



SoftwarePolish

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FALL 2009 EA-2A EXAM SOLUTIONS

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Fall 2009 EA-2A Exam Solutions

These solutions were prepared based on the law as in effect at June 30, 2009. The Pension Protection Act of 2006 (PPA 2006) was included on the syllabus for the first time on the 2007 exam.

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:

October 23, 2013	Corrected solution for problem 16
November 12, 2012	Corrected solution for problems 16, 20 and 31
October 22, 2012	Corrected solution for problem 15
October 15, 2012	Corrected solution for problem 56
September 19, 2012	Corrected solution for problem 51
October 28, 2011	Corrected solutions for problems 39, 50 and 53
August 18, 2011	Corrected solution for problem 22
October 26, 2010	Corrected solution for problem 9
October 11, 2010	Corrected solutions for problems 8, 9, 10, 22, 32, 38, 42, 50 and 54
August 25, 2010	Original solutions

<u>Exam Year</u>	<u>Pass Mark</u>	<u>Percentage Who passed</u>	
2009	107	46.7	
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	

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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 are equal to AAV - PB. Otherwise, the modified assets equal the AAV with no reduction.

Based on 2009 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%

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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

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

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

2009 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.

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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 2009 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 $140\% \times (\text{Current Liability}) - \text{AAV}$. 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.

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Problem 1

FALSE

When adjusting contributions with interest, you use the effective rate of interest. The effective rate is based on the plan year for which the contribution is made. In this situation, the 2009 plan year contribution will be adjusted with the 2009 effective rate of interest.

Answer is B

Problem 2

FALSE

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 S/F = (Applicable percentage)*(Funding target) - (AAV - PB)

Since the plan was established in 2008, the applicable percentage for 2010 is 100% (not 96%).

Answer is B

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Problem 3

FALSE

A plan is subject to quarterly contributions if it is a single employer plan, and there was a funding shortfall for the prior plan year. There is no special exemption for frozen plans.

Answer is B

Problem 4

FALSE

For non-multiemployer plans, the excise tax is 10% on unpaid minimum contributions. Multiemployer plans have a 5% excise tax on an accumulated funding deficiency.

See IRC 4971(a)(2).

Answer is B

The easy way to miss this is by thinking of non-deductible contributions. Those have a 10% excise tax.

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Problem 5

TRUE

When a plan changes either the stability period or the lookback period, there is a 12 month grandfathering period. During that time, any amount calculated under 417(e) must be the greater of the values under the new and the old definitions of both periods.

See 1.417(e)-1(d)(10)

Answer is A

Problem 6

FALSE

There is a specific exception which allows certain amendments that increase benefit accruals. The amendment must be paid for by additional contributions that are not part of the rehabilitation plan. In addition, after the increase in benefits, the plan is still expected to emerge from critical status under the schedule in the rehabilitation plan.

Answer is B

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Problem 7

FALSE

You can have a different lookback month under IRC 430 versus IRC 417(e). There is no relationship between the segment rates used to determine the funding target and the segment rates used for 417(e) calculations.

Answer is B

Problem 8

Revised 10/11/10

FALSE

In order for a plan to be in at-risk status, you must have more than 500 participants on at least one day of the prior plan year. In addition, for this plan to be in at-risk status at 01/01/2010, two conditions must be satisfied:

- The 2009 funding target attainment percentage (FTAP) must be less than 75%, and
- The 2009 FTAP determined using the 430(i)(1)(B) assumptions must be less than 70%

Since the 2009 FTAP is 78%, the plan is not in at-risk status for the 2010 year.

Answer is B

Problem 9

Revised 10/26/10

FALSE

In IRC 4972, it defines the excise tax as 10%, so the amount of 20,000 looks correct (since $20,000 = 10\% \times (900,000 - 700,000)$).

But the question is false for two reasons:

- The amount of the excise tax is not 20,000. The excise tax is based on the unpaid minimum contribution, which must be measured at 01/01/10. You must compare the discounted value of the employer contribution to the minimum contribution. The unpaid minimum contribution is $266,324 = 900,000 - 700,000(1.06)^{-20.5/12}$.
- If an excise tax is assessed, it does not occur instantaneously. If the final contribution is paid on 09/15/2011, the IRS would not assess the excise tax until after 09/15/2011.

Answer is B

Problem 10

Revised 10/11/10

TRUE

A plan is subject to quarterly contributions if it is a single employer plan, and there was a funding shortfall for the prior plan year. Based on the FTAP value, there was a shortfall in 2009.

Since the plan is frozen, the target normal cost is zero. The plan was exempt from establishing a new shortfall amortization base for the years 2008 and 2009:

2008 shortfall base exemption test

Modified AAV = AAV - PB (or AAV - 0)

Modified FT = 92%*(Funding Target)

The plan is exempt from establishing a shortfall base if the modified AAV \geq modified FT.

2008 FTAP = 93.1%

93.1% = (AAV - CB - PB) / FT

93.1%*FT = AAV - CB - PB

AAV - PB = CB + 93.1%*FT, which is greater than 92%*FT

The plan satisfies the shortfall base exemption for 2008.

2009 shortfall base exemption test

Modified AAV = AAV - PB (or AAV - 0)

Modified FT = 94%*(Funding Target)

The plan is exempt from establishing a shortfall base if the modified AAV \geq modified FT.

2009 FTAP = 94.1%

94.1% = (AAV - CB - PB) / FT

94.1%*FT = AAV - CB - PB

AAV - PB = CB + 94.1%*FT, which is greater than 94%*FT

The plan satisfies the shortfall base exemption for 2009. With no shortfall bases, the minimum required contribution is zero for 2009.

The required installment is 25% times the required annual payment (RAP). The RAP is defined as the lesser of

- 90% of the minimum required contribution for 2010, and
- 100% of the minimum required contribution for 2009.

The required annual payment for 2010 is zero. As a result, the required installment is also zero.

Answer is A

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Problem 11

When adjusting contributions with interest, you use the effective rate of interest. The effective rate is based on the plan year for which the contribution is made.

When adjusting the carryover balance or the prefunding balance from one year to the next, you use the actual rate of return on the market value of assets.

Answer is B

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Problem 12

ASSERTION

This is true. People receiving Social Security disability benefits are typically severely disabled.

REASON

This is true. If a plan has a fairly liberal definition of disability, its mortality rates for disabled lives would be much lower than those who are eligible to receive Social Security disability benefits.

