actuarial increase factor

If the plan does define a life annuity benefit at both ages 65 and the benefit commencement age, the \$415 dollar limit is increased using the lower of the mandated basis factor and the plan basis factor.

It is not intuitively obvious based on the information given, but you should assume that the plan grants actuarial increases beyond age 65. This is based on a concept from IRC 411, which is not on the EA-2A exam syllabus.

If the plan did not grant actuarial increases, then it would have to provide participants with a notice of benefit suspension. If the problem said that it did provide participants with a notice of benefit suspension after 65, then you would assume the plan did not grant actuarial increases.

Since there is an actuarial increase in plan benefits beyond age 65, you should calculate the actuarial increase factor. But the plan basis for the actuarial increase factors is not specified, which seems like a strange omission.

In the absence of any other information, you can only use the commutation factors which are given. The best assumption is that the plan defines the late retirement actuarial increase factor as $N_{65}^{(12)} / N_{70}^{(12)}$, so the actuarial increase factor is the same value calculated previously.

The plan basis factor for increasing the 415 dollar limit is defined in the 1.415 regulation, and it is rather complex. It basically ignores future benefit accruals beyond age 65, but includes any actuarial increase after age 65. For more details, see the notes at the end of this solution.

The plan basis actuarial increase factor is equal to A / B:

- A. Actuarially increased benefit at late retirement age
- B. Accrued benefit at age 65

For this participant, you can not calculate the plan basis factor. The reason is that they can not receive a life annuity benefit at age 65. The plan has no early retirement benefits, and this participant's normal retirement age is 70.

The \$415 dollar limit is increased using the mandated basis factor:

$$\begin{aligned}\$415 \text{ dollar limit at age 70} &= 92,500 * N_{65}^{(12)} / N_{70}^{(12)} \\ \text{Annual life annuity} &= 92,500 * 1.5764 \\ &= 145,817\end{aligned}$$

Smith's 415 limit at age 70 is the lesser of the compensation limit of 135,000 and the dollar limit of 145,817. This is based on a life annuity payment form.

The 415 limit of 135,000 is less than the plan benefit of 143,880. The resulting monthly benefit is 11,250.

Fall 2008 EA-2A Exam Solutions

Problem 22 – Page 4

415 Limit at 12/31/2007

The 1.415 regulation was finalized during 2007, and it included the requirement that pay used to calculate the 415(b)(1)(B) compensation limit must be limited by the 401(a)(17) limit.

There is a grandfather rule in 1.415(a)-1(g)(4) that preserves any benefit accrued or payable at the end of the limitation year before the effective date of the new regulation. The new regulation becomes effective for limitation years beginning on or after July 1, 2007.

The first step is to calculate the plan benefit based on retirement at 12/31/2007. Smith is age 69, and has only 5 years of service at that date.

PLAN BENEFIT

The plan benefit is based on pay. The first step is to calculate the pay values, after allowing for the 401(a)(17) limit. Then you can calculate the accrued benefit payable at age 69.

Year	2003	2004	2005	2006	2007
Pay	300,000	250,000	225,000	225,000	230,000
401(a)(17) limit	200,000	205,000	210,000	220,000	225,000
Limited pay	200,000	205,000	210,000	220,000	225,000

The high consecutive five years are 2003 through 2007:

High 5 year average pay = $(200,000 + 205,000 + 210,000 + 220,000 + 225,000) / 5$
Each year's pay limited by 401(a)(17)

High 5 year average pay = 212,000

Accrued benefit = $212,000 * 11\% * 5$
= 116,600

There is no point in recalculating the 415 limit based on retirement at 12/31/2007. The reason is that the accrued benefit of 116,600 is lower than the previously calculated 415 limit of 135,000. The 415 grandfather rule will have no effect on the participant's final benefit, which is 11,250.

Answer is C

(see note on next page)

NOTE**Lengthy discussion of actuarial increases in 1.415 regulation****Actuarial increase of 415 dollar limit above age 65 (LONG version)**

If the plan document does not define a life annuity at both age 65 and the late retirement age, then the §415 dollar limit is increased using a factor calculated based on the mandated mortality and interest rate. If the plan does define a life annuity benefit at both ages, then the §415 dollar limit is increased using the lower of two factors:

1. Actuarial increase factor based on the mandated mortality and interest rate, and
2. Adjustment ratio for plan benefits after age 65 (as defined in the regulation)

The definition of the actuarial equivalent increase factor (on the mandated mortality and interest rate) will vary depending on the definition of the death benefit. If there is no forfeiture on death, then you can ignore pre-retirement mortality:

$$v^{65-x} (\ddot{a}_{65}^{(12)} / \ddot{a}_x^{(12)})$$

If the death benefit is defined as 100% of the present value of the accrued benefit, then there is no forfeiture upon death. In 1.415(b)-1(e)(3), it states that you may treat a typical Qualified Pre-retirement Survivor Annuity (QPSA) death benefit as resulting in no forfeiture on death. This treatment is only allowed if the plan does not charge for the cost of the QPSA, and if the plan applies the same treatment for all retirement ages (both before age 65 and after age 65).

If there is a forfeiture on death, then you must reflect pre-retirement mortality:

$$(N_{65}^{(12)} / N_x^{(12)}) = (v^{65-x} / {}_{x-65}p_{65}) (\ddot{a}_{65}^{(12)} / \ddot{a}_x^{(12)})$$

If there is no death benefit, then there is a full forfeiture upon death. This can happen if the participant is single, or if they are married, and they elect out of the Qualified Pre-retirement Survivor Annuity (QPSA). With a typical QPSA death benefit, there will be a forfeiture on death. Based on exam condition 12, in the absence of any other information, you should assume that the plan does charge the participants for the cost of the QPSA.

(next page)

Problem 22 – Page 6**Actuarial increase of 415 dollar limit above age 65 (continued)**

Actuarial increase factor for 415 dollar limit, based on mandated 5%, applicable mortality:

Death benefit definition	Factor
Waived QPSA, or NO death benefit (complete forfeiture on death)	$N_{65}^{(12)} / N_X^{(12)}$
QPSA death benefit, and plan charges participants for cost of QPSA (default per exam condition 12)	$N_{65}^{(12)} / N_X^{(12)}$
100% of PV of accrued benefit (no forfeiture on death)	$v^{65-X} (\ddot{a}_{65}^{(12)} / \ddot{a}_X^{(12)})$
QPSA death benefit, and plan does NOT charge for cost of QPSA (treat as no forfeiture on death)	$v^{65-X} (\ddot{a}_{65}^{(12)} / \ddot{a}_X^{(12)})$

If the plan did define a life annuity benefit at both ages, then the \$415 dollar limit would be increased using the lower of two factors: The plan basis factor is equal to the “Adjustment ratio” for plan benefits after age 65 (as defined in the regulation).

The “Adjustment ratio” is equal to A / B:

- A. Adjusted immediately commencing straight life annuity
 - (1) Ignoring Section 415 limits and accruals after age 65
 - (2) Including actuarial increases after 65
- B. Adjusted age 65 straight life annuity
 - (1) For hypothetical participant at age 65 with same accrued benefit as the actual participant
 - (2) Ignoring Section 415 limits, accruals after age 65, AND actuarial increases after 65

In the absence of any additional information, you should assume that the plan benefits are actuarially increased beyond normal retirement age. The only time you should not make this assumption is when the problem clearly indicates that the plan does not grant actuarial increases in benefits.

THIS PAGE WAS INTENTIONALLY LEFT BLANK

Fall 2008 EA-2A Exam Solutions

Problem 23

This problem is a simple one on handling of the carryover and prefunding balances.

I. TRUE

The determination of At-Risk status is based on two calculations of the prior year's Funding target attainment percentage (FTAP). One calculation uses the prior year's Funding target ignoring the 430(i) rules. The second calculation uses the prior year's Funding target reflecting the additional assumptions in 430(i)(1)(B).

The FTAP is always calculated by reducing the Actuarial value of assets by both the carryover and prefunding balances:

$$\begin{array}{lcl} \text{FTAP} & = & \frac{\text{AAV} - \text{CB} - \text{PB}}{\text{Funding target (non At-Risk basis)}} \quad (\text{prior year valuation results}) \\ \text{Not At-Risk} & & \end{array}$$

$$\begin{array}{lcl} \text{FTAP} & = & \frac{\text{AAV} - \text{CB} - \text{PB}}{\text{Funding target using 430(i)(1)(B)}} \quad (\text{prior year valuation results}) \\ \text{"At-Risk"} & & \text{But excluding any load factors} \end{array}$$

II. FALSE

A modified asset value is calculated as part of the test for the shortfall base exemption. If any portion of the prefunding balance is applied toward the minimum required contribution, the modified assets equal AAV - PB. Otherwise, the modified assets equal the AAV with no reduction.

III. FALSE

The prior year's "funding ratio" must be at least 80% for a plan to apply the prefunding balance (and carryover balance) toward the minimum required contribution. The assets in this calculation do not reflect any reduction by the carryover balance:

$$\begin{array}{lcl} \text{Funding ratio} & = & \frac{\text{AAV} - \text{PB}}{\text{Funding target (non At-Risk basis)}} \quad (\text{prior year valuation results}) \end{array}$$

Only item I is true

Answer is A

NOTE

The definition of the "funding ratio" in item III does not offset the assets by the CB. This is designed to be favorable to plans which developed large credit balances prior to the passage of PPA 2006.

Fall 2008 EA-2A Exam Solutions

Problem 24

This problem is a simple one on handling of the carryover and prefunding balances.

FALSE

In the absence of any contributions or elections, the carryover balance and prefunding balance are increased from one valuation date to the next. The adjustment is done using the rate of asset return for the plan year.

Answer is B

Fall 2008 EA-2A Exam Solutions

Problem 25 – Page 1

This problem asks for “the smallest amount that satisfies the minimum funding standard”. Based on exam condition 35, this amount is calculated by offsetting both the funding standard carryover balance (CB) and the prefunding balance (PB) against the minimum contribution under IRC 430. In this problem, you are told that the plan sponsor does not elect to apply the CB toward the minimum required contribution.

The key to this problem is knowing how to calculate the Shortfall amortization base at 01/01/2009 under IRC Section 430. The plan had a funding standard carryover balance (CB) equal to 55,000 at 01/01/2008. All plans start with a zero prefunding balance (PB) in 2008.

2008 Funding Shortfall

The funding shortfall is defined as the excess of the funding target over the 430(f)(4)(B) assets, which equals the actuarial value of assets less the prefunding balance and the carryover balance.

One thing to be careful of is that the problem gives you the market value as 1,030,000. You should check to be sure that the AAV of 960,000 is within 10% of the market value:

$$\begin{aligned} 90\% \text{ of MVA} &= .90(1,030,000) \\ &= 927,000 \end{aligned}$$

Now you can safely use the given AAV of 960,000 for the rest of the calculations.

$$\begin{aligned} \text{Funding S/F} &= \text{Funding target} - (\text{AAV} - \text{CB} - \text{PB}) \\ &= 1,270,000 - (960,000 - 55,000 - 0) \\ &= 365,000 \end{aligned}$$

2008 Shortfall Base Exemption

You are told that the plan was effective at 01/01/04. You should think about whether this plan satisfies the shortfall base exemption. I will define the “modified funding shortfall” as the modified funding target less the modified assets.

If the “modified funding shortfall” is less than or equal to zero, then you would not have to set up the Shortfall base for 2008:

- Modified funding target: the applicable percentage times the funding target
- Since this plan existed prior to 2008, and it was not subject to 412(l) for 2007, the applicable percentage is 92%
- Modified assets: if any portion of the prefunding balance is applied toward the minimum required contribution, the modified assets equal $\text{AAV} - \text{PB}$. Otherwise, the modified assets equal the AAV with no reduction.

Fall 2008 EA-2A Exam Solutions

Problem 25 – Page 2

$$\begin{aligned}\text{Modified S/F} &= 92\% * (\text{Funding target}) - (\text{AAV} - 0) \\ &= .92(1,270,000) - 960,000 \\ &= 208,400\end{aligned}$$

2008 Shortfall amortization installment

Since the modified shortfall is greater than zero, the plan is not eligible for the shortfall base exemption. You have to set up the 2008 shortfall amortization base, which is equal to

1. The Applicable percentage times the Funding target
2. Minus the Actuarial asset value reduced by both CB and PB
3. Minus the present value of prior years' shortfall and waiver amortization installments:

$$\text{S/F Amort base} = (\text{Applicable \%}) * (\text{Funding target}) - (\text{AAV} - \text{CB} - \text{PB}) - (\text{PV of PY Amortizations})$$

There are no prior amortizations at 01/01/08.

$$\begin{aligned}\text{S/F Amort base} &= 92\% * (\text{Funding target}) - (\text{AAV} - \text{CB} - \text{PB}) - \text{zero} \\ &= .92 * 1,270,000 - (960,000 - 55,000 - 0) - 0 \\ &= 263,400\end{aligned}$$

The problem gives you the amortization factor for the 2008 shortfall base:

$$\begin{aligned}\text{S/F amort} &= 263,400 / 5.9982 \\ &= 43,913\end{aligned}$$

2009 Funding Shortfall

The problem gives the carryover balance and the prefunding balance at 01/01/09. The funding shortfall is defined as the excess of the funding target over the 430(f)(4)(B) assets, which equals the actuarial value of assets less the prefunding balance and the carryover balance.