Answer is A

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Problem 13

ASSERTION

This is false. The actuary must conform to the "best estimate" criteria for selecting actuarial assumptions.

REASON

This is false. The population of the spun-off plan may have a completely different composition than the original plan, which will produce different experience in the future.

Answer is E

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Problem 14 – Page 1

This problem asks for change in X due to the asset method change. The contribution of X is described as “the smallest amount that satisfies the minimum funding standard”. Based on exam condition 31, 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 27 and 28, 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 installment at 01/01/2010 under IRC Section 430. This requires you to calculate the shortfall amortization base, and also to check the shortfall base exemption at 01/01/2010.

2009 Funding Shortfall

You are told that the Funding target attainment percentage (FTAP) was 100% at 01/01/09. The FTAP is calculated by reducing the Actuarial value of assets by both the carryover and prefunding balances:

$$\text{FTAP} = \frac{\text{AAV} - \text{CB} - \text{PB}}{\text{Funding target}} = 100\%$$

Based on this FTAP value, the 01/01/2009 funding shortfall was zero:

$$\text{Funding S/F} = \text{Funding target} - (\text{AAV} - \text{CB} - \text{PB})$$

With a zero funding shortfall, any prior shortfall amortization installments were eliminated at 01/01/2009. Now you can determine the value of X based on the actuarial value of assets before and after the method change.

BEFORE METHOD CHANGE

2010 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.

$$\begin{aligned}\text{Funding S/F} &= \text{Funding target} - (\text{AAV} - \text{CB} - \text{PB}) \\ &= 980,000 - (955,000 - 10,000 - 10,000) \\ &= 45,000\end{aligned}$$

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Problem 14 – Page 2

BEFORE METHOD CHANGE

2010 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 2010.

- 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 for 2010 is 96%.
- 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.

In this problem, they did not specify the effective date of the plan. Since there is a non-zero carryover balance, the plan was effective prior to 01/01/08.

$$\begin{aligned}\text{Modified S/F} &= 96\% * (\text{Funding target}) - (\text{AAV} - \text{PB}) \\ &= .96 * 980,000 - (955,000 - 10,000) \\ &= \text{zero}\end{aligned}$$

Based on 2009 exam conditions 30 and 31, the plan sponsor elects to apply both the CB and the PB against the MRC. As a result, the calculation above offsets the entire PB against the AAV. 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.

Shortfall amortization installment

The plan is eligible for the shortfall base exemption. The shortfall amortization charge is zero for 2010.

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.

$$\begin{aligned}\text{MRC} &= \text{TNC} + \text{Shortfall amort charge} + \text{Waiver amort charge} \\ &= 50,000 + 0 + 0 \\ &= 50,000\end{aligned}$$

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Problem 14 – Page 3

BEFORE METHOD CHANGE

Smallest amount

The problem states that the employer contributes “the smallest amount that satisfies the minimum funding standard” on 01/01/2010:

$$\begin{aligned}\text{Smallest contr} &= \text{MRC} - \text{CB} - \text{PB} \\ &= 50,000 - 10,000 - 10,000 \\ &= 30,000\end{aligned}$$

AFTER METHOD CHANGE

2010 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.

$$\begin{aligned}\text{Funding S/F} &= \text{Funding target} - (\text{AAV} - \text{CB} - \text{PB}) \\ &= 980,000 - (940,000 - 10,000 - 10,000) \\ &= 60,000\end{aligned}$$

2010 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 2010.

- 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 for 2010 is 96%.
- 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.

In this problem, they did not specify the effective date of the plan. Since there is a non-zero carryover balance, the plan was effective prior to 01/01/08.

$$\begin{aligned}\text{Modified S/F} &= 96\% * (\text{Funding target}) - (\text{AAV} - \text{PB}) \\ &= .96 * 980,000 - (940,000 - 10,000) \\ &= 10,800\end{aligned}$$

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AFTER METHOD CHANGE

Based on 2009 exam conditions 30 and 31, the plan sponsor elects to apply both the CB and the PB against the MRC. As a result, the calculation above offsets the entire PB against the AAV. 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.

Shortfall amortization installment

The plan is not eligible for the shortfall base exemption. You have to set up the 2010 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:

$$\begin{aligned}\text{S/F Amort base} &= (\text{Applicable \%}) * (\text{Funding target}) - (\text{AAV} - \text{CB} - \text{PB}) - (\text{PV of PY Amortizations}) \\ &= .96 * 980,000 - (940,000 - 10,000 - 10,000) - \text{zero} \\ &= 20,800\end{aligned}$$

As previously discussed, the 2009 Funding shortfall was zero. Any shortfall amortization installments for 2008 were eliminated at 01/01/2009. The present value of all prior shortfall amortizations is zero at 01/01/2010.

$$\begin{aligned}\text{S/F amort} &= 20,800 / 5.9574 \\ &= 3,491\end{aligned}$$

$$\begin{aligned}\text{S/F charge} &= 3,491 + \text{zero} \\ &= 3,491\end{aligned}$$

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.

$$\begin{aligned}\text{MRC} &= \text{TNC} + \text{Shortfall amort charge} + \text{Waiver amort charge} \\ &= 50,000 + 3,491 + 0 \\ &= 53,491\end{aligned}$$

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Problem 14 – Page 5

You don't need to calculate the "smallest amount" at 01/01/2010 after the method change. Due to the size of the Target normal cost, the change in the "smallest amount" due to the method change is the same as the change in the minimum required contribution due to the method change:

$$\begin{aligned}\text{Change} &= 53,491 - 50,000 \\ &= 3,491\end{aligned}$$

Answer is B

Problem 15 – Page 1**Revised 10/22/12**

$$\begin{aligned} \text{AL} &= \text{PV of AB} \\ &= 27,000(D_{65} / D_{45}) \ddot{a}_{65}^{(12)} \\ &= 27,000(1+i)^{-20}({}_{20}p_{45}) \ddot{a}_{65}^{(12)} \\ &= 27,000(1.07)^{-20}(8.0) \\ &= 55,819 = \text{Funding target} \end{aligned}$$

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.

$$\begin{aligned} \text{NC} &= \text{PV of } (\Delta \text{ AB}) \\ &= 3,591(D_{65} / D_{45}) \ddot{a}_{65}^{(12)} \\ &= 3,591(1.07)^{-20}(8.0) \\ &= 7,424 = \text{Target normal cost} \end{aligned}$$

You need to calculate the PUC accrued liability at 01/01/2010. 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.

$$\begin{aligned} \text{2009 pay (age 44)} &= 90,000 \\ \text{Projected pay at age 64} &= 90,000*(1.03)^{20} \\ \text{Funding accrued ben} &= 3.0\%(10)(90,000)*(1.03)^{-20} \\ &= 27,000*(1.03)^{20} \\ \text{PUC AL} &= 27,000*(1.03)^{20}(D_{65} / D_{45}) \ddot{a}_{65}^{(12)} \\ &= (\text{FAB}/\text{AB})(\text{Funding target}) \\ &= (1.03)^{20}(55,819) \\ &= 100,814 \end{aligned}$$

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$$\begin{aligned}\text{Cushion amount} &= 50\%(\text{Funding target}) + (\text{PUC AL} - \text{Funding target}) \\ &= \text{PUC AL} - 50\%(\text{Funding target}) \\ &= 100,814 - .5(55,819) \\ &= 72,905\end{aligned}$$

Now you can calculate the deductible limit:

Unit Credit normal cost	7,424
+ Funding target	55,819
+ Cushion amount	72,905
Sub-total	136,148
Less unreduced AAV	60,000
Deductible limit	76,148

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 76,148.

Answer is D

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Problem 16 – Page 1

Similar to 2007 #15

Revised 10/23/13

The key to this problem is recognizing that you need to set up the amortization payment for the new Assumption change base. You also need to recalculate the amortization payments for the Gain / Loss bases.

Apparently there was no Initial Accrued Liability base for this plan. This implies that the plan did not grant past service credit prior to the effective date.

All bases set up starting in 2008 use 15 years for the amortization period. Based on 2009 exam condition 37, you should assume that no extensions of amortization periods have been granted.

This problem asks for the increase in the “minimum required contribution”. Based on 2009 exam condition 34, this amount does not reflect the funding standard account credit balance (CB).

You need to calculate the loss amortization payment at the old 7.5% interest rate:

Base Description	Remaining Years 01/01/10	Outstanding 7.5%base	7.5% amortization
1-1-2010 Loss base	15	150,000	$150,000 / \ddot{a}_{15 .075} = 15,808$

Now you can set up the Minimum Funding Standard Account (MFSA) using the old 7.5% interest rate:

2010 Minimum Funding Standard Account - 7.5%			
Charges		Credits	
Normal Cost	NC	Credit Balance	N/A
		Gain amortization	80,000
Loss amortization	15,808	01/01/10 minimum	x
Total charges	<u>NC + 15,808</u>	Total credits	<u>x + 80,000</u>

The MFSA is set up with no interest to simplify the solution. The problem specifies that the contribution will be paid at 01/01/2010.

The problem does not give you the credit balance at 01/01/2010. You do not need that to determine the "minimum required contribution" (MRC). The 01/01/10 MRC equals the excess of the MFSA charges over the credits, excluding the credit balance:

$$\begin{aligned} 7.5\% \text{ MRC} &= \text{NC} + 15,808 - 80,000 \\ &= \text{NC} - 64,192 \end{aligned}$$

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Revised 10/23/13

Now you need to recalculate the amortization payments at the new 7% interest rate, and also determine the amortization for the new Assumption change base:

Base Description	Remaining Years 01/01/10	Outstanding 7.0%base	7.0% amortization
1-1-2009 Gain base	14	$\ddot{a}_{\overline{14} .075} (80,000) =$ $730,067$	$730,067 / \ddot{a}_{\overline{14} .07} =$ 78,018
1-1-2010 Loss base	15	150,000	$150,000 / \ddot{a}_{\overline{15} .07} =$ 15,392
1-1-2010 Assump base	15	200,000	$200,000 / \ddot{a}_{\overline{15} .07} =$ 20,522

Now you can set up the Minimum Funding Standard Account (MFSA) using the new 7% interest rate:

2010 Minimum Funding Standard Account - 7.0%

Charges		Credits	
Normal Cost	NC + 18,000	Credit Balance	N/A
Assump amortization	20,522	Gain amortization	78,018
Loss amortization	15,392	01/01/10 minimum	x
Total charges	NC + 53,914	Total credits	x + 78,018

Normal Cost NC + 18,000
Assump amortization 20,522
Loss amortization 15,392
Total charges NC + 53,914

Credit Balance N/A
Gain amortization 78,018
01/01/10 minimum x
Total credits x + 78,018

The 01/01/10 MRC equals the excess of the MFSA charges over the credits, excluding the credit balance:

$$\begin{aligned} 7.0\% \text{ MRC} &= \text{NC} + 53,914 - 78,018 \\ &= \text{NC} - 24,104 \end{aligned}$$

The absolute value of the difference in the MRC is 40,088 = NC - 64,192 - (NC - 24,104).

Answer is C

NOTE

You need to be extra careful when setting up the normal cost in the MFSA. It is too easy to forget the 18,000 increase due to the change in interest rate.

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Problem 17

This is a very short question that tests your understanding of some terminology from the 417 regulation:

- Stability period is the period of time for which the 417(e) interest rate remains stable (does not change)
- Look-back month is the month used to look up the value of the 417(e) interest rate

In the absence of any other information, the stability period is the plan year. The default look-back month is the month immediately preceding the start of the stability period.

The problem states that the stability period is a calendar quarter. The look-back month is the 3rd month preceding the first day of the stability period.

Smith's benefit commencement date is 11/01/09. The plan's lump sum basis uses the 417(e) applicable interest rate and applicable mortality table.

The first day of the quarter containing that benefit commencement date is 10/01/09. The look-back month is July 2009. The annuity rate based on the July interest rate is 11.93.

Smith's lump sum is $143,160 = 11.93(12)(1,000)$.

Answer is E

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Problem 18

Smith is highly paid, and their compensation is near the 401(a)(17) limit. The key point of the question is how the 401(a)(17) limit applies to Smith's pay. There is a tiny detail in the regulation at 1.401(a)(17)-1(b)(4) that addresses this. Under either a multiemployer plan, or a multiple employer plan, the 401(a)(17) limit applies separately to compensation received from each employer.

Here is a summary of Smith's pay, which shows an asterisk for the pay values that were limited by 401(a)(17). The table uses the assumed 2010 IRC section 401(a)(17) limit of 260,000 that was given in the problem:

Plan year	401(a)(17) limit	Employer A	Employer B	Employer C	Total pay
2005	210,000	153,000	123,500		276,500
2006	220,000	220,000*	45,500		265,500
2007	225,000	225,000*	84,000		309,000
2008	230,000	175,000	150,000		325,000
2009	245,000	0	0	245,000*	245,000*
2010	260,000	0	0	260,000*	260,000*

Smith's total career compensation is 1,681,000. The accrued benefit is 1% of pay, or 16,810.