One thing to be careful of is that the problem gives you the market value as 1,140,000. You should check to be sure that the AAV of 1,100,000 is within 10% of the market value:

$$\begin{aligned}90\% \text{ of MVA} &= .90(1,140,000) \\ &= 1,026,000\end{aligned}$$

Now you can safely use the given AAV of 1,100,000 for the rest of the calculations.

$$\begin{aligned}\text{Funding S/F} &= \text{Funding target} - (\text{AAV} - \text{CB} - \text{PB}) \\ &= 1,400,000 - (1,100,000 - 15,000 - 10,000) \\ &= 325,000\end{aligned}$$

2009 Shortfall Base Exemption

You should think about whether this plan satisfies the shortfall base exemption. I will define the “modified funding shortfall” as the modified funding target less the modified assets. If the “modified funding shortfall” is less than or equal to zero, then you would not have to set up the Shortfall base for 2009:

- Modified funding target: the applicable percentage times the funding target
- In the absence of any information to the contrary, you can assume the applicable percentage is 94%
- Modified assets: if any portion of the prefunding balance is applied toward the minimum required contribution, the modified assets equal AAV - PB. Otherwise, the modified assets equal the AAV with no reduction.

$$\begin{aligned}\text{Modified S/F} &= 94\% * (\text{Funding target}) - (\text{AAV} - 0) \\ &= .94 * (1,400,000) - (1,100,000 - 0) \\ &= 216,000\end{aligned}$$

2009 Shortfall amortization installment

The plan is not eligible for the shortfall base exemption. You have to set up the 2009 shortfall amortization base, which is equal to

1. The Applicable percentage times the Funding target
2. Minus the Actuarial asset value reduced by both CB and PB
3. Minus the present value of prior years' shortfall and waiver amortization installments:

$$\begin{aligned}\text{S/F Amort base} &= (\text{Applicable \%}) * (\text{Funding target}) - (\text{AAV} - \text{CB} - \text{PB}) - (\text{PV of PY Amortizations}) \\ &= .94 * 1,400,000 - (1,100,000 - 15,000 - 10,000) - (\text{PV of PY Amortizations}) \\ &= 241,000 - (\text{PV of PY Amortizations})\end{aligned}$$

You must calculate the present value of the 2008 amortization installment of 43,913. You are given the 6 year annuity factor:

$$\begin{aligned}\text{PV of amort} &= 43,913 * 5.2932 \\ &= 232,442\end{aligned}$$

$$\begin{aligned}\text{2009 S/F base} &= 241,000 - 232,442 \\ &= 8,558\end{aligned}$$

$$\begin{aligned}\text{S/F amort} &= 8,558 / 5.9982 \\ &= 1,427\end{aligned}$$

$$\begin{aligned}\text{S/F charge} &= 43,913 + 1,427 \\ &= 45,340\end{aligned}$$

Fall 2008 EA-2A Exam Solutions

Problem 25 – Page 4

The shortfall amortization charge is defined as the sum of all the shortfall amortizations. The shortfall amortization charge is limited so it is never less than zero. It is allowable for any individual shortfall amortization installment to be less than zero.

Minimum Required Contribution

In general, the minimum required contribution (MRC) is defined as the target normal cost plus the shortfall amortization charge and the waiver amortization charge, all at the valuation date.

$$\begin{aligned}\text{MRC} &= \text{TNC} + \text{Shortfall amort charge} + \text{Waiver amort charge} \\ &= 58,500 + 45,340 + 0 \\ &= 103,840\end{aligned}$$

Smallest Amount

The problem asks for “the smallest amount that satisfies the minimum funding standard”. There is one final trick to this problem. You are told that the plan sponsor does not elect to apply the CB toward the minimum required contribution.

But what about the PB of 10,000? The sponsor can't apply the PB towards the MRC either. The reason is that they would first have to either reduce the CB to zero, or apply the CB towards the MRC. Since the problem says the plan sponsor does not elect to apply the CB toward the MRC, they must not make any election for the PB either.

$$\begin{aligned}\text{Smallest contr} &= \text{MRC} - 0 \\ &= 103,840\end{aligned}$$

Answer is C

NOTES

1. The official answer using the pre-WRERA rules was 119,835 in answer range D.
2. What if the problem stated that the plan sponsor did elect to apply the CB towards the MRC?

Since you are given valuation results for 2008, you can not rely upon exam condition 30. You would need to check that the 2008 "funding ratio" is at least 80%, otherwise the plan sponsor could NOT elect to apply the CB towards the MRC.

Fall 2008 EA-2A Exam Solutions

Problem 26 – Page 1

This problem asks for “the smallest amount that satisfies the minimum funding standard”. Based on exam condition 35, this amount is calculated by offsetting both the funding standard carryover balance (CB) and the prefunding balance (PB) against the minimum contribution under IRC 430.

The key to this problem is knowing how to calculate the Shortfall amortization base at 01/01/2009 under IRC Section 430. The plan had a funding standard carryover balance (CB) equal to 5,000 and a prefunding balance (PB) equal to 10,000 at 01/01/2009.

2009 Funding Shortfall

The funding shortfall is defined as the excess of the funding target over the 430(f)(4)(B) assets, which equals the actuarial value of assets less the prefunding balance and the carryover balance.

One thing to be careful of is that the problem gives you the market value as 355,000. You should check to be sure that the AAV of 375,000 is within 10% of the market value:

$$\begin{aligned} 110\% \text{ of MVA} &= 1.10(355,000) \\ &= 390,500 \end{aligned}$$

Now you can safely use the given AAV of 375,000 for the rest of the calculations.

$$\begin{aligned} \text{Funding S/F} &= \text{Funding target} - (\text{AAV} - \text{CB} - \text{PB}) \\ &= 341,000 - (375,000 - 5,000 - 10,000) \\ &= \text{zero} \end{aligned}$$

Minimum Required Contribution

In general, the minimum required contribution (MRC) is defined as the target normal cost plus the shortfall amortization charge and the waiver amortization charge, all at the valuation date.

Since the Funding shortfall for a year is zero, then there is a different definition of the MRC. All existing shortfall and waiver amortization bases are considered fully amortized. In that case, the MRC is defined as the target normal cost plus the funding target minus the 430(f)(4)(B) assets, all at the valuation date:

$$\begin{aligned} \text{ALT MRC} &= \text{TNC} + \text{Funding target} - (\text{AAV} - \text{CB} - \text{PB}) \\ &= 36,000 + 341,000 - (375,000 - 5,000 - 10,000) \\ &= 17,000 \end{aligned}$$

Fall 2008 EA-2A Exam Solutions

Problem 26 – Page 2

Smallest Amount for Minimum funding

The problem asks for “the smallest amount that satisfies the minimum funding standard”, payable at 01/01/2009:

$$\begin{aligned}\text{Smallest contr} &= \text{MRC} - \text{CB} - \text{PB} \\ &= 17,000 - 5,000 - 10,000 \\ &= 2,000\end{aligned}$$

Answer is A

NOTE

This is the same answer as under the pre-WRERA rules.

Fall 2008 EA-2A Exam Solutions

Problem 27 – Page 1

This is a basic question on your understanding of segment interest rates. Under PPA 2006, you would calculate the present value of a stream of annual benefit payments for a life annuity payable to a person age x (currently in pay status) as follows:

$$\begin{aligned} \text{Present value} &= \sum_{t=0}^4 (1.0500)^{-t} {}_t p_x^{(T)} (\text{Benefit Payment}_{x+t}) \\ &+ \sum_{t=5}^{19} (1.0600)^{-t} {}_t p_x^{(T)} (\text{Benefit Payment}_{x+t}) \\ &+ \sum_{t=20}^{\omega-x} (1.0700)^{-t} {}_t p_x^{(T)} (\text{Benefit Payment}_{x+t}) \end{aligned}$$

You can write the present value formula in terms of annual annuities:

$$\text{Age } x \text{ PV} = \text{Benefit} \{ \ddot{a}_{x:\overline{5}|} \text{ at } 5.0\% + (1.06)^{-5} ({}_5 p_x) \ddot{a}_{x+5:\overline{15}|} \text{ at } 6.0\% + (1.07)^{-20} ({}_{20} p_x) \ddot{a}_{x+20} \text{ at } 7.0\% \}$$

Target normal cost - ARA 65

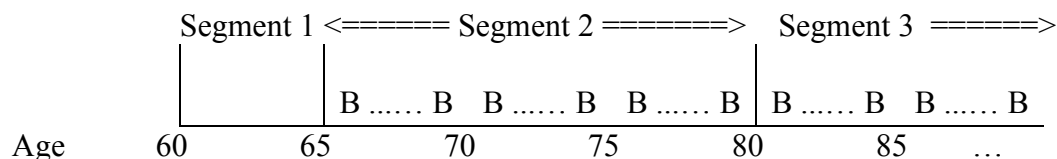
You need to calculate the Target normal cost at 01/01/2009 under two assumed retirement ages (ARA). The first step is to determine the accrued benefit at the valuation date, and the benefit accrual during 2009. One trick is to allow for the salary increase during 2009:

Valuation date	01/01/2009	01/01/2010
Age	60	61
Past service	20	21
Valuation pay	120,000	120,000*1.04
Accrued benefit	1.5%(20)(120,000) = 36,000	1.5%(21)(124,800) = 39,312

$$\Delta AB = 3,312$$

The Target normal cost is defined as the present value of the change in the accrued benefit. It is similar to the traditional Unit Credit normal cost.

Based on the old ARA of 65, the participant is currently 5 years from retirement. Their benefit payments will be valued using the second and third segment rates:



Fall 2008 EA-2A Exam Solutions

Problem 27 – Page 2

One important aspect of the problem is that the pre-retirement mortality and post-retirement mortality are the same. This means you can simply use the commutation functions to do all present value calculations, even prior to benefit commencement age.

Here is the formula for the Target normal cost using monthly annuity rates:

$$\begin{aligned}\text{Age 60 TNC} &= 3,312 * [{}_5| \ddot{a}_{60:\overline{15}| \text{seg}_2}^{(12)} + {}_{20|} \ddot{a}_{60 \text{ seg}_3}^{(12)}] \\ &= 3,312 * [(v^5 {}_5p_{60}) \ddot{a}_{65:\overline{15}| \text{seg}_2}^{(12)} + (v^{20} {}_{20}p_{60}) \ddot{a}_{80 \text{ seg}_3}^{(12)}]\end{aligned}$$

Notice that the second annuity actually starts 20 years from the valuation date. Now you need to express these annuities in terms of commutation functions:

$$\begin{aligned}{}_5| \ddot{a}_{60:\overline{15}| \text{seg}_2}^{(12)} &= (v^5 {}_5p_{60}) \ddot{a}_{65:\overline{15}| \text{seg}_2}^{(12)} && \text{all at segment 2 rate} \\ &= (D_{65} / D_{60}) * (N_{65}^{(12)} - N_{80}^{(12)}) / D_{65} && \text{all at segment 2 rate} \\ &= (N_{65}^{(12)} - N_{80}^{(12)}) / D_{60} && \text{all at segment 2 rate} \\ {}_{20|} \ddot{a}_{60 \text{ seg}_3}^{(12)} &= (v^{20} {}_{20}p_{60}) \ddot{a}_{80 \text{ seg}_3}^{(12)} && \text{all at segment 3 rate} \\ &= (D_{80} / D_{60}) * (N_{80}^{(12)} / D_{80}) && \text{all at segment 3 rate} \\ &= N_{80}^{(12)} / D_{60} && \text{all at segment 3 rate}\end{aligned}$$

$$\begin{aligned}\text{Age 60 TNC} &= 3,312 [\frac{215,712 - 35,335}{28,267} + \frac{15,917}{16,092}] \\ &= 3,312 [6.3812 + .9891] \\ &= 24,410\end{aligned}$$

Target normal cost - ARA 62

Now you need to recalculate the Target normal cost based on ARA 62. There is an additional trick to watch out for. You need to apply the early retirement factor at age 62 to the benefits that were previously calculated:

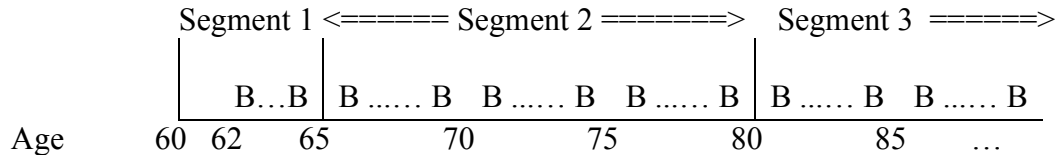
Valuation date	01/01/2009	01/01/2010
Age	60	61
ERF at 62	86.5% = 1-(65-62)(4.5%)	86.5% = 1-(65-62)(4.5%)
Accrued benefit	1.5%(20)(120,000)(.865) = 36,000(.865)	1.5%(21)(124,800)(.865) = 39,312(.865)

Fall 2008 EA-2A Exam Solutions

Problem 27 – Page 3

$$\begin{aligned}\Delta AB &= 3,312(.865) \\ &= 2,865\end{aligned}$$

The Target normal cost is defined as the present value of the change in the accrued benefit. It is similar to the traditional Unit Credit normal cost. The participant is currently 3 years from retirement, based on the new ARA of 62. Their benefit payments will be valued using all three segment rates:



Here is the formula for the Target normal cost using monthly annuity rates:

$$\begin{aligned}\text{Age 60 TNC} &= 2,865 * [{}_2| \ddot{a}_{60:\overline{3}|seg_1}^{(12)} + {}_5| \ddot{a}_{60:\overline{15}|seg_2}^{(12)} + {}_{20}| \ddot{a}_{60seg_3}^{(12)}] \\ &= 2,865 * [(v^2 p_{60}) \ddot{a}_{62:\overline{3}|seg_1}^{(12)} + (v^5 p_{60}) \ddot{a}_{65:\overline{15}|seg_2}^{(12)} + (v^{20} p_{60}) \ddot{a}_{80seg_3}^{(12)}]\end{aligned}$$

Now you need to express these annuities in terms of commutation functions. The good news is that you can re-use most of the work from the first set of calculations:

$$\begin{aligned}{}_2| \ddot{a}_{60:\overline{3}|seg_1}^{(12)} &= (v^2 p_{60}) \ddot{a}_{62:\overline{3}|seg_1}^{(12)} && \text{all at segment 1 rate} \\ &= (D_{62} / D_{60}) * (N_{62}^{(12)} - N_{65}^{(12)}) / D_{62} && \text{all at segment 1 rate} \\ &= (N_{62}^{(12)} - N_{65}^{(12)}) / D_{60} && \text{all at segment 1 rate} \\ &= \frac{(556,090 - 432,743)}{49,921}\end{aligned}$$

$$\begin{aligned}\text{Age 60 TNC} &= 2,865 [2.4708 + 6.3812 + .9891] \\ &= 28,194\end{aligned}$$

The difference in the Target normal cost due to the change in assumed retirement ages is 3,783, which is 28,194 minus 24,410.