Answer is D

NOTE

This is the first question ever asked on multiple employer plans. It is also the first question asked on any details of the 1.401(a)(17) regulation (see question 22 for another one).

Fall 2009 EA-2A Exam Solutions

Problem 19

Similar to 2008 #23

This problem is a simple one on definitions under IRC 430.

I. TRUE

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:

$$\begin{aligned}\text{Funding ratio} &= \frac{\text{AAV} - \text{PB}}{\text{Funding target (non At-Risk basis)}} && \text{(prior year valuation results)} \\ &= \frac{25,500,000 - 950,000}{25,000,000} && = 98.2\%\end{aligned}$$

II. TRUE

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 2010.

- 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 for 2010 is 96%.
- 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.

$$\begin{aligned}\text{Mod FT} &= 96\%(32,500,000) && = 31,200,000 \\ \text{Mod AAV} &= 32,400,000 - 1,100,000 && = 31,300,000 \\ \text{Mod S/F} &= 31,200,000 - 31,300,000 && = \text{zero}\end{aligned}$$

III. TRUE

A plan is subject to quarterly contributions if it is a single employer plan, and there was a funding shortfall for the prior plan year.

$$\begin{aligned}2009 \text{ S/F} &= \text{Funding target} - (\text{AAV} - \text{CB} - \text{PB}) \\ &= 25,000,000 - (25,500,000 - 1,250,000 - 950,000) = 1,700,000\end{aligned}$$

All three items are true.

Answer is D

Problem 20

Similar to 2008 #17

Revised 11/12/12

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

TRUE

A plan is in "endangered" status when the plan is not in critical status for plan year, and it satisfies either item below:

- Plan's funded percentage < 80%, or
- 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))

The plan's funded percentage is 82% ($820,000 / 1,000,000$), so it does not satisfy the first item. Since the plan is projected to have a deficiency in 2016, it does satisfy the second item.

But you can't say that the plan is in "endangered" status yet. First you must determine that the plan is not in critical status - and it takes quite a bit of memorization to do this.

There are multiple definitions of critical status in the code. The definitions in IRC 432(b)(2)(A), IRC 432(b)(2)(C) and IRC 432(b)(2)(D) are based on comparisons of the present value of future contributions and the present value of future benefit payments. You are not given any of this information, so you can not say the plan is in critical status based on these definitions.

Under IRC 432(b)(2)(B)(i), the plan is in critical status if it has an accumulated funding deficiency for the current year. Under IRC 432(b)(2)(B)(ii), the plan is in critical status if

- it has an accumulated funding deficiency in the succeeding 3 plan years and the funded percentage is more than 65%, or
- it has an accumulated funding deficiency in the succeeding 4 plan years and the funded percentage is 65% or less.

The plan does not satisfy either of these definitions, so the plan is not in critical status. The final result is that the plan does satisfy the definition of endangered status for 2010.

Answer is A

NOTE

If plan is not in critical status for the plan year, and it satisfies both items above, then the plan is in "seriously endangered" status.

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Problem 21

Similar to 2004 EA-2B #35

This problem tests your knowledge of the 1.417(e)-1 regulation. In IRC 417(e)(3), it states the basis for calculation of present values as "applicable mortality table" and "applicable interest rate".

But not all optional forms of payment are subject to this requirement. At 1.417(e)-1(d)(6), there are some exceptions to this requirement:

“... does not apply to the amount of a distribution under a non-decreasing annuity payable for a period not less than the life of the participant or, in the case of a QPSA, the life of the surviving spouse. A non-decreasing annuity includes a QJSA, QPSA, and an annuity that decreases merely because of the cessation or reduction of Social Security supplements or qualified disability payments (as defined in §411(a)(9)).”

The lump sum is not paid over the lifetime of the participant. The second optional form that is also subject to the 417(e)(3) requirement is the Social Security level income option. The reason is that it is a decreasing annuity.

Answer is B

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Problem 22

Revised 08/18/11

Smith is highly paid, and their compensation is near the 401(a)(17) limit. The key point of the question is how the 401(a)(17) limit applies to Smith's pay.

The plan document defines the benefit using the highest 36 consecutive months of pay. Since Smith retires on 10/31/08, you need to figure out how to apply the calendar year 401(a)(17) limits to their monthly pay values.

There is a tiny detail in the regulation at 1.401(a)(17)-1(b)(3)(ii) that addresses this:

"Alternatively, if a plan determines compensation used in determining allocations or benefit accruals for the plan year on the basis of compensation for a 12-consecutive-month period, or periods, ending no later than the last day of the plan year, then the annual compensation limit applies to compensation for each of those periods based on the annual compensation limit in effect for the respective calendar year in which each 12-month period begins."

Period starts	Applicable 401(a)(17) limit	Pay for 12 months	Limited pay
11/01/05	210,000	$215,000 = 2(17,500) + 10(18,000)$	210,000
11/01/06	220,000	$218,500 = 2(18,000) + 10(18,250)$	218,500
11/01/07	225,000	$231,500 = 2(18,250) + 10(19,500)$	225,000

Smith's average annual compensation is $217,833 = 653,500/3$.

Answer is A

NOTES

1. In general, the 401(a)(17) limit for a calendar year applies to any plan year that begins in that calendar year. This is consistent with the rules for applying the compensation threshold under IRC 414(q) for highly compensated employees.
2. Under the 416 regulation, it appears the rule is different. Based on Question T-12, the 416 key employee threshold for a calendar year applies to any plan year that ends in that calendar year.
3. This is the second question asked on details of the 1.401(a)(17) regulation. See question 18 for another one.

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Problem 23 – Page 1

This is the first problem asked on the post-PPA 2006 definitions for quarterly contribution requirements. This question was a surprise for the 2009 exam, since exam condition 44 implies that this topic would not be tested in 2009:

"(44) The effect of the quarterly requirements and the liquidity shortfall on minimum funding shall be disregarded for the purposes of the November, 2009 examination."

There are two key points to this question:

1. The carryover balance is available to satisfy the first quarterly contribution installment. It does not matter that the sponsor elected to apply the carryover balance to satisfy the 2010 minimum required contribution.
2. The 01/01/10 carryover balance can be increased with interest to 04/15/10 to compare against the quarterly contribution installment. The 2010 effective interest rate of 6.6% is used.

To calculate the required quarterly contribution for 2010, you must first determine that the plan is subject to the quarterly contribution requirements. In IRC 430(j)(3), it states that plans with a funding shortfall for the preceding plan year are subject to the quarterly contribution requirements. Since the plan had a non-zero shortfall amortization installment for 2009, it is subject to those requirements.

The next step is calculation of the required annual payment (RAP). This is the lesser of 100% of last year's minimum required contribution (MRC) or 90% of this year's MRC.

The MRC is defined in IRC 430 as the sum of the target normal cost, the shortfall amortizations and the waiver amortizations. It does not reflect any offset of the carryover balance (CB) or the prefunding balance (PB).

$$\begin{aligned} \text{2009 MRC} &= 100,000 + 50,000 \\ &= 150,000 \end{aligned}$$

$$\begin{aligned} \text{2010 MRC} &= 110,000 + 55,000 \\ &= 165,000 \end{aligned}$$

The required annual payment (RAP) is the lesser of the 2009 MRC or 90% of the 2010 MRC, which is $148,500 = 90\% \times 165,000$. The 2010 required quarterly installment is 25% of the RAP, which is $37,125 = 25\%(148,500)$.

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Problem 23 – Page 2

The problem asks for X, which is the smallest amount paid at 04/15/10 to satisfy the 2010 quarterly contribution requirement. You should increase the carryover balance to 04/15/10, and subtract it from the required installment. The difference is the value of X:

$$\begin{aligned} 37,125 &= X + 5,100(1.066)^{3.5/12} \\ X &= 31,929 = 37,125 - 5,196 \end{aligned}$$

Answer is D

NOTE

In the 10/15/09 final regulations, there is a special rule about the relationship between two dates:

1. The due date for a required quarterly installment, and
2. The date that the plan sponsor makes the election to apply the CB (or PB) towards the MRC

If the plan sponsor elects to apply the CB towards the MRC after the due date for a quarterly installment, then you use a interest different rate to adjust for the time period from the quarterly installment due date up to the plan sponsor's date of election. Instead of using the effective rate of interest, you use the effective rate plus 5% (the penalty rate). This is counter-intuitive, to say the least. See the example in the regulation at 1.430(f)-1(d)(1).

In this problem, the employer made the election to apply the CB towards the MRC on 03/01/10. Since this election was prior to the 04/15/10 due date for the first quarterly installment, the additional 5% penalty rate was not used to discount any payments.

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Problem 24

This problem is a simple one on definitions under IRC 430.

I. TRUE

This is a correct statement of the requirements in IRC 430(h)(1).

II. FALSE

There are two other assumptions that are prescribed for At-risk plans in IRC 430(i)(1)(B). The first is the assumption that anyone who is eligible to retire within the first 11 plan years will elect to retire at the earliest retirement age (but not prior to the end of the first plan year). The second assumption is that all participants will elect the benefit payment form which produces the highest present value.

III. FALSE

This is a not a correct statement of the requirements in IRC 430(h)(5). In addition to the 50,000,000 unfunded vested benefit liabilities, assumption changes must cause a decrease in the funding shortfall that exceeds this threshold:

"430(h)(5)(iii)

the change in assumptions (determined after taking into account any changes in interest rate and mortality table) results in a decrease in the funding shortfall of the plan for the current plan year that exceeds \$50,000,000, or that exceeds \$5,000,000 and that is 5 percent or more of the funding target of the plan before such change."

Only item I is true.

Answer is E

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Problem 25 – Page 1

The key to this problem is knowing how to do calculations under the Frozen Initial Liability (FIL) cost method. You have to calculate the actual UAL at 01/01/10 after the plan amendment, as well as the normal cost.

You must set up the valuation results after the plan amendment, and calculate the increase in the UAL due to the plan amendment. Under the FIL method, you adjust the UAL by the change in the Entry age normal accrued liability.

$$\begin{aligned}\text{Old plan AL} &= 2,000,000 \\ \text{New plan AL} &= 2,000,000(45/40) \\ &= 2,250,000\end{aligned}$$

$$\begin{aligned}\text{Change in UAL} &= 2,250,000 - 2,000,000 \\ &= 250,000\end{aligned}$$

Under the FIL method, the actual UAL is defined as always equal to the expected UAL. In this problem, you are not given last year's valuation results, so you can't calculate the expected UAL. Instead, you must use the actuarial balance equation:

$$01/01/10 \text{ UAL} = \text{O/S 431 bases} - \text{CB} - \text{ARA}$$

$$\text{O/S 431 bases} = \text{O/S IAL base} + \text{plan chg base}$$

$$\begin{aligned}\text{Plan change} &= 250,000 \\ \text{Amortization} &= 25,653 &= 250,000 \div \ddot{a}_{15|.07}\end{aligned}$$

$$\begin{aligned}\text{IAL base} &= 700,000 \\ \text{Amortization} &= 52,720 &= 700,000 \div \ddot{a}_{30|.07}\end{aligned}$$

$$\begin{aligned}01/01/10 \text{ UAL} &= \text{O/S 431 bases} - \text{CB} - \text{ARA} \\ &= 700,000(\ddot{a}_{20|.07} / \ddot{a}_{30|.07}) + 250,000 - 40,000 \\ &= 52,720(\ddot{a}_{20|.07}) + 210,000 \\ &= 807,613\end{aligned}$$

The next step is calculation of the FIL normal cost. First you must calculate the PV of future normal costs. Once you have the PVNC, you can calculate the normal cost.

To calculate the PVNC, you first need the PV of future benefits under the new plan:

$$\begin{aligned}\text{Old plan PVB} &= 3,200,000 \\ \text{New plan PVB} &= 3,200,000(45/40) \\ &= 3,600,000\end{aligned}$$

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Problem 25 – Page 2

$$\begin{aligned}\text{FIL PVNC} &= \text{PVB} - \text{AAV} - \text{UAL} \\ &= 3,600,000 - 1,400,000 - 807,613 \\ &= 1,392,387\end{aligned}$$

The FIL normal cost is equal to the PVNC divided by the average temporary annuity for active participants. Since the benefit is not pay-related, you need to calculate the average temporary annuity with no salary scale.

$$\begin{aligned}\text{PVL/L} &= 1,250 / 100 \\ &= 12.50\end{aligned}$$

$$\begin{aligned}\text{FIL NC} &= 1,392,387 / 12.50 \\ &= 111,391\end{aligned}$$

Based on exam condition 37, you should assume that no extensions of amortization periods have been granted. You can't check the Full Funding Limitation, since you don't know the value of the Entry Age normal cost at 01/01/10.