Answer is C

Fall 2008 EA-2A Exam Solutions

Problem 28

Similar to 2007 #07

This is a relatively straightforward 415 problem. Starting in 1997, earnings under §415 is defined as total compensation (not taxable). Based on the regulation that became final in 2007, earnings under §415 are subject to the §401(a)(17) limit.

At 12/31/08

Age	60
Service	20 years
Participation	20 years

PLAN BENEFIT

The plan benefit is based on the three year final average pay. You need to apply the §401(a)(17) limit to each year of pay:

Year	Total Pay	401(a)(17) limit	Limited Pay
2002	245,000	200,000	200,000
2003	238,000	200,000	200,000
2004	232,000	205,000	205,000
2005	228,000	210,000	210,000
2006	222,000	220,000	220,000
2007	228,000	225,000	225,000
2008	235,000	230,000	230,000

$$\begin{aligned} \text{5 year final average pay} &= (205,000 + 210,000 + 220,000 + 225,000 + 230,000) / 5 \\ &= 218,000 \end{aligned}$$

$$\begin{aligned} \text{Accrued benefit} &= 218,000 * 15 * 5\% && \text{(payable at NRA 65)} \\ &= 163,500 \end{aligned}$$

415 COMP LIMIT

The §415(b)(1)(B) compensation limit is reduced when service is less than ten years.

$$\begin{aligned} \text{\$415 compensation limit} &= [(220,000 + 225,000 + 230,000) / 3] * (10/10) \\ &= 225,000 \end{aligned}$$

415 DOLLAR LIMIT

Under §415(b)(1)(A), the dollar limit is reduced when participation is less than ten years.

$$\begin{aligned} \text{\$415 dollar limit during 2008} &= 185,000 * (10/10) && \text{for ages 62-65} \\ &= 185,000 \end{aligned}$$

The 415 limit has no effect in this problem. The final plan benefit is 163,500, payable at 65.

Answer is D

Fall 2008 EA-2A Exam Solutions

Problem 29 – Page 1

Similar to 2007 #45

With an individual cost method, there are two things to be aware of. One is that you should check the Full Funding Limitation if you have sufficient information. The other item is that you may need to solve for the amount of the experience gain (or loss).

This is a straightforward question on how a plan change affects the MFSA. The key point of the problem is that you need to use the actuarial balance equation to solve for the new plan change base.

Another key point is that the pre-2008 amortization bases retain their old amortization periods. All bases set up starting in 2008 use 15 years for the amortization period. Based on exam condition 37, you should assume that no extensions of amortization periods have been granted.

This problem asks for “the smallest amount that satisfies the minimum funding standard”. Based on exam condition 35, this amount is calculated by offsetting the funding standard account credit balance (CB) against the minimum contribution.

$$\begin{aligned}\text{UAL} &= \text{O/S } \$431 \text{ bases} - \text{CB} - \text{ARA} \\ &= \text{Accrued Liability} - \text{AAV} \\ &= 1,000,000 - 800,000 \\ &= 200,000\end{aligned}$$

The first step is to calculate the outstanding amounts for the \$431 bases:

Amortization base	Amortization payment	Remaining Years 01/01/09	Outstanding base at 01/01/09
1-1-2005 Initial AL	5,000	26 = 30-(2009-2005)	$63,268 = 5,000 * \ddot{a}_{\overline{26} .07}$
1-1-2008 Loss base	2,500	14 = 15-(2009-2008)	$23,394 = 2,500 * \ddot{a}_{\overline{14} .07}$
Total O/S bases			86,662

Now you can use the equation of balance to solve for the plan change base. This base should be amortized over 15 years:

$$\begin{aligned}\text{UAL} &= \text{O/S } \$431 \text{ bases} - \text{CB} - \text{ARA} \\ 200,000 &= 86,662 + \text{PLAN} - 25,000 - 0 \\ \text{PLAN} &= 138,338 \\ \text{Amort} &= 138,338 / \ddot{a}_{\overline{15}|.07} \\ &= 14,195\end{aligned}$$

Fall 2008 EA-2A Exam Solutions

Problem 29 – Page 2

Now you can set up the MFSA for 2009:

2009 Minimum Funding Standard Account			
Charges		Credits	
Normal Cost	75,000	Credit Balance	25,000
IAL amortization	5,000		
Loss amortization	2,500		
PLAN amortization	14,195		
7% interest	N/A	7% interest	N/A
Total charges	<u>96,695</u>	Total credits	<u>25,000</u>

The MFSA is set up with no interest to simplify the solution. The problem specifies that the contribution will be paid at 01/01/2009.

“The smallest amount that satisfies the minimum funding standard” is equal to the excess of the MFSA charges over the credits at 01/01/09. This equals $96,695 - 25,000 = 71,695$.

You should remember to check the Full Funding Limitation (FFL):

$$\begin{aligned}\text{\$431 "ERISA" FFL} &= (1+i) \cdot (\text{NC} + \text{AL}) - (1+i) \cdot [\text{lesser (MVA, AAV)} - \text{CB}] \\ &= 1.07 * (75,000 + 1,000,000) - 1.07 * (800,000 - 25,000) \\ &= 321,000\end{aligned}$$

Since the FFL exceeds the MFSA charges less the amortization credits, there is no FFL credit for 2009. The 2009 "smallest amount" is unchanged at 71,695.

Answer is D

NOTE

In this problem, it did not matter if you remember to check the Full Funding Limitation. But they will test this again on a future exam.

Fall 2008 EA-2A Exam Solutions

Problem 30 – Page 1

Similar to 2007 #42

This problem asks for “the smallest amount that satisfies the minimum funding standard”. Based on exam condition 35, this amount is calculated by offsetting both the funding standard carryover balance (CB) and the prefunding balance (PB) against the minimum contribution under IRC 430. Based on exam conditions 30 and 31, the plan sponsor does elect to offset both the CB and the PB.

The key to this problem is knowing how to calculate the minimum required contribution (MRC) under IRC Section 430. You need to calculate the amount of the funding shortfall. Then you can determine the amount of the MRC at 01/01/2009, as well as the “smallest amount”.

Funding Shortfall

The problem states that both the CB and the PB equal zero at 01/01/09. The funding shortfall is defined as the excess of the funding target over the 430(f)(4)(B) assets, which equals the actuarial value of assets less the CB and PB.

$$\begin{aligned}\text{Funding S/F} &= \text{Funding target} - (\text{AAV} - \text{CB} - \text{PB}) \\ &= 1,000,000 - (700,000 - 0 - 0) \\ &= 300,000\end{aligned}$$

Shortfall Base Exemption

You should think about whether this plan satisfies the shortfall base exemption. If the “modified funding shortfall” is less than or equal to zero, then you would not have to set up the Shortfall base for 2009:

- Modified funding target: the applicable percentage times the funding target
- In the absence of any information to the contrary, you can assume the applicable percentage is 94%.
- Modified assets: if any portion of the prefunding balance is applied toward the minimum required contribution, the modified assets equal AAV - PB. Otherwise, the modified assets equal the AAV with no reduction.

$$\begin{aligned}\text{Modified S/F} &= 94\% * (\text{Funding target}) - (\text{AAV} - \text{PB}) \\ &= .94(1,000,000) - (700,000 - 0) \\ &= 240,000\end{aligned}$$

In this problem, they did not specify the effective date of the plan. I assumed that the plan is effective prior to 01/01/08, so the applicable percentage is 94%. Under WRERA, both the amount of the modified shortfall and the shortfall amortization base will be affected by this assumption. For exam problems in 2009 and later, the problem should specify the plan's effective date.

Fall 2008 EA-2A Exam Solutions

Problem 30 – Page 2

Shortfall amortization installment

The plan is not eligible for the shortfall base exemption. You have to set up the 2009 shortfall amortization base, which is equal to

1. The Applicable percentage times the Funding target
2. Minus the Actuarial asset value reduced by both CB and PB
3. Minus the present value of prior years' shortfall and waiver amortization installments:

$$\text{S/F Amort base} = (\text{Applicable \%}) * (\text{Funding target}) - (\text{AAV} - \text{CB} - \text{PB}) - (\text{PV of PY Amortizations})$$

The problem states that the 2008 shortfall base was zero.

$$\begin{aligned}\text{S/F Amort base} &= 94\% * (\text{Funding target}) - (\text{AAV} - \text{CB} - \text{PB}) - \text{zero} \\ &= .94 * 1,000,000 - (700,000 - 0 - 0) - 0 \\ &= 240,000\end{aligned}$$

The 2009 shortfall amortization installment is equal to the Funding shortfall base divided by the amortization factor given in the problem:

$$\begin{aligned}\text{S/F Amort} &= 240,000 / 5.9982 \\ &= 40,012\end{aligned}$$

The shortfall amortization charge is defined as the sum of all the shortfall amortizations. The shortfall amortization charge is limited so it is never less than zero. It is allowable for any individual shortfall amortization installment to be less than zero.

Minimum Required Contribution

In general, the minimum required contribution (MRC) is defined as the target normal cost plus the shortfall amortization charge and the waiver amortization charge, all at the valuation date.

$$\begin{aligned}\text{MRC} &= \text{TNC} + \text{Shortfall amort charge} + \text{Waiver amort charge} \\ &= 60,000 + 40,012 + 0 \\ &= 100,012\end{aligned}$$

Smallest amount

The problem asks for “the smallest amount that satisfies the minimum funding standard”, payable at 03/01/2010. The first step is calculation of the "smallest amount" at 01/01/2009:

$$\begin{aligned}\text{Smallest contr} &= \text{MRC} - \text{CB} - \text{PB} \\ &= 100,012 - 0 - 0 \\ &= 100,012\end{aligned}$$

Fall 2008 EA-2A Exam Solutions

Problem 30 – Page 3

The plan sponsor paid a contribution of X at 03/01/2010. The minimum required contribution is defined as of the valuation date. The contribution of X must be discounted back to 01/01/2009 using the 2009 effective interest rate (given as 5.75%).

$$\begin{aligned} \text{PV of contrib} &= X \cdot (1.0575)^{-14/12} && \text{(using compound interest)} \\ 100,012 &= X \cdot (1.0575)^{-14/12} \\ X &= 100,012 \cdot (1.0575)^{14/12} \\ &= 106,753 \end{aligned}$$

Answer is A

NOTES

1. The official answer using the pre-WRERA rules was 117,430 in answer range C.
2. You will get the same answer range if you decided to use simple interest:

$$\begin{aligned} 100,012 &= X \cdot [1 + (14/12) \cdot (5.75\%)]^{-1} && \text{(using simple interest)} \\ X &= 100,012 \cdot [1 + (14/12) \cdot (5.75\%)] \\ &= 106,721 \end{aligned}$$

Fall 2008 EA-2A Exam Solutions

Problem 31

Similar to 2005 EA-2B #25

Revised 10/17/10

The key part of the problem is figuring out whether the plans must be aggregated for Top Heavy (T-H) testing under 416. Both plans are part of a required 416 aggregation group, since they both include at least one key employee. You must combine the two plans to determine the T-H status. If the entire aggregation group is T-H, then each of the plans would also be T-H for the year.

You need to calculate the T-H minimum benefit for each employee. You need to figure out which years the plans were Top Heavy to determine the years of T-H service. Since the plans must be aggregated for T-H testing, you should use the T-H ratio shown for the aggregated plans. The plans were Top Heavy in four years (2000 through 2003), since the T-H ratio was more than 60%.

Now you should calculate the plan benefits for both employees:

	Smith	Jones
Plan	A	B
Effective date	01/01/2002	01/01/2000
Hire date	01/01/2003	01/01/2000
12/31/09 service	7	10
Annual pay	35,000	35,000
Plan accrued benefit	$1.5\%(7)(35,000)$ $= 3,675$	$10(250)$ $= 2,500$

Neither Smith nor Jones is a key employee, so they are both eligible for the T-H minimum benefit. For DB plans, the T-H minimum is 2% times T-H service (not more than 10 years) times T-H pay. One key point of the problem is that Smith only has one year of T-H service:

	Smith	Jones
Top Heavy service	1	4
T-H minimum	$2\%*(1)*35,000$ $= 700$	$2\%*(4)*35,000$ $= 2,800$
Final accrued benefit	3,675	2,800

The sum of the annual accrued benefits is 6,475.

Answer is B

Fall 2008 EA-2A Exam Solutions

Problem 32 – Page 1

Similar to 2005 EA-2B #18

This is a very long §415 problem. The key point of the problem is the calculation of the actuarial reduction factor used to adjust the §415 dollar limit prior to age 62.

Starting in 1997, earnings under §415 is defined as total compensation (not taxable). Based on the regulation that became final in 2007, earnings under §415 are subject to the §401(a)(17) limit.

At 12/31/08	Smith	Jones
Retirement age	60	58
Past service	31 years	9 years
Participation	8 years	8 years

PLAN BENEFIT

In this problem, you are given the accrued benefit for each participant is equal to 185,000.

Since Smith has more than 25 years of service, their benefit at age 60 is unreduced. You need to calculate the early retirement benefits for Jones at age 58:

$$\begin{aligned}\text{Jones' early ret benefit at 58} &= 185,000 * (1 - 6.0\%(65-58)) \\ &= 185,000 * (.58) \\ &= 107,300\end{aligned}$$

$$\text{Smith's early ret benefit at 60} = 185,000$$

415 COMP LIMIT

The §415(b)(1)(B) compensation limit is based on the high consecutive three years. It is reduced when service is less than ten years:

Year	2006	2007	2008
Pay	230,000	230,000	230,000
401(a)(17) limit	220,000	225,000	230,000
Limited pay	220,000	225,000	230,000

$$\begin{aligned}\text{High 3 year average pay} &= (220,000+225,000+230,000) / 3 \\ &= 225,000\end{aligned}$$

Since Smith has more than 10 years of service, their 415 comp limit is unreduced. You must calculate Jones' reduced 415 comp limit:

$$\begin{aligned}\text{Jones' 3 year comp §415 limit} &= 225,000*(9/10) \\ &= 202,500\end{aligned}$$

Fall 2008 EA-2A Exam Solutions

Problem 32 – Page 2

415 COMP LIMIT - continued

$$\begin{aligned}\text{Smith's 3 year comp §415 limit} &= 225,000 * (10/10) \\ &= 225,000\end{aligned}$$

415 DOLLAR LIMIT

The third step is calculation of the §415 dollar limit under §415(b)(1)(A). The dollar limit is reduced when participation is less than ten years. Both participants have 8 years of participation service:

$$\begin{aligned}\text{§415 dollar limit during 2008} &= 185,000 * (8/10) && \text{for ages 62-65} \\ \text{(for both Smith and Jones)} &= 148,000\end{aligned}$$

§415(b)(2)(E)(i) says to use the greater of 5% and the interest rate specified in the plan to reduce the §415 dollar limit prior to age 62, but here the code is misleading. The examples in the 1.415 regulation clarify the reductions in the §415 dollar limit.

Mandated basis reduction factor

Here is the short version of what you need to know. If you want to see the long version, check out the notes at the end of the solution to this problem.

Actuarial decrease factor for 415 dollar limit, based on mandated 5%, applicable mortality

Death benefit definition	Factor
Waived QPSA, or NO death benefit (complete forfeiture on death)	$N_{62}^{(12)} / N_X^{(12)}$
QPSA death benefit, and plan charges participants for cost of QPSA (default per exam condition 12)	$N_{62}^{(12)} / N_X^{(12)}$
100% of PV of accrued benefit (no forfeiture on death)	$v^{62-x} (\ddot{a}_{62}^{(12)} / \ddot{a}_X^{(12)})$
QPSA death benefit, and plan does NOT charge for cost of QPSA (treat as no forfeiture on death)	$v^{62-x} (\ddot{a}_{62}^{(12)} / \ddot{a}_X^{(12)})$

You are told nothing about the plan's death benefit. You should assume the death benefit is the Qualified Pre-retirement Survivor Annuity (QPSA). With a typical QPSA death benefit, there will be a forfeiture on death.

Based on exam condition 12, in the absence of any other information, you should assume that the plan does charge the participants for the cost of the QPSA. This means that a forfeiture DOES occur upon the death of a participant, and you must reflect pre-retirement mortality in the actuarial reduction prior to age 62.

Fall 2008 EA-2A Exam Solutions

Problem 32 – Page 3

Mandated basis reduction factor - continued

You should use the $N_{62}^{(12)} / N_x^{(12)}$ factors to reduce the dollar limit prior to age 62 on the mandated basis. In this problem, you are given “reduction factor” values at ages 58, 60, 62 and 65. Since the age 65 reduction factor is 1.0, you can assume these factors reflect an actuarial reduction from age 65.

Mandated basis reduction factor - Jones

$$\begin{aligned}\text{Actuarial reduction from 62 to 58} &= N_{62}^{(12)} / N_{58}^{(12)} \\ \text{Actuarial reduction from 65 to 62} &= N_{65}^{(12)} / N_{62}^{(12)} \\ \text{Actuarial reduction from 62 to 58} &= [N_{65}^{(12)} / N_{58}^{(12)}] / [N_{65}^{(12)} / N_{62}^{(12)}] \\ &= 57.8\% / 78.2\% \\ \text{Jones' actuarial reduction factor} &= .739\end{aligned}$$

Plan basis reduction factor - Jones

The plan basis factor is defined as the ratio of the plan's life annuity benefit at the early retirement age divided by the plan's life annuity benefit at age 62, both ignoring the 415 limits:

$$\begin{aligned}\text{Plan basis reduction at 58} &= (\text{Plan benefit at 58}) / (\text{Plan benefit at 62}) \\ &= (1 - 6.0\%(65-58)) / (1 - 6.0\%(65-62)) \\ &= .5800 / .8200 \\ &= .7073\end{aligned}$$

Final benefit determination - Jones

$$\begin{aligned}\$415 \text{ dollar limit at age 58} &= 148,000 * \text{lesser of } [.7390 \text{ or } .7073] \\ &= 104,683 \\ \text{Life annuity \$415 limit at 58} &= \text{lesser of 3 year comp limit and dollar limit} \\ &= \text{lesser of 202,500 and 104,683} \\ &= 104,683 \\ \text{Final benefit payable at age 58} &= \text{lesser of plan benefit and 415 limit} \\ &= \text{lesser of 107,300 and 104,683} \\ &= 104,683\end{aligned}$$

(next page)

Fall 2008 EA-2A Exam Solutions

Problem 32 – Page 4

Mandated basis reduction factor - Smith

$$\begin{aligned}\text{Actuarial reduction from 62 to 60} &= N_{62}^{(12)} / N_{60}^{(12)} \\ \text{Actuarial reduction from 65 to 62} &= N_{65}^{(12)} / N_{62}^{(12)} \\ \text{Actuarial reduction from 62 to 60} &= [N_{65}^{(12)} / N_{60}^{(12)}] / [N_{65}^{(12)} / N_{62}^{(12)}] \\ &= 67.0\% / 78.2\% \\ \text{Smith's actuarial reduction factor} &= .857\end{aligned}$$

Plan basis reduction factor - Smith

Since Smith has more than 25 years of service, their benefit at age 60 is unreduced. Their plan basis reduction factor is equal to 1.0

$$\begin{aligned}\text{Plan basis reduction at 60} &= (\text{Plan benefit at 60}) / (\text{Plan benefit at 62}) \\ &= 185,000 / 185,000 \\ &= 1.0\end{aligned}$$

Final benefit determination - Smith

$$\begin{aligned}\text{\$415 dollar limit at age 60} &= 148,000 * \text{lesser of } [.857 \text{ or } 1.0] \\ &= 126,803 \\ \text{Life annuity \$415 limit at 60} &= \text{lesser of 3 year comp limit and dollar limit} \\ &= \text{lesser of 225,000 and 126,803} \\ &= 126,803 \\ \text{Final benefit payable at age 60} &= \text{lesser of plan benefit and 415 limit} \\ &= \text{lesser of 185,000 and 126,803} \\ &= 126,803\end{aligned}$$

415 Limit at 12/31/2007

The 1.415 regulation was finalized during 2007, and it included the requirement that pay used to calculate the 415(b)(1)(B) compensation limit must be limited by the 401(a)(17) limit.

There is a grandfather rule in 1.415(a)-1(g)(4) that preserves any benefit accrued or payable at the end of the limitation year before the effective date of the new regulation. The new regulation becomes effective for limitation years beginning on or after July 1, 2007.

Fall 2008 EA-2A Exam Solutions

Problem 32 – Page 5

415 Limit at 12/31/2007 - continued

For this problem, you can't check the grandfather rule at 12/31/07, since you don't know the participants' accrued benefits at that date. Even if you did know the accrued benefit at 12/31/07, it probably would not make any difference. Based on the calculation of the 415 limit at 12/31/08, it is likely that the final 415 limit at 12/31/07 would be based on the 415 dollar limit, not the 3 year compensation limit.

The sum of the benefits for Smith and Jones is $231,486 = 104,683 + 126,803$.

Answer is C

NOTE

Actuarial reduction of 415 dollar limit below age 62 (LONG version)

If the plan document does not define a life annuity at both age 62 and the early retirement age, then the §415 dollar limit is reduced using a factor calculated based on the mandated mortality and interest rate. If the plan does define a life annuity benefit at both ages, then the §415 dollar limit is reduced using the lower of two factors:

1. Actuarial reduction factor based on the mandated mortality and interest rate, and
2. The ratio of the plan's life annuity benefit at the early retirement age divided by the plan's life annuity benefit at age 62, both ignoring the 415 limits

The definition of the actuarial equivalent reduction factor (on the mandated mortality and interest rate) will vary depending on the definition of the death benefit. If there is no forfeiture on death, then you can ignore pre-retirement mortality:

$$v^{62-x} (\ddot{a}_{62}^{(12)} / \ddot{a}_x^{(12)})$$

If the death benefit is defined as 100% of the present value of the accrued benefit, then there is no forfeiture upon death. In 1.415(b)-1(e)(3), it states that you may treat a typical Qualified Pre-retirement Survivor Annuity (QPSA) death benefit as resulting in no forfeiture on death. This treatment is only allowed if the plan does not charge for the cost of the QPSA, and if the plan applies the same treatment for all retirement ages (both before age 62 and after age 65).

If there is a forfeiture on death, then you must reflect pre-retirement mortality:

$$(N_{62}^{(12)} / N_x^{(12)}) = v^{62-x} p_x (\ddot{a}_{62}^{(12)} / \ddot{a}_x^{(12)})$$

If there is no death benefit, then there is a full forfeiture upon death. This can happen if the participant is single, or if they are married, and they elect out of the Qualified Pre-retirement Survivor Annuity (QPSA). With a typical QPSA death benefit, there will be a forfeiture on death. Based on exam condition 12, in the absence of any other information, you should assume that the plan does charge the participants for the cost of the QPSA.

Fall 2008 EA-2A Exam Solutions

Problem 32 – Page 6

Actuarial reduction of 415 dollar limit below age 62 - continued

Actuarial decrease factor for 415 dollar limit, based on mandated 5%, applicable mortality

Death benefit definition	Factor
Waived QPSA, or NO death benefit (complete forfeiture on death)	$N_{62}^{(12)} / N_X^{(12)}$
QPSA death benefit, and plan charges participants for cost of QPSA (default per exam condition 12)	$N_{62}^{(12)} / N_X^{(12)}$
100% of PV of accrued benefit (no forfeiture on death)	$v^{62-x} (\ddot{a}_{62}^{(12)} / \ddot{a}_X^{(12)})$
QPSA death benefit, and plan does NOT charge for cost of QPSA (treat as no forfeiture on death)	$v^{62-x} (\ddot{a}_{62}^{(12)} / \ddot{a}_X^{(12)})$

Fall 2008 EA-2A Exam Solutions

Problem 33

Similar to 2005 EA-2B #05

TRUE

One of three definitions must be satisfied for an employee to be a key employee for 2009. The definition must be satisfied during the 12 months ending on the determination date.

To determine Top Heavy status for the 2009 plan year, the determination date is 12/31/08. The 12 month period is the 2008 calendar year.

- (i) Officer with 2008 compensation > 150,000 (2008 value)
- (ii) Someone with more than 5% of the stock ownership
- (iii) Someone with more than 1% of the stock ownership with pay > 150,000

This employee satisfies the third definition.

Answer is A

NOTES:

1. There is a limit on the number of officers counted as key employees. See IRC 416(i)(1)(A).
2. The fact that the employee terminated on 07/01/08 does not affect their status as a key employee. If they had terminated more than 12 months before the determination date, they would have been excluded from the T-H calculations entirely.

Fall 2008 EA-2A Exam Solutions

Problem 34 – Page 1

Revised 06/10/11

The key to this problem is knowing the formulas for the non-investment G/L. Another key point is recognizing that this is not like any retirement G/L question asked on prior exams. This is the first problem where you must calculate an expected accrued liability, and reflect retirement decrements.

The problem asks for the experience G/L for 2008. There is no pre-retirement mortality, but there are two sources of G/L. There is a loss due to salary experience and a gain due to retirement experience.

$$\begin{aligned}\text{Non-inv G/L} &= {}_e\text{AL}_1 - \text{AL}_1 \\ {}_e\text{AL}_1 &= (1+i) * (\text{NC}_0 + \text{AL}_0) - (\text{actual benefit payments} + \text{interest})\end{aligned}$$

This problem gives the cost method as Unit Credit. But the key point to the problem is that it is not legal to use the Unit Credit method to fund a multiemployer plan where benefits are based on final pay. This is based on the old 1.412(c)(3)-1 regulation.

You need to calculate the Projected Unit Credit (PUC) accrued liability and normal cost. Under PUC, the accrued liability is defined as the present value of the “funding accrued benefit” (FAB):

$$\text{AL} = \text{PV (FAB)}$$

The 1.412(c)(3)-1 regulation defines “funding accrued benefit”:

1. Project pay to retirement age
 2. Calculate the projected benefit
 3. Pro-rate the projected benefit based on service today versus service at retirement.
- This pro-rata calculation must reflect each year’s rate of benefit accrual.

For a final average pay plan, you get the same value for the FAB if you apply the benefit formula to past service, but use projected earnings. For a career average pay plan, you must do the calculation as described in the regulations.

01/01/08 valuation calculations

The plan benefit is based on the final year of pay. The normal retirement age is 65 by default. You have decrements at both age 62 and 65, so you need to project pay to those ages.