Now you have enough information to complete the 2010 MFSA:

2010 Minimum Funding Standard Account			
Charges		Credits	
Normal Cost	111,391	Credit Balance	40,000
IAL amortization	52,720		
PLAN amortization	25,653	01/01/10 minimum	x
7% interest	N/A	7% interest	N/A
Total charges	189,764	Total credits	40,000 + x

The problem asks for the "smallest amount" at 01/01/10. You should skip the interest calculations in the MFSA. The 01/01 "smallest amount" is $189,764 - 40,000 = 149,764$.

Answer is B

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Problem 26

Similar to 2007 #9

The key to this problem is knowing the investment G/L formula and the formula for the total G/L. The problem specifies the cost method as Entry age normal, but that does not affect the solution. The G/L calculations are the same for all individual cost methods.

$$\text{Non-inv G/L} = {}_e\text{AL}_1 - \text{AL}_1$$

$$\text{Inv G/L} = {}_e\text{AAV}_1 - \text{AAV}_1$$

$$\text{Total G/L} = {}_e\text{UAL}_1 - \text{UAL}_1$$

$$\begin{aligned} {}_e\text{UAL}_1 &= (1+i)(\text{NC}_0 + \text{UAL}_0) - (\text{contribution} + \text{interest}) \\ &= 1.07(425,000 + 1,200,000) - 600,000 \\ &= 1,138,750 \end{aligned}$$

$$\begin{aligned} \text{UAL} &= \text{AL} - \text{AAV} \\ &= 4,250,000 - 2,900,000 \\ &= 1,350,000 \end{aligned}$$

$$\begin{aligned} \text{Total G/L} &= {}_e\text{UAL}_1 - \text{UAL}_1 \\ &= 1,138,750 - 1,350,000 \end{aligned}$$

$$\text{Total Loss} = 211,250$$

$$\begin{aligned} 01/10 {}_e\text{AAV}_1 &= (1+i)({}_e\text{AAV}_0) - (\text{benefit payments} + \text{interest}) + (\text{contributions} + \text{interest}) \\ &= 1.07(2,300,000) - 0 + 600,000 \\ &= 3,061,000 \end{aligned}$$

$$\begin{aligned} \text{Inv G/L} &= {}_e\text{AAV}_1 - \text{AAV}_1 \\ &= 3,061,000 - 2,900,000 \\ &= 161,000 \end{aligned}$$

$$\begin{aligned} \text{Ratio} &= (\text{Inv Loss}) / (\text{Total Loss}) \\ &= 161,000 / 211,250 \\ &= 76.2\% \end{aligned}$$

Answer is C

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Problem 27 – Page 2

$$\begin{aligned}AL &= \text{PV of AB} \\&= 40,000(D_{65} / D_{44}) \ddot{a}_{65}^{(12)} \\&= 40,000(1+i)^{-21}({}_{21}p_{44}) \ddot{a}_{65}^{(12)} \\&= 40,000(1.07)^{-21}(8.0) \\&= 77,284 = \text{Funding target}\end{aligned}$$

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.

$$\begin{aligned}NC &= \text{PV of } (\Delta AB) \\&= 4,625(D_{65} / D_{44}) \ddot{a}_{65}^{(12)} \\&= 4,625(1.07)^{-21}(8.0) \\&= 8,936 = \text{Target normal cost}\end{aligned}$$

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.

$$\begin{aligned}\text{Funding S/F} &= \text{Funding target} - (\text{AAV} - \text{CB} - \text{PB}) \\&= 77,284 - (72,000 - 5,800 - 0) \\&= 11,084\end{aligned}$$

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 2010:

- 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 96%
- 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.

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Problem 27 – Page 3

$$\begin{aligned}\text{Modified S/F} &= 96\% * (\text{Funding target}) - (\text{AAV} - \text{PB}) \\ &= .96 * 77,284 - (72,000 - 0) \\ &= 2,193\end{aligned}$$

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 2010 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 plan was exempt from establishing a shortfall base for years prior to 2010. As a result, there are no prior amortizations at 01/01/10:

$$\begin{aligned}\text{S/F Amort base} &= 96\% * (\text{Funding target}) - (\text{AAV} - \text{CB} - \text{PB}) - \text{zero} \\ &= .96 * 77,284 - (72,000 - 5,800 - 0) - 0 \\ &= 7,993\end{aligned}$$

Shortfall amortization installment

The problem gives you the 2010 segment rates and the amortization factor for the shortfall base:

$$\begin{aligned}5.9982 &= \ddot{a}_{\overline{5}|.05} + (\ddot{a}_{\overline{7}|.06} - \ddot{a}_{\overline{5}|.06}) \\ &= \underbrace{1 + v^1 + v^2 + v^3 + v^4}_{\text{using 5.0\%}} + \underbrace{v^5 + v^6}_{\text{using 6.0\%}}\end{aligned}$$

$$\begin{aligned}\text{S/F amort} &= 7,993 / 5.9982 \\ &= 1,333\end{aligned}$$

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.

$$\begin{aligned}\text{MRC} &= \text{TNC} + \text{Shortfall amort charge} + \text{Waiver amort charge} \\ &= 8,936 + 1,333 + 0 \\ &= 10,269\end{aligned}$$

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Problem 27 – Page 4

Smallest amount

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

$$\begin{aligned}\text{Smallest contr} &= \text{MRC} - \text{CB} - \text{PB} \\ &= 10,269 - 5,800 - 0 \\ &= 4,469\end{aligned}$$

Answer is B

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Problem 28 – Page 1

The key to this problem is knowing how to calculate the deductible limit under IRC 404(o). The problem tells you that the deductible limit is based on the plan year ending within the fiscal year.

The plan year is the calendar year (based on the exam conditions), and the fiscal year ends on 01/31/10. You should calculate the deductible limit using the valuation results for the 2009 plan year, which ends during the fiscal year (from 02/01/09 to 01/31/10).

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.

The maximum deductible limit is defined under 404(o)(2)(A):

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

The problem gives you the funding target on two sets of assumptions. One uses the At-Risk assumptions, and has been provided for use in an alternative definition of the deductible limit.

Cushion Amount

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. Since this plan’s benefit is not based on pay, the second item is equal to zero.

$$\begin{aligned}\text{Cushion amount} &= 50\%(\text{Funding target}) + \text{zero} \\ &= .5(100,000) \\ &= 50,000\end{aligned}$$

Now you can calculate the deductible limit. This calculation uses the non At-Risk funding target. The plan is not in At-Risk status, since it only has 35 participants.

Target normal cost	81,000
+ Funding target	100,000
+ Cushion amount	50,000
Sub-total	231,000
Less unreduced AAV	100,000
Deductible limit	131,000

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Problem 28 – Page 2

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

This calculation uses values determined as if the plan is in At-Risk status. The problem gives you the values of the normal cost and funding target for use in this alternate deductible limit definition.

At-Risk Target normal cost	86,000
+ At-Risk Funding target	110,000
Sub-total	196,000
Less unreduced AAV	100,000
Deductible limit	96,000

The alternate definition does not produce a higher value for the deductible limit. The final deductible limit is 131,000.

Answer is C

NOTES

1. 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. If there had been prior changes in the \$25 benefit level, then you could make an allowance for future increases, based on IRC 404(o)(3)(A)(ii)(II):

“(II) if the plan does not base benefits for service to date on compensation, increases in benefits which are expected to occur in succeeding plan years (determined on the basis of the average annual increase in benefits over the 6 immediately preceding plan years).”

2. Some prior exam problems have not given you the At-Risk values of the target normal cost and funding target. 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.

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Problem 29

In general, IRC 430(g)(3) requires that the actuarial value of assets (AAV) be equal to the market value. Plans may use an averaging method, but only if the resulting AAV is between 90% and 110% of market value.

Under IRC 430(g)(4), both values should be increased by the present value of any receivable contributions (as of the valuation date) for the prior plan year. The present value is calculated using the effective interest rate for the prior plan year.

IRS Notice 2009-22 clarifies calculation of the thresholds based on 90% and 110% of market value. The present value of the discounted contributions is added to the market value first. Then you apply the 90% and 110% factors.

$$\begin{aligned} 01/01 \text{ MVA} &= 9,000,000 + 100,000(1.056)^{-(3/12)} + 200,000(1.056)^{-(8/12)} \\ &= 9,000,000 + 98,647 + 192,865 \\ &= 9,291,512 \end{aligned}$$

$$\begin{aligned} 110\% \text{ of MVA} &= 9,291,512 * 1.10 \\ &= 10,220,664 \end{aligned}$$

Answer is C

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Problem 30 – Page 1

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

The key to this problem is knowing how to calculate the Shortfall amortization base at 01/01/2010 under IRC Section 430. The plan had a CB of zero and a PB equal to 20,000 at 01/01/2010.

2010 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.

$$\begin{aligned}\text{Funding S/F} &= \text{Funding target} - (\text{AAV} - \text{CB} - \text{PB}) \\ &= 2,200,000 - (2,050,000 - 0 - 20,000) \\ &= 170,000\end{aligned}$$

2010 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 2010:

- 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 96%
- 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.

$$\begin{aligned}\text{Modified S/F} &= 96\% * (\text{Funding target}) - (\text{AAV} - 0) \\ &= .96 * (2,200,000) - (2,050,000 - 20,000) \\ &= 82,000\end{aligned}$$

2010 Shortfall amortization installment

The plan is not eligible for the shortfall base exemption. You have to set up the 2010 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:

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Problem 30 – Page 2

$$\begin{aligned}\text{S/F Amort base} &= (\text{Applicable \%}) * (\text{Funding target}) - (\text{AAV-CB-PB}) - (\text{PV of PY Amortizations}) \\ &= .96 * 2,200,000 - (2,050,000 - 0 - 20,000) - (\text{PV of PY Amortizations}) \\ &= 82,000 - (\text{PV of PY Amortizations})\end{aligned}$$

You must calculate the present value of the 2009 amortization installment of 25,000. You are given the 6 year annuity factor:

$$\begin{aligned}\text{PV of amort} &= 25,000 * 5.2932 \\ &= 132,330\end{aligned}$$

$$\begin{aligned}\text{2010 S/F base} &= 82,000 - 132,330 \\ &= -50,330\end{aligned}$$

$$\begin{aligned}\text{S/F amort} &= -50,330 / 5.9982 \\ &= -8,391\end{aligned}$$

$$\begin{aligned}\text{S/F charge} &= 25,000 - 8,391 \\ &= 16,609\end{aligned}$$

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.

$$\begin{aligned}\text{MRC} &= \text{TNC} + \text{Shortfall amort charge} + \text{Waiver amort charge} \\ &= 42,000 + 16,609 + 0 \\ &= 58,609\end{aligned}$$

Answer is C

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Problem 31 – Page 1

Similar to 2007 #45

Revised 11/12/12

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.

The key to this problem is recognizing that you need to set up an assumption change base and a new Gain / Loss base. 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.

You are given values of the normal cost and accrued liability after the assumption change. You need to calculate the assumption change base, which is equal to the difference in the accrued liability values:

$$8.0\% \text{ AL} = 20,000,000$$

$$7.5\% \text{ AL} = 22,500,000$$

$$\begin{aligned} \text{Assum change} &= 22,500,000 - 20,000,000 \\ &= 2,500,000 \end{aligned}$$

You have to calculate the experience G/L during 2009. You don't have any prior year valuation results, so you need to use the actuarial equation of balance to calculate the experience G/L base that is established at 01/01/2010.

$$\begin{aligned} 01/01/10 \text{ UAL} &= \text{AL} - \text{AAV} \\ &= 22,500,000 - 19,500,000 \\ &= 3,000,000 \end{aligned}$$

Now you need to recalculate the amortization payments at the new 7.5% interest rate:

Base Description	Remaining Years 01/01/10	Outstanding 8.0%base	7.5% amortization
1-1-2008	14	$\ddot{a}_{\overline{13} .08} (44,925) = 383,483$	$383,483 / \ddot{a}_{\overline{13} .075} = 43,901$
1-1-2009	14	$\ddot{a}_{\overline{14} .08} (54,088) = 481,587$	$481,587 / \ddot{a}_{\overline{14} .075} = 52,772$

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Problem 31 – Page 2

$$\begin{aligned} 01/10/10 \text{ UAL} &= \text{O/S 431 bases} - \text{CB} - \text{ARA} \\ 3,000,000 &= 2,500,000 + 383,483 + 481,587 + \text{Loss} - 75,000 - 0 \end{aligned}$$

$$\begin{aligned} \text{Loss} &= 3,000,000 - 3,365,071 + 75,000 \\ \text{Gain} &= 290,071 \end{aligned}$$