01/2008 Age	62
Past service	7
2007 pay (age 61)	50,000
Projected pay @ 64	$= 50,000 * (1.045)^3$
	$= 57,058$

Fall 2008 EA-2A Exam Solutions

Problem 34 – Page 2

$$\begin{aligned}\text{Funding Accrued benefit at 65} & \quad 1.0\%(7)(\text{Final pay}) \\ & \quad 1.0\%(7)(57,058) \\ & \quad = 3,994\end{aligned}$$

$$\begin{aligned}\text{Funding Accrued benefit at 62} & \quad 1.0\%(7)(50,000) \\ & \quad = 3,500\end{aligned}$$

$$\text{Early retirement factor at 62} \quad 1 - 5\%(65-62) = .85$$

$$\begin{aligned}\text{Early retirement benefit} & \quad .85(3,500) \\ & \quad = 2,975\end{aligned}$$

The PUC AL could be calculated as a summation:

$$AL = \sum_{t=0}^3 v^t p_{62}^{(T)} q_{62+t}^{(r)} (\text{ER Ben})_{62+t} \ddot{a}_{62+t}^{(12)}$$

With decrements at only two ages, the expression is easy to evaluate:

$$\begin{aligned}01/01/08 \text{ PUC AL} & \quad (1-25\%)(3,994)(D_{65}/D_{62}) \ddot{a}_{65}^{(12)} + 25\%(2,975) \ddot{a}_{62}^{(12)} \\ & \quad .75(3,994)(1.07)^{-3}(9.24) + .25(2,975)(9.94) \\ & \quad 29,987 = 22,594 + 7,393\end{aligned}$$

There is a shortcut to calculate the PUC normal cost, which is defined as the present value of the change in the benefit accrual for 2008. The change in benefit accrual is 1% of pay.

Since the funding accrued benefit is 7% of pay, the PUC NC is one seventh of the PUC AL. But you should only use the portion of the accrued liability based on retirement at age 65. The normal cost is zero for the 25% of the person assumed to retire at age 62:

$$\begin{aligned}\text{PUC NC} & = 22,594 / 7 \\ & = 3,228\end{aligned}$$

Now you can calculate the expected accrued liability:

$${}_eAL_1 = (1+i) * (NC_0 + AL_0) - (\text{actual benefit payments} + \text{interest})$$

Since the participant did not retire until 12/31/08, the actual benefit payment for the year is zero:

$$\begin{aligned}{}_eAL_1 & = (1.07) * (3,228 + 29,987) - \text{zero} \\ & = 35,540\end{aligned}$$

Fall 2008 EA-2A Exam Solutions

Problem 34 – Page 3

01/01/09 valuation calculations

The participant retired at 12/31/08. You need to calculate their accrued liability, which is equal to the present value of benefits as a retiree:

01/2009 Age	63
Past service	8
2008 pay	52,500

Accrued benefit at 63	$1.0\%(8)(52,500)$
	$= 4,200$

Early retirement factor at 63	$1 - 5\%(65-63) = .90$
-------------------------------	------------------------

Early retirement benefit	$.90(4,200)$
	$= 3,780$

$$\begin{aligned} AL = PVB &= 3,780 * \ddot{a}_{63}^{(12)} \\ &= 3,780 * (9.72) \\ &= 36,742 \end{aligned}$$
$$\begin{aligned} \text{Non-inv G/L} &= {}_eAL_1 - AL_1 \\ &= 35,540 - 36,742 \\ &= -1,202 \end{aligned}$$

Since the actual accrued liability exceeds the expected value, there is a loss of 1,202. The absolute value is 1,202.

Answer is C

NOTE

For all prior exam problems on retirement G/L, there were no retirement decrements. In those problems, the retirement gain / loss calculation is simply the difference between two accrued liability values, both calculated at the current valuation date. One accrued liability is calculated as an active employee, and another is calculated as a retired employee.

Fall 2008 EA-2A Exam Solutions

Problem 35 – Page 1

This problem asks for “the smallest amount that satisfies the minimum funding standard”. Based on exam condition 35, this amount is calculated by offsetting both the funding standard carryover balance (CB) and the prefunding balance (PB) against the minimum contribution under IRC 430. Based on exam conditions 30 and 31, the plan sponsor does elect to offset both the CB and the PB.

The key to this problem is knowing how to calculate the Shortfall amortization base at 01/01/2009 under IRC Section 430. The plan had a funding standard carryover balance (CB) equal to 20,000 at 01/01/2009.

Funding Shortfall

The funding shortfall is defined as the excess of the funding target over the 430(f)(4)(B) assets, which equals the actuarial value of assets less the prefunding balance and the carryover balance.

$$\begin{aligned}\text{Funding S/F} &= \text{Funding target} - (\text{AAV} - \text{CB} - \text{PB}) \\ &= 2,000,000 - (1,840,000 - 20,000 - 0) \\ &= 180,000\end{aligned}$$

Shortfall Base Exemption

You should think about whether this plan satisfies the shortfall base exemption. I will define the “modified funding shortfall” as the modified funding target less the modified assets. If the “modified funding shortfall” is less than or equal to zero, then you would not have to set up the Shortfall base for 2009:

- Modified funding target: the applicable percentage times the funding target
- Since this plan had a deficit reduction contribution in 2007, it was subject to 412(l). This plan must use an applicable percentage of 100%.
- Modified assets: if any portion of the prefunding balance is applied toward the minimum required contribution, the modified assets equal AAV - PB. Otherwise, the modified assets equal the AAV with no reduction.

$$\begin{aligned}\text{Modified S/F} &= 100\% * (\text{Funding target}) - (\text{AAV} - \text{PB}) \\ &= 1.0 * 2,000,000 - (1,840,000 - 0) \\ &= 160,000\end{aligned}$$

Shortfall amortization installment

Since the modified shortfall is greater than zero, the plan is not eligible for the shortfall base exemption. You have to set up the 2009 shortfall amortization base, which is equal to

1. The Applicable percentage times the Funding target
2. Minus the Actuarial asset value reduced by both CB and PB
3. Minus the present value of prior years’ shortfall and waiver amortization installments

Fall 2008 EA-2A Exam Solutions

Problem 35 – Page 2

S/F Amort base = (Applicable %)*(Funding target) - (AAV-CB-PB) - (PV of PY Amortizations)

This plan was exempt from setting up a Shortfall base in 2008, so there are no prior years' shortfall amortization installments.

S/F Amort base = 100%*(Funding target) - (AAV - CB - PB) - zero

The 2009 Shortfall amortization base is equal to the Funding shortfall of 180,000. You are given the 7 year annuity factor based on the 2009 segment rates:

$$\begin{aligned}\text{S/F amort} &= 180,000 / 5.9852 \\ &= 30,074\end{aligned}$$

Minimum Required Contribution

In general, the minimum required contribution (MRC) is defined as the target normal cost plus the shortfall amortization charge and the waiver amortization charge, all at the valuation date.

$$\begin{aligned}\text{MRC} &= \text{TNC} + \text{Shortfall amort charge} + \text{Waiver amort charge} \\ &= 250,000 + 30,074 + 0 \\ &= 280,074\end{aligned}$$

Smallest amount

The problem asks for “the smallest amount that satisfies the minimum funding standard”:

$$\begin{aligned}\text{Smallest contr} &= \text{MRC} - \text{CB} - \text{PB} \\ &= 280,074 - 20,000 - 0 \\ &= 260,074\end{aligned}$$

Answer is D

NOTE

This is the same answer as under the pre-WRERA rules.

Fall 2008 EA-2A Exam Solutions

Problem 36 – Page 1

This problem asks for “the smallest amount that satisfies the minimum funding standard”. Based on exam condition 35, this amount is calculated by offsetting both the funding standard carryover balance (CB) and the prefunding balance (PB) against the minimum contribution under IRC 430. Based on exam conditions 30 and 31, the plan sponsor does elect to offset both the CB and the PB.

The key to this problem is knowing how to calculate the Shortfall amortization base at 01/01/2009 under IRC Section 430. All plans start with a zero prefunding balance (PB) in 2008.

2008 Minimum Funding

You need to figure out what happened with respect to minimum funding for the 2008 plan year. You are told that the employer made no contribution for 2008, but there was a carryover balance of 240,000 at 01/01/08.

2008 Minimum Required Contribution

In general, the minimum required contribution (MRC) is defined as the target normal cost plus the shortfall amortization charge and the waiver amortization charge, all at the valuation date.

$$\begin{aligned}\text{MRC} &= \text{TNC} + \text{Shortfall amort charge} + \text{Waiver amort charge} \\ &= 160,000 + 20,000 + 0 \\ &= 180,000\end{aligned}$$

2009 Carryover balance

With no contribution for 2008, the plan sponsor elected to apply the carryover balance toward the MRC. There is 60,000 remaining, which must be brought forward to 2009.

$$\begin{aligned}\text{Remain CB} &= 240,000 - 180,000 \\ &= 60,000\end{aligned}$$

The carryover balance is brought forward to 01/01/09 using the plan's rate of return on assets for the 2008 year:

$$\begin{aligned}01/2009 \text{ CB} &= 60,000 * (1.15) \\ &= 69,000\end{aligned}$$

Fall 2008 EA-2A Exam Solutions

Problem 36 – Page 2

2009 Funding Shortfall

The funding shortfall is defined as the excess of the funding target over the 430(f)(4)(B) assets, which equals the actuarial value of assets less the prefunding balance and the carryover balance.

$$\begin{aligned}\text{Funding S/F} &= \text{Funding target} - (\text{AAV} - \text{CB} - \text{PB}) \\ &= 2,100,000 - (2,000,000 - 69,000 - 0) \\ &= 169,000\end{aligned}$$

2009 Shortfall Base Exemption

You should think about whether this plan satisfies the shortfall base exemption. I will define the “modified funding shortfall” as the modified funding target less the modified assets. If the “modified funding shortfall” is less than or equal to zero, then you would not have to set up the Shortfall base for 2009:

- Modified funding target: the applicable percentage times the funding target
- In the absence of any information to the contrary, you can assume the applicable percentage is 94%
- Modified assets: if any portion of the prefunding balance is applied toward the minimum required contribution, the modified assets equal AAV - PB. Otherwise, the modified assets equal the AAV with no reduction.

$$\begin{aligned}\text{Modified S/F} &= 94\% * (\text{Funding target}) - (\text{AAV} - \text{PB}) \\ &= .94 * 2,100,000 - (2,000,000 - 0) \\ &= -26,000\end{aligned}$$

Shortfall amortization installment

The plan is eligible for the shortfall base exemption. You do not have to set up the 2009 shortfall amortization base.

Minimum Required Contribution

In general, the minimum required contribution (MRC) is defined as the target normal cost plus the shortfall amortization charge and the waiver amortization charge, all at the valuation date.

$$\begin{aligned}\text{MRC} &= \text{TNC} + \text{Shortfall amort charge} + \text{Waiver amort charge} \\ &= 183,000 + 20,000 + 0 \\ &= 203,000\end{aligned}$$

Fall 2008 EA-2A Exam Solutions

Problem 36 – Page 3

Smallest amount

The problem asks for “the smallest amount that satisfies the minimum funding standard”:

$$\begin{aligned}\text{Smallest contr} &= \text{MRC} - \text{CB} - \text{PB} \\ &= 203,000 - 69,000 - 0 \\ &= 134,000\end{aligned}$$

Answer is A

NOTE

The official answer using the pre-WRERA rules was 144,580 in answer range B.

Fall 2008 EA-2A Exam Solutions

Problem 37 – Page 1

This problem asks for “the smallest amount that satisfies the minimum funding standard”. Based on exam condition 35, this amount is calculated by offsetting both the funding standard carryover balance (CB) and the prefunding balance (PB) against the minimum contribution under IRC 430. Based on exam conditions 30 and 31, the plan sponsor does elect to offset both the CB and the PB.

The key to this problem is knowing how to calculate the Shortfall amortization base at 01/01/2009 under IRC Section 430. You are not given the amount of the prefunding balance at 01/01/09. The plan had a funding standard carryover balance (CB) equal to zero at 01/01/2008. All plans start with a zero prefunding balance (PB) in 2008.

You must calculate the amount of the 2008 shortfall amortization installment. Then you can use the given amount of the 2009 shortfall amortization charge to calculate the prefunding balance at 01/01/09.

2008 Funding Shortfall

The funding shortfall is defined as the excess of the funding target over the 430(f)(4)(B) assets, which equals the actuarial value of assets less the prefunding balance and the carryover balance.

$$\begin{aligned}\text{Funding S/F} &= \text{Funding target} - (\text{AAV} - \text{CB} - \text{PB}) \\ &= 1,700,000 - (1,520,000 - 0 - 0) \\ &= 180,000\end{aligned}$$

2008 Shortfall Base Exemption

You should think about whether this plan satisfies the shortfall base exemption. I will define the “modified funding shortfall” as the modified funding target less the modified assets. If the “modified funding shortfall” is less than or equal to zero, then you would not have to set up the Shortfall base for 2008:

- Modified funding target: the applicable percentage times the funding target
- In the absence of any information to the contrary, you can assume the applicable percentage is 92% for 2008
- Modified assets: if any portion of the prefunding balance is applied toward the minimum required contribution, the modified assets equal AAV - PB. Otherwise, the modified assets equal the AAV with no reduction.

$$\begin{aligned}\text{Modified S/F} &= 92\% * (\text{Funding target}) - (\text{AAV} - \text{PB}) \\ &= .92(1,700,000) - (1,520,000 - 0) \\ &= 44,000\end{aligned}$$

Fall 2008 EA-2A Exam Solutions

Problem 37 – Page 2

In this problem, they did not specify the effective date of the plan. I assumed that the plan is effective prior to 01/01/08, so the applicable percentage is 92%. Under WRERA, both the amount of the modified shortfall and the shortfall amortization base will be affected by this assumption. For exam problems in 2009 and later, the problem should specify the plan's effective date.

2008 Shortfall amortization installment

Since the modified shortfall is greater than zero, the plan is not eligible for the shortfall base exemption. You have to set up the 2008 shortfall amortization base, which is equal to

1. The Applicable percentage times the Funding target
2. Minus the Actuarial asset value reduced by both CB and PB
3. Minus the present value of prior years' shortfall and waiver amortization installments:

$$\text{S/F Amort base} = (\text{Applicable \%}) * (\text{Funding target}) - (\text{AAV} - \text{CB} - \text{PB}) - (\text{PV of PY Amortizations})$$

There are no prior amortizations at 01/01/08.

$$\begin{aligned}\text{S/F Amort base} &= 92\% * (\text{Funding target}) - (\text{AAV} - \text{CB} - \text{PB}) - \text{zero} \\ &= .92 * 1,700,000 - (1,520,000 - 0 - 0) - 0 \\ &= 44,000\end{aligned}$$

The problem gives you the 7 year amortization factor for the shortfall base:

$$\begin{aligned}\text{S/F amort} &= 44,000 / 5.9928 \\ &= 7,342\end{aligned}$$

2009 Funding Shortfall

The funding shortfall is defined as the excess of the funding target over the 430(f)(4)(B) assets, which equals the actuarial value of assets less the prefunding balance and the carryover balance.

$$\begin{aligned}\text{Funding S/F} &= \text{Funding target} - (\text{AAV} - \text{CB} - \text{PB}) \\ &= 2,000,000 - (1,800,000 - 0 - \text{PB})\end{aligned}$$

Since you are not given the 01/01/09 PB, you can't calculate the amount of the shortfall yet.

2009 Shortfall Base Exemption

You should think about whether this plan satisfies the shortfall base exemption. The problem gives you the shortfall amortization installment for 2009, so this plan did not satisfy the exemption.

Fall 2008 EA-2A Exam Solutions

Problem 37 – Page 3

2009 Shortfall amortization installment

The plan is not eligible for the shortfall base exemption. You have to set up the 2009 shortfall amortization base, which is equal to

1. The Applicable percentage times the Funding target
2. Minus the Actuarial asset value reduced by both CB and PB
3. Minus the present value of prior years' shortfall and waiver amortization installments:

$$\begin{aligned}\text{S/F Amort base} &= (\text{Applicable \%}) * (\text{Funding target}) - (\text{AAV-CB-PB}) - (\text{PV of PY Amortizations}) \\ &= .94 * 2,000,000 - (1,800,000 - 0 - \text{PB}) - (\text{PV of PY Amortizations})\end{aligned}$$

You can use the given amount of the 2009 shortfall amortization charge to calculate the prefunding balance at 01/01/09. You can calculate the present value of the 2008 amortization installment. You are given the 6 year annuity factor.

$$\begin{aligned}\text{PV of amort} &= 7,342 * 5.2798 \\ &= 38,765\end{aligned}$$

$$\begin{aligned}\text{2009 S/F base} &= .94 * 2,000,000 - (1,800,000 - 0 - \text{PB}) - (\text{PV of PY Amortizations}) \\ &= 80,000 + \text{PB} - 38,765 \\ &= 41,235 + \text{PB}\end{aligned}$$

The problem gives you the 7 year amortization factor for the 2009 shortfall base, as well as the 2009 shortfall amortization charge:

$$\begin{aligned}\text{2009 S/F base} &= 41,235 + \text{PB} \\ &= 5.9928 * (\text{2009 S/F amort})\end{aligned}$$

The shortfall amortization charge is defined as the sum of all the shortfall amortizations. The shortfall amortization charge is limited so it is never less than zero. It is allowable for any individual shortfall amortization installment to be less than zero.

$$\begin{aligned}\text{S/F charge} &= \text{2008 S/F amort} + \text{2009 S/F amort} \\ 40,000 &= 7,342 + \text{2009 S/F amort}\end{aligned}$$

$$\begin{aligned}\text{S/F amort} &= 40,000 - 7,342 \\ &= 32,658\end{aligned}$$

$$\begin{aligned}41,235 + \text{PB} &= 32,658 * 5.9928 \\ \text{PB} &= 195,713 - 41,235 \\ &= 154,478\end{aligned}$$

Fall 2008 EA-2A Exam Solutions

Problem 37 – Page 4

Minimum Required Contribution

In general, the minimum required contribution (MRC) is defined as the target normal cost plus the shortfall amortization charge and the waiver amortization charge, all at the valuation date.

$$\begin{aligned}\text{MRC} &= \text{TNC} + \text{Shortfall amort charge} + \text{Waiver amort charge} \\ &= 100,000 + 40,000 + 0 \\ &= 140,000\end{aligned}$$

Smallest amount

The problem asks for “the smallest amount that satisfies the minimum funding standard”, payable at 12/31/2009. Based on exam conditions 30 and 31, the plan sponsor elects to apply both the CB and the PB towards the MRC.

Since you are given valuation results for 2008, you can not rely upon exam condition 30. You need to check that the 2008 "funding ratio" is at least 80%, otherwise the plan sponsor can NOT elect to apply both the CB and the PB towards the MRC:

$$\begin{aligned}\text{Funding ratio} &= \frac{\text{AAV} - \text{PB}}{\text{Funding target (non At-Risk basis)}} && \text{(based on 2008 valuation)} \\ &= (1,520,000 - 0) / 1,700,000 \\ &= 89.4\%\end{aligned}$$

The employer can elect to apply both the CB and the PB toward the MRC. The next step is calculation of the "smallest amount" at 01/01/2009:

$$\begin{aligned}\text{Smallest contr} &= \text{MRC} - \text{CB} - \text{PB} \\ &= 140,000 - 0 - 154,478 \\ &= \text{zero}\end{aligned}$$

The plan sponsor paid a contribution of X at 12/31/2009, which would also be equal to zero.

Answer is A

NOTE

The official answer using the pre-WRERA rules was 129,006 in answer range C.

Fall 2008 EA-2A Exam Solutions

Problem 38 – Page 1

The key to this problem is knowing how to calculate the deductible limit under IRC 404(o). You need to know the definition of the cushion amount.

Deductible Limit

The deductible limit is defined as the greater of the minimum contribution required under IRC 430 and the amount under 404(o)(2). IRC 430 defines “the minimum required contribution” as the amount prior to reduction by the carryover balance or the prefunding balance.

Here is the maximum deductible contribution under 404(o)(2):

Target normal cost + Funding target + Cushion amount - Actuarial asset value

The Cushion amount is defined as the sum of two pieces: (1) 50% of the Funding target, and (2) the increase in the Funding target due to allowing for future pay increases. You can think of the second item as the excess of the Projected Unit Credit accrued liability over the Traditional Unit Credit accrued liability. In this problem you are given the value of item (2):

$$\begin{aligned}\text{Cushion amount} &= 50\%(300,000) + (60,000) \\ &= 150,000 + 60,000 \\ &= 210,000\end{aligned}$$

Now you can calculate the deductible limit:

Target normal cost	24,000
+ Funding target	300,000
+ Cushion amount	210,000
Sub-total	534,000
Less unreduced AAV	275,000
Deductible limit	259,000

Minimum contribution

You are given the minimum required contribution as 28,000. It has no impact on the maximum deductible limit.

Alternative Deductible Limit: At-Risk

For plans that are not At-Risk, there is an alternate definition of the deductible limit in 404(o)(2)(B):

“Final” At-Risk Target normal cost + “Final” At-Risk Funding target - Actuarial asset value

Fall 2008 EA-2A Exam Solutions

Problem 38 – Page 2

I have added the descriptive term “Final” to the At-Risk items in this definition. The reason is due to exam condition 48. That condition states that the “At-Risk Funding target” and “At-Risk Target normal cost” given in the problem’s data refer to the values before applying the weighting factors shown in IRC 430(i)(5).

Calculation of At-Risk values

You are told that this plan is not At-Risk for 2009. For the deductible limit calculation, the “Final” At-Risk values will equal the sum of 20% times the At-Risk value and (1-20%) times the non-At-Risk value:

“Final” At-Risk values

$$\begin{aligned}\text{Funding Target} &= 20\%*(450,000) + 80\%*(300,000) \\ &= 330,000\end{aligned}$$

$$\begin{aligned}\text{Target normal cost} &= 20\%*(30,000) + 80\%*(24,000) \\ &= 25,200\end{aligned}$$

"Final" At-Risk Target normal cost	25,200
+ "Final" At-Risk Funding target	330,000
Less unreduced AAV	275,000
Deductible limit	80,200

This is less than the previously calculated deductible limit of 259,000. The final deductible limit is 259,000.

Answer is B

NOTES:

1. This problem did not use the same wording as problem 15:
Problem 38 - "Funding target / Target normal cost using At-Risk assumptions"
Problem 15 - "At-risk Funding target / Target normal cost for IRC section 404 purposes"
2. Even if you forgot to do a phase-in calculation of the At-Risk values, the deductible limit is still 259,000. The impact of the At-Risk rules must be VERY large to make up for the missing Cushion amount under the alternate At-Risk deductible limit definition.

Fall 2008 EA-2A Exam Solutions

Problem 39 – Page 1

Revised 10/17/10

This is a basic question on your understanding of segment interest rates. Under PPA 2006, you would calculate the present value of a stream of annual benefit payments for a life annuity payable to a person age x (currently in pay status) as follows:

$$\begin{aligned} \text{Present value} &= \sum_{t=0}^4 (1.0560)^{-t} {}_t p_x^{(T)} (\text{Benefit Payment}_{x+t}) \\ &+ \sum_{t=5}^{19} (1.0575)^{-t} {}_t p_x^{(T)} (\text{Benefit Payment}_{x+t}) \\ &+ \sum_{t=20}^{\omega-x} (1.0635)^{-t} {}_t p_x^{(T)} (\text{Benefit Payment}_{x+t}) \end{aligned}$$

You can write the present value formula in terms of annual annuities:

$$\text{Age } x \text{ PV} = \text{Benefit} \{ \ddot{a}_{x:\overline{5}|} \text{ at } 5.6\% + (1.0575)^{-5} ({}_5 p_x) \ddot{a}_{x+5:\overline{15}|} \text{ at } 5.75\% + (1.0635)^{-20} ({}_{20} p_x) \ddot{a}_{x+20} \text{ at } 6.35\% \}$$

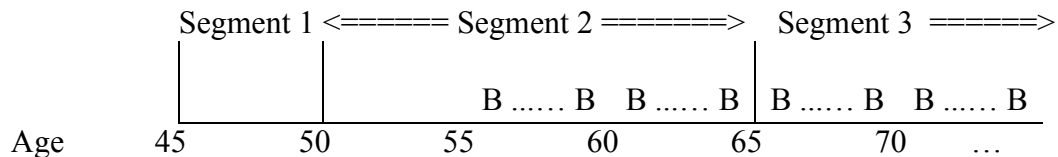
You need to calculate the Funding target at 01/01/2009 allowing for retirement decrements at ages 55 and 65. The first step is to determine the accrued benefit at the valuation date:

Valuation date	01/01/2009
Age	45
Past service	15
Accrued benefit	15(1,750) = 26,250

The Funding target is defined as the present value of the accrued benefit. It is similar to the traditional Unit Credit accrued liability.

The participant is currently 10 years from retirement, based on the first decrement age of 55. The participant will have 25 years of service when they attain age 55, so they will be eligible for unreduced benefits at that age. You can calculate the Funding target using the unreduced accrued benefit at both age 55 and at age 65.

Their benefit payments will be valued using the second and third segment rates:



Problem 39 – Page 2

Revised 10/17/10

One important aspect of the problem is that the pre-retirement mortality and post-retirement mortality are not the same. This means you must be careful to only use the commutation functions after benefit commencement age. Discounting values from the assumed retirement ages back to the valuation date must be done on an interest-only basis.

Here is the formula for the Funding target using monthly annuity rates:

$$\text{Age 45 FT} = 26,250[.50({}_{10|} \ddot{a}_{45:10| \text{seg}_2}^{(12)} + {}_{20|} \ddot{a}_{45 \text{seg}_3}^{(12)}) + .50({}_{20|} \ddot{a}_{45 \text{seg}_3}^{(12)})] \quad (\text{incorrect})$$

As written, this formula for the Funding target is misleading. It appears you can combine the last two annuities, but you really can't. Here is the correct expression:

$$\begin{aligned} \text{Age 45 FT} = 26,250(.50)[(1.0575)^{-10}(\ddot{a}_{55:10| \text{seg}_2}^{(12)}) + (1.0635)^{-10}(v^{10} {}_{10}p_{55})(\ddot{a}_{65 \text{seg}_3}^{(12)}) \\ + (1.0635)^{-20}(\ddot{a}_{65 \text{seg}_3}^{(12)})] \end{aligned}$$

Now you need to express these annuities in terms of commutation functions:

$$\ddot{a}_{55:10| \text{seg}_2}^{(12)} = (N_{55}^{(12)} - N_{65}^{(12)}) / D_{55} \quad \text{all at segment 2 rate}$$

$${}_{10|} \ddot{a}_{55 \text{seg}_3}^{(12)} = (v^{10} {}_{10}p_{55})(\ddot{a}_{65 \text{seg}_3}^{(12)}) \quad \text{all at segment 3 rate}$$

$$= (D_{65} / D_{55}) * (N_{65}^{(12)} / D_{65}) \quad \text{all at segment 3 rate}$$

$$= (N_{65}^{(12)} / D_{55}) \quad \text{all at segment 3 rate}$$

$$\ddot{a}_{65 \text{seg}_3}^{(12)} = (N_{65}^{(12)} / D_{65}) \quad \text{all at segment 3 rate}$$

That is the most confusing part of this problem. If you can write down the commutation functions correctly, there is only a bit of arithmetic to produce the final answer.

$$\begin{aligned} \text{Age 45 FT} &= 26,250(.50)[(1.0575)^{-10} \frac{(450,843 - 199,375)}{33,440} + (1.0635)^{-10} \frac{(167,616)}{29,367} \\ &\quad + (1.0635)^{-20} \frac{(167,616)}{15,426}] \\ &= 26,250(.50)[(1.0575)^{-10}(7.5200) + (1.0635)^{-10}(5.7076) + (1.0635)^{-20}(10.8658)] \\ &= 26,250(.50)[4.2994 + 3.0837 + 3.1718] \\ &= 138,533 \end{aligned}$$

Answer is B

I think this is one of the hardest problems on the exam!

Fall 2008 EA-2A Exam Solutions

Problem 40 – Page 1

This is a basic question on your understanding of segment interest rates. Under PPA 2006, you would calculate the present value of a stream of annual benefit payments for a life annuity payable to a person age x (currently in pay status) as follows:

$$\begin{aligned} \text{Present value} &= \sum_{t=0}^4 (1.0500)^{-t} {}_t p_x^{(T)} (\text{Benefit Payment}_{x+t}) \\ &+ \sum_{t=5}^{19} (1.0600)^{-t} {}_t p_x^{(T)} (\text{Benefit Payment}_{x+t}) \\ &+ \sum_{t=20}^{\omega-x} (1.0700)^{-t} {}_t p_x^{(T)} (\text{Benefit Payment}_{x+t}) \end{aligned}$$

You can write the present value formula in terms of annual annuities:

$$\text{Age } x \text{ PV} = \text{Benefit} \left\{ \ddot{a}_{x:\overline{5}|} \text{ at } 5.0\% + (1.055)^{-5} ({}_5 p_x) \ddot{a}_{x+5:\overline{15}|} \text{ at } 5.5\% + (1.06)^{-20} ({}_{20} p_x) \ddot{a}_{x+20} \text{ at } 6\% \right\}$$

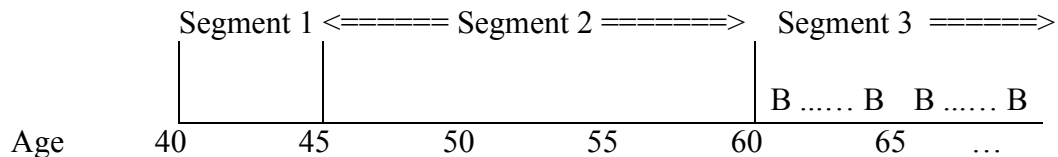
You need to calculate the Funding target at 01/01/2009 allowing for retirement decrements at ages 60 and 62. The first step is to determine the accrued benefit at the valuation date:

Valuation date	01/01/2009
Age	40
Past service	10
Accrued benefit	$10(12)(100)$ $= 12,000$

The Funding target normal cost is defined as the present value of the accrued benefit. It is similar to the traditional Unit Credit accrued liability.

The participant is currently 20 years from retirement, based on the first decrement age of 60. The participant will have 32 years of service when they attain age 62. You can calculate the Funding target using the unreduced accrued benefit at age 62. You must allow for the early retirement reductions at age 60.

Their benefit payments will be valued using only the third segment rate:



Fall 2008 EA-2A Exam Solutions

Problem 40 – Page 2

One important aspect of the problem is that the pre-retirement mortality and post-retirement mortality are not the same. This means you must be careful to only use the commutation functions after benefit commencement age. Discounting values from the assumed retirement ages back to the valuation date must be done on an interest-only basis.

Here is the formula for the Target normal cost using monthly annuity rates:

$$\text{Age 40 FT} = 12,000[25\%(\text{ERF}_{60})({}_{20|}\ddot{a}_{40 \text{ seg}_3}^{(12)}) + 75\%({}_{22|}\ddot{a}_{40 \text{ seg}_3}^{(12)})] \quad (\text{incorrect})$$

As written, this formula for the Funding target is misleading. It appears you can combine the last two annuities, but you really can't. Here is the correct expression:

$$\text{Age 40 FT} = 12,000[25\%(\text{ERF}_{60})(1.06)^{-20}(\ddot{a}_{60 \text{ seg}_3}^{(12)}) + 75\%(1.06)^{-22}(\ddot{a}_{62 \text{ seg}_3}^{(12)})]$$

You need to calculate the early retirement reduction factor at age 60:

$$\begin{aligned}\text{ERF}_{60} &= 1 - (65-60)(7\%) \\ &= .65\end{aligned}$$

Now you need to express these annuities in terms of commutation functions:

$$\ddot{a}_{60 \text{ seg}_3}^{(12)} = (N_{60}^{(12)} / D_{60}) \quad \text{all at segment 3 rate}$$

$$\ddot{a}_{62 \text{ seg}_3}^{(12)} = (N_{62}^{(12)} / D_{62}) \quad \text{all at segment 3 rate}$$

That is the most confusing part of this problem. If you can write down the commutation functions correctly, there is only a bit of arithmetic to produce the final answer.

$$\begin{aligned}\text{Age 40 FT} &= 12,000[25\%(.65)(1.06)^{-20}\frac{(7,411)}{551} + 75\%(1.06)^{-22}\frac{(6,363)}{495}] \\ &= 12,000[.25(.65)(1.06)^{-20}(13.5401) + .75(1.06)^{-22}(12.8545)] \\ &= 12,000[.6815 + 2.6754] \\ &= 40,283\end{aligned}$$

Answer is B

After working problem 39, this one seems a bit easier.

Fall 2008 EA-2A Exam Solutions

Problem 41 – Page 1

This problem asks the shortfall amortization installment for the 2009 shortfall base. The key to this problem is knowing how to calculate the Shortfall amortization base at 01/01/2009 under IRC Section 430. The plan had a funding standard carryover balance (CB) equal to 45,600 at 01/01/2008. All plans start with a zero prefunding balance (PB) in 2008.

2008 Funding Shortfall

The funding shortfall is defined as the excess of the funding target over the 430(f)(4)(B) assets, which equals the actuarial value of assets less the prefunding balance and the carryover balance.

$$\begin{aligned}\text{Funding S/F} &= \text{Funding target} - (\text{AAV} - \text{CB} - \text{PB}) \\ &= 848,000 - (736,000 - 45,600 - 0) \\ &= 157,600\end{aligned}$$

2008 Shortfall Base Exemption

You should think about whether this plan satisfies the shortfall base exemption. I will define the “modified funding shortfall” as the modified funding target less the modified assets. If the “modified funding shortfall” is less than or equal to zero, then you would not have to set up the Shortfall base for 2008:

- Modified funding target: the applicable percentage times the funding target
- In the absence of any information to the contrary, you can assume the applicable percentage is 92%
- Modified assets: if any portion of the prefunding balance is applied toward the minimum required contribution, the modified assets equal AAV - PB. Otherwise, the modified assets equal the AAV with no reduction.

$$\begin{aligned}\text{Modified S/F} &= 92\% * (\text{Funding target}) - (\text{AAV} - \text{PB}) \\ &= .92 * 848,000 - (736,000 - 0) \\ &= 44,160\end{aligned}$$

Shortfall amortization installment

Since the modified shortfall is greater than zero, the plan is not eligible for the shortfall base exemption. You have to set up the 2008 shortfall amortization base, which is equal to

1. The Applicable percentage times the Funding target
2. Minus the Actuarial asset value reduced by both CB and PB
3. Minus the present value of prior years’ shortfall and waiver amortization installments:

$$\text{S/F Amort base} = (\text{Applicable \%}) * (\text{Funding target}) - (\text{AAV} - \text{CB} - \text{PB}) - (\text{PV of PY Amortizations})$$

Fall 2008 EA-2A Exam Solutions

Problem 41 – Page 2

There are no prior amortizations at 01/01/08.

$$\begin{aligned}\text{S/F Amort base} &= 92\% * (\text{Funding target}) - (\text{AAV} - \text{CB} - \text{PB}) - \text{zero} \\ &= .92 * 848,000 - (736,000 - 45,600 - 0) - 0 \\ &= 89,760\end{aligned}$$

Shortfall amortization installment

The problem gives you the 2008 amortization factor for the shortfall base:

$$\begin{aligned}\text{S/F amort} &= 89,760 / 5.9682 \\ &= 15,040\end{aligned}$$

2009 Funding Shortfall

The funding shortfall is defined as the excess of the funding target over the 430(f)(4)(B) assets, which equals the actuarial value of assets less the prefunding balance and the carryover balance.

$$\begin{aligned}\text{Funding S/F} &= \text{Funding target} - (\text{AAV} - \text{CB} - \text{PB}) \\ &= 1,200,000 - (918,400 - 0 - 0) \\ &= 281,600\end{aligned}$$

2009 Shortfall Base Exemption

You should think about whether this plan satisfies the shortfall base exemption. I will define the “modified funding shortfall” as the modified funding target less the modified assets. If the “modified funding shortfall” is less than or equal to zero, then you would not have to set up the Shortfall base for 2008:

- Modified funding target: the applicable percentage times the funding target
- In the absence of any information to the contrary, you can assume the applicable percentage is 94%
- Modified assets: if any portion of the prefunding balance is applied toward the minimum required contribution, the modified assets equal AAV - PB. Otherwise, the modified assets equal the AAV with no reduction.

$$\begin{aligned}\text{Modified S/F} &= 94\% * (\text{Funding target}) - (\text{AAV} - \text{PB}) \\ &= .94 * 1,200,000 - (918,400 - 0) \\ &= 209,600\end{aligned}$$

Fall 2008 EA-2A Exam Solutions

Problem 41 – Page 3

Shortfall amortization installment

The plan is not eligible for the shortfall base exemption. You have to set up the 2009 shortfall amortization base, which is equal to

1. The Applicable percentage times the Funding target
2. Minus the Actuarial asset value reduced by both CB and PB
3. Minus the present value of prior years' shortfall and waiver amortization installments:

$$\begin{aligned}\text{S/F Amort base} &= (\text{Applicable \%}) * (\text{Funding target}) - (\text{AAV-CB-PB}) - (\text{PV of PY Amortizations}) \\ &= .94 * 1,200,000 - (918,400 - 0 - 0) - (\text{PV of PY Amortizations}) \\ &= 209,600 - (\text{PV of PY Amortizations})\end{aligned}$$

You must allow for the 2008 amortization installment of 15,040. You are given the 6 year annuity factor, using the new segment rates for 2009:

$$\begin{aligned}\text{PV of amort} &= 15,040 * 5.2532 \\ &= 79,007\end{aligned}$$

$$\begin{aligned}\text{2009 S/F base} &= 209,600 - 79,007 \\ &= 130,593\end{aligned}$$

The problem gives you the 2009 segment rates and the amortization factor for the shortfall base:

$$\begin{aligned}\text{S/F amort} &= 130,593 / 5.9682 \\ &= 21,881\end{aligned}$$

Answer is A

NOTE

The official answer using the pre-WRERA rules was 23,940 in answer range A.

Fall 2008 EA-2A Exam Solutions

Problem 42 – Page 1

Revised 10/17/10

This problem asks for the Funding target used to calculate the shortfall amortization base. The key idea is that the plan has been At-Risk for all years since 2007.

Exam condition 48 defines terms related to At-Risk plans:

The terms “at-risk funding target” and “at-risk target normal cost” mean the funding target and target normal cost calculated reflecting additional actuarial assumptions and loading factors (if applicable) for a plan in at-risk status prior to the application of any five-year transition as described in IRC section 430(i)(5).

The information given in the problem does not match what is described in the exam condition, but it is clearly described in a non-ambiguous manner. The problem gives you the Funding target ignoring the At-Risk rules. You are also given the Funding target reflecting the At-Risk assumptions, but ignoring the load factors.

IRC 430(i)(1)(A) defines the load factors that are used in calculating the Funding target and the Target normal cost on an At-Risk basis. The Funding target equals the sum of

- PV of all benefits accrued or earned under the plan
 - As of the beginning of the plan year
 - Using assumptions in 430(i)(1)(B), plus
- For plan in at-risk status for at least 2 of the 4 preceding plan years, a loading factor of \$700 per participant, plus 4% of the Funding target, ignoring 430(i) rules

The plan has previously been determined to be in At-Risk status for 2008 and 2009, so both of the additional load factors should be applied for 2010:

Funding target using 430(i)(1)(B) assump	10,250,000
4% load	333,000 = 4%*8,325,000
Per participant load	420,000 = 700*600
At-Risk Funding target	11,003,000

At-Risk plan - Weighting factors

IRC 430(i)(5) defines weighting factors that are used in calculating the “final values” of the Funding target and the Target normal cost on an At-Risk basis:

Consecutive years plan has been in at-risk status	Percent of item based on 430(i) rules	Percent of item ignoring 430(i) rules
1	20%	80%
2	40%	60%
3	60%	40%
4	80%	20%
5	100%	zero

Fall 2008 EA-2A Exam Solutions

Problem 42 – Page 2

The plan has previously been determined to be in At-Risk status for 2008 through 2010, for three consecutive years. The “Final” At-Risk value will equal the sum of 60% times the At-Risk value (which includes loads) and (1-60%) times the non-At-Risk value:

$$\begin{aligned}\text{Funding Target} &= 60\%*(11,003,000) + 40%*(8,325,000) \\ &= 9,931,800\end{aligned}$$

Answer is C

Fall 2008 EA-2A Exam Solutions

Problem 43 – Page 1

This problem asks for “the smallest amount that satisfies the minimum funding standard”. Based on exam condition 35, this amount is calculated by offsetting both the funding standard carryover balance (CB) and the prefunding balance (PB) against the minimum contribution under IRC 430. Based on exam conditions 30 and 31, the plan sponsor does elect to offset both the CB and the PB.

The key to this problem is knowing how to calculate the Shortfall amortization base at 01/01/2009 under IRC Section 430. You are not given the amount of the prefunding balance at 01/01/09. All plans start with a zero prefunding balance (PB) in 2008.

2008 Minimum Funding

You need to figure out what happened with respect to minimum funding for the 2008 plan year. You are told that the employer made no contribution for 2008, but there was a carryover balance of 180,000 at 01/01/08.

2008 Funding Shortfall

The funding shortfall is defined as the excess of the funding target over the 430(f)(4)(B) assets, which equals the actuarial value of assets less the prefunding balance and the carryover balance.

$$\begin{aligned}\text{Funding S/F} &= \text{Funding target} - (\text{AAV} - \text{CB} - \text{PB}) \\ &= 1,500,000 - (1,519,600 - 180,000 - 0) \\ &= 160,400\end{aligned}$$

2008 Shortfall Base Exemption

You should think about whether this plan satisfies the shortfall base exemption. I will define the “modified funding shortfall” as the modified funding target less the modified assets. If the “modified funding shortfall” is less than or equal to zero, then you would not have to set up the Shortfall base for 2008:

- Modified funding target: the applicable percentage times the funding target
- In the absence of any information to the contrary, you can assume the applicable percentage is 92% for 2008
- Modified assets: if any portion of the prefunding balance is applied toward the minimum required contribution, the modified assets equal AAV - PB. Otherwise, the modified assets equal the AAV with no reduction.

$$\begin{aligned}\text{Modified S/F} &= 92\% * (\text{Funding target}) - (\text{AAV} - \text{PB}) \\ &= .92(1,500,000) - (1,519,600 - 0) \\ &= \text{zero}\end{aligned}$$

Fall 2008 EA-2A Exam Solutions

Problem 43 – Page 2

2008 Minimum Required Contribution

Since the modified shortfall is zero, the plan is eligible for the shortfall base exemption. In general, the minimum required contribution (MRC) is defined as the target normal cost plus the shortfall amortization charge and the waiver amortization charge, all at the valuation date.

$$\begin{aligned}\text{MRC} &= \text{TNC} + \text{Shortfall amort charge} + \text{Waiver amort charge} \\ &= 120,000 + 0 + 0 \\ &= 120,000\end{aligned}$$

2009 Carryover balance

With no contribution for 2008, the plan sponsor elected to apply the carryover balance toward the MRC. There is 60,000 remaining, which must be brought forward to 2009.

$$\begin{aligned}\text{Remain CB} &= 180,000 - 120,000 \\ &= 60,000\end{aligned}$$

The carryover balance is brought forward to 01/01/09 using the plan's rate of return on assets for the 2008 year:

$$\begin{aligned}\text{01/2009 CB} &= 60,000 \times (1.02) \\ &= 61,200\end{aligned}$$

2009 Plan amendment

There was a plan amendment effective January 1, 2009. You need to calculate the values of the Funding target and the Target normal cost that reflect the plan amendment:

$$\begin{aligned}\text{Funding target} &= 1,600,000 \times (27/25) \\ &= 1,728,000\end{aligned}$$

$$\begin{aligned}\text{Target NC} &= 145,000 \times (27/25) \\ &= 156,600\end{aligned}$$

2009 Funding Shortfall

The funding shortfall is defined as the excess of the funding target over the 430(f)(4)(B) assets, which equals the actuarial value of assets less the prefunding balance and the carryover balance.

$$\begin{aligned}\text{Funding S/F} &= \text{Funding target} - (\text{AAV} - \text{CB} - \text{PB}) \\ &= 1,728,000 - (1,550,000 - 61,200 - 0) \\ &= 239,200\end{aligned}$$

Fall 2008 EA-2A Exam Solutions

Problem 43 – Page 3

2009 Shortfall Base Exemption

You should think about whether this plan satisfies the shortfall base exemption. I will define the “modified funding shortfall” as the modified funding target less the modified assets. If the “modified funding shortfall” is less than or equal to zero, then you would not have to set up the Shortfall base for 2009:

- Modified funding target: the applicable percentage times the funding target
- In the absence of any information to the contrary, you can assume the applicable percentage is 94%
- Modified assets: if any portion of the prefunding balance is applied toward the minimum required contribution, the modified assets equal AAV - PB. Otherwise, the modified assets equal the AAV with no reduction.

$$\begin{aligned}\text{Modified S/F} &= 94\% * (\text{Funding target}) - (\text{AAV} - \text{PB}) \\ &= .94 * 1,728,000 - (1,550,000 - 0) \\ &= 74,320\end{aligned}$$

2009 Shortfall amortization installment

The plan is not eligible for the shortfall base exemption. You have to set up the 2009 shortfall amortization base, which is equal to

1. The Applicable percentage times the Funding target
2. Minus the Actuarial asset value reduced by both CB and PB
3. Minus the present value of prior years’ shortfall and waiver amortization installments:

$$\text{S/F Amort base} = (\text{Applicable \%}) * (\text{Funding target}) - (\text{AAV} - \text{CB} - \text{PB}) - (\text{PV of PY Amortizations})$$

There was no shortfall base established for 2008.

$$\begin{aligned}\text{S/F Amort base} &= .94 * 1,728,000 - (1,550,000 - 61,200 - 0) - 0 \\ &= 135,520\end{aligned}$$

The problem gives you the 7 year amortization factor for the 2009 shortfall base:

$$\begin{aligned}\text{S/F amort} &= 135,520 / 5.9682 \\ &= 22,707\end{aligned}$$

Fall 2008 EA-2A Exam Solutions

Problem 43 – Page 4

Minimum Required Contribution

In general, the minimum required contribution (MRC) is defined as the target normal cost plus the shortfall amortization charge and the waiver amortization charge, all at the valuation date.

$$\begin{aligned}\text{MRC} &= \text{TNC} + \text{Shortfall amort charge} + \text{Waiver amort charge} \\ &= 156,600 + 22,707 + 0 \\ &= 179,307\end{aligned}$$

Smallest amount

The problem asks for “the smallest amount that satisfies the minimum funding standard”, payable at 01/01/2009. Based on exam conditions 30 and 31, the plan sponsor elects to apply both the CB and the PB towards the MRC.

Since you are given valuation results for 2008, you can not rely upon exam condition 30. You need to check that the 2008 "funding ratio" is at least 80%, otherwise the plan sponsor can NOT elect to apply both the CB and the PB towards the MRC:

$$\begin{aligned}\text{Funding ratio} &= \frac{\text{AAV} - \text{PB}}{\text{Funding target (non At-Risk basis)}} && \text{(based on 2008 valuation)} \\ &= (1,519,600 - 0) / 1,500,000 \\ &= 101.3\%\end{aligned}$$

The employer can elect to apply both the CB and the PB toward the MRC. The next step is calculation of the "smallest amount" at 01/01/2009:

$$\begin{aligned}\text{Smallest contr} &= \text{MRC} - \text{CB} - \text{PB} \\ &= 179,307 - 61,200 - 0 \\ &= 118,107\end{aligned}$$

Answer is A

NOTE

The official answer using the pre-WRERA rules was 135,479 in answer range C.

Fall 2008 EA-2A Exam Solutions

Problem 44 – Page 1

Similar to 2007 #07

This is a relatively straightforward 415 problem. Starting in 1997, earnings under §415 is defined as total compensation (not taxable). Based on the regulation that became final in 2007, earnings under §415 are subject to the §401(a)(17) limit.

At 12/31/08

Age	68
Service	8 years
Participation	5 years

PLAN BENEFIT

The plan benefit is based on "compensation", which is given as 8,700 for all years.

$$\begin{aligned}\text{Accrued benefit} &= 8,700 * 100\% \\ &= 8,700\end{aligned}$$

415 COMP LIMIT

The §415(b)(1)(B) compensation limit is reduced when service is less than ten years.

$$\begin{aligned}\text{\$415 compensation limit} &= 8,700 * (8/10) \\ &= 6,960\end{aligned}$$

415 DOLLAR LIMIT

Under §415(b)(1)(A), the dollar limit is reduced when participation is less than ten years.

$$\begin{aligned}\text{\$415 dollar limit during 2008} &= 185,000 * (5/10) && \text{for ages 62-65} \\ &= 92,500\end{aligned}$$

The 415 dollar limit should be actuarially increased beyond age 65. But the problem does not give you any factors on the mandated basis.

FINAL 415 LIMIT

There is a reason why the problem does not give any actuarial increase factors for the 415 limit. Since the 415 compensation limit is so much lower, actuarial increases in the dollar limit will have no effect. The final 415 limit is the lesser of the comp limit and the dollar limit, or 6,960.

The key point of the problem is that the final 415 limit does NOT include the 10,000 floor. In IRC 415(b)(4)(B), it states that the 10,000 floor is NOT available if the employer has maintained a defined contribution plan in which this person was a participant. The fact that the plan document includes the IRC 415(b)(4) language about the 10,000 floor is irrelevant.

Fall 2008 EA-2A Exam Solutions

Problem 44 – Page 2

The final 415 limit is the lesser of the comp limit and the dollar limit, or 6,960. Since this is less than the participant's accrued benefit, the monthly benefit payable is $580 = 6,960/12$.

Answer is C

NOTE

The participant appears to be a late retirement, so I would expect an actuarial increase in the plan benefit from age 65 to age 68. Due to the size of the 415 compensation limit, actuarial increases in the plan benefit will have no effect.

For more background on late retirement calculations, see the notes at the end of the solution for problem 22.

Fall 2008 EA-2A Exam Solutions

Problem 45

The key to this problem is that the retirement gain / loss calculation is simply the difference between two accrued liability values. One accrued liability is calculated as an active employee, and another is calculated as a retired employee.

You need to calculate the Unit Credit accrued liability at 01/01/2009. The accrued liability is defined as the present value of the accrued benefit.

Retired AL = PV of Early retirement benefit

Active AL = PV of Accrued benefit

Retired PVB calculations

Name	Smith	Jones	Brown
01-01-09 Age	56	64	60
Accrued benefit	$1,440 = 12(120)$	$6,600 = 12(550)$	$3,600 = 12(300)$
Early retirement Reduction factor	$1 - (65-60)(8\%) - (60-56)(3\%) = .48$	$1 - (65-64)(8\%) = .92$	$1 - (65-60)(8\%) = .60$
Early Ret Benefit	$.48(1,440) = 691.20$	$.92(6,600) = 6,072$	$.60(3,600) = 2,160$
Retirement annuity	$\ddot{a}_{56}^{(12)}$	$\ddot{a}_{64}^{(12)}$	$\ddot{a}_{60}^{(12)}$
PVB as retiree	$691.20*(14.00) = 9,677$	$6,072*(12.00) = 72,864$	$2,160*(13.00) = 28,080$

Active AL calculations

Name	Smith	Jones	Brown
01-01-09 Age	56	64	60
Accrued benefit	$1,440 = 12(120)$	$6,600 = 12(550)$	$3,600 = 12(300)$
Accrued liability	$1,440(1.07)^{-9} \ddot{a}_{65}^{(12)} = 9,203$	$6,600(1.07)^{-1} \ddot{a}_{65}^{(12)} = 72,477$	$3,600(1.07)^{-5} \ddot{a}_{65}^{(12)} = 30,159$
Gain or Loss?	Loss	Loss	Gain

Only Brown's retirement causes an experience gain.

Answer is C

Fall 2008 EA-2A Exam Solutions

Problem 46 – Page 1

The key to this problem is that you have to know how to do calculations under the Entry Age Normal method. But even better, you have retirement decrements, and you need to calculate the Entry Age Normal cost. With this problem, they really "saved the best for last!"

In general, the Entry Age Normal Cost (EANC) is defined as the present value of benefits at entry age, divided by a temporary annuity at entry age. The complicating factor in this problem is the retirement decrements at ages 60 and 65:

$$EANC = PVB_{EA} / \ddot{a}_{\overline{EA:RA-EA}|}$$

Age 50 at 01/01/09

Entry age 40

Past service 10

This participant is eligible to retire at age 60. To calculate the present value of future benefits, you need to calculate the projected monthly benefit at ages 60 and 65. The present value calculation allows for 50% of the participant to retire at age 60, and the remaining 50% to retire at age 65:

Retirement age	60	65
Projected service	20	25
Projected benefit	48,000 = 20(12)(200)	60,000 = 25(12)(200)
Early retirement		
Reduction factor	1 - (65-60)(5%) = .75	1.00
PVB at entry age	50%(.75)(48,000)(D ₆₀ / D ₄₀) $\ddot{a}_{60}^{(12)}$	50%(60,000)(D ₆₅ / D ₄₀) $\ddot{a}_{65}^{(12)}$
	= .5(36,000)(N ₆₀ ⁽¹²⁾ / D ₄₀)	= .5(60,000)(N ₆₅ ⁽¹²⁾ / D ₄₀)
	= 18,000(878,199/243,921)	= 30,000(567,159/243,921)
	= 64,806	= 69,755

The total PVB at entry age 40 is 134,561 = 64,806 + 69,755. Now you must calculate the temporary annuity from entry age to 65, allowing for the retirement decrements at ages 60 and 65.

With no retirement decrements, this is the expression for the temporary annuity:

$$\ddot{a}_{\overline{40:25}|} = (N_{40} - N_{65}) / D_{40} \quad (\text{assuming no decrements})$$

Fall 2008 EA-2A Exam Solutions

Problem 46 – Page 2

With a 50% decrement at age 60, you can think of the temporary annuity as the sum of two temporary annuities: 50% of the temporary annuity assuming retirement at age 60 plus 50% of the temporary annuity assuming retirement at age 65:

$$\ddot{a}_{\overline{40:25}|} = (N_{40} - N_{65}) / D_{40} \quad (\text{assuming no decrements})$$

$$\begin{aligned} \ddot{a}_{\overline{40:25}|} &= .50(N_{40} - N_{60}) / D_{40} + .50(N_{40} - N_{65}) / D_{40} \quad (\text{with decrements}) \\ &= .50(2N_{40} - N_{60} - N_{65}) / D_{40} \\ &= .50[2(3,845,511) - 911,524 - 591,082] / 243,921 \\ &= 12.6853 \end{aligned}$$

Finally, the Entry Age normal cost is $10,608 = 134,561 / 12.6853$.

Answer is C