The last step to set up the minimum funding standard account is to calculate the amortizations for the new bases:

$$\begin{aligned} \text{Gain Amort} &= 30,569 &= 290,071 \div \ddot{a}_{\overline{15}|.075} \\ \text{Assum Amort} &= 263,459 &= 2,500,000 \div \ddot{a}_{\overline{15}|.075} \end{aligned}$$

Now you have enough information to complete the 2010 MFSA:

2010 Minimum Funding Standard Account			
Charges		Credits	
Normal Cost	1,000,000	Credit Balance	75,000
2008 amortization	43,901	Gain amortization	30,569
2009 amortization	52,772		
Assum amortization	263,459	01/01/10 minimum	X
7% interest	N/A	7% interest	N/A
Total charges	<u>1,360,132</u>	Total credits	<u>105,569 + X</u>

The problem asks for the "smallest amount" at 01/01/10. You should skip the interest calculations in the MFSA. The 01/01/10 "smallest amount" is $1,360,132 - 105,569 = 1,254,563$.

Don't forget - you need to check the Full Funding Limitation (FFL):

$$\begin{aligned} \S 431 \text{ "ERISA" FFL} &= (1+i) \cdot (\text{NC} + \text{AL}) - (1+i) \cdot [\text{lesser}(\text{MVA}, \text{AAV}) - \text{CB}] \\ &= 1.075 \cdot (1,000,000 + 22,500,000) - 1.075 \cdot (19,500,000 - 75,000) \end{aligned}$$

The FFL clearly exceeds the MFSA charges less the amortization credits. There is no FFL credit for 2010.

Answer is B

NOTE

In this problem, it did not matter if you forgot to check the Full Funding Limitation. If the FFL was close to the value of X, you would need to adjust it to the 01/01/10 calculation date.

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Problem 32 – Page 1

Revised 10/11/10

The key to this problem is knowing the gain / loss formulas. The problem asks for the mortality G/L due to the death of one retiree during 2010.

$$\begin{aligned}\text{Non-inv G/L} &= {}_eAL_1 - AL_1 \\ {}_eAL_1 &= (1+i)(AL_0 + NC_0) - (\text{actual benefit payments} + i)\end{aligned}$$

Since the participants are retired, the normal cost is zero. For the entire population, you have these results:

$$\begin{aligned}AL_0 &= 100*2,000*[{}_{\overline{a}}_{4|.07} + (D_{69} / D_{65}) {}_{\overline{a}}_{69}] \\ &= 100*2,000*[{}_{\overline{a}}_{4|.07} + N_{69} / D_{65}] \\ AL_1 &= 99*2,000*[{}_{\overline{a}}_{3|.07} + N_{69} / D_{66}] + 1*2,000*[{}_{\overline{a}}_{3|.07}]\end{aligned}$$

There is a slight shortcut to working this problem. You can ignore the annuity payments during the period certain. The reason is that these payments will be made whether the retiree lives or dies.

$$\begin{aligned}{}_eAL_1 &= (1+i)(AL_0 + \text{zero}) - (\text{actual benefit payments} + i) \\ &= 1.07*100*2,000*(N_{69} / D_{65}) - \text{zero} \quad (\text{ignoring period certain benefits}) \\ &= 1.07(200,000)(74,340/10,981) \\ &= 1,448,753\end{aligned}$$

$$AL_1 = 99*2,000*[\text{zero} + N_{69} / D_{66}] \quad (\text{ignoring period certain benefits})$$

Now you should use the q_x values given to derive the value of D_{66} .

$$\begin{aligned}D_{66} &= v^{66}l_{66} & D_{65} &= v^{65}l_{65} \\ &= v(l_{66} / l_{65})(D_{65}) \\ &= [p_{65} / (1+i)](D_{65}) \\ &= [(1-.011)/1.07](10,981) \\ &= 10,150\end{aligned}$$

$$\begin{aligned}AL_1 &= 99*2,000*[74,340/10,150] & (\text{ignoring period certain benefits}) \\ &= 1,450,218\end{aligned}$$

Difference between actual and expected AL is $1,465 = 1,450,218 - 1,448,753$.

Answer is B

(see note on next page)

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Problem 32 – Page 2

NOTES

But there is something I don't like about this calculation. The magnitude of the two accrued liability figures is much greater than the final result.

If you look carefully at the data given in the problem, the result of 1,465 mostly consists of random noise. When you subtract the two accrued liability values, the result does not have three significant digits of information.

The qx values given only have three (or four) significant digits. Any calculations based on the qx values can have no more than four significant digits. The accrued liability values should be rounded to reflect only four significant digits before doing the final calculation:

$${}_eAL_1 = 1,449,000 \text{ (rounded)}$$

$$AL_1 = 1,450,000 \text{ (rounded)}$$

Difference between actual and expected AL is $1,000 = 1,450,000 - 1,449,000$. But this produces a result in a different answer range.

Answer is A

If I include the benefit payments in the calculations, the unrounded values are 2,010,357 for the expected AL versus 2,011,822 for the actual AL = 1,465 for the loss. This is exactly what should happen: an alternate method of solution that produces the same numerical value for the answer.

If I round the expected and actual accrued liability to 4 significant digits before subtracting, I get an answer in a third answer range!

$${}_eAL_1 = 2,012,000 \text{ (rounded)}$$

$$AL_1 = 2,010,000 \text{ (rounded)}$$

Difference between actual and expected AL is $2,000 = 2,012,000 - 2,010,000$.

Answer is E

I think that this result (different calculation methods that produce three different answer ranges) illustrates a potential defect in this problem. The data for this problem should have been given to more decimal places, so the answer would have five significant digits of information.

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Problem 33 – Page 1

This problem asks for “the smallest amount that satisfies the minimum funding standard”. Based on exam condition 31, 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 27 and 28, 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 01/01/2010 under IRC Section 430. The plan had a CB of 5,000 and a PB equal to 0 at 01/01/2010.

2010 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.

$$\begin{aligned}\text{Funding S/F} &= \text{Funding target} - (\text{AAV} - \text{CB} - \text{PB}) \\ &= 1,000,000 - (978,000 - 5,000 - 0) \\ &= 27,000\end{aligned}$$

2010 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 2010:

- 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 96%
- 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.

$$\begin{aligned}\text{Modified S/F} &= 96\% * (\text{Funding target}) - (\text{AAV} - 0) \\ &= .96 * (1,000,000) - (978,000 - 0) \\ &= -18,000\end{aligned}$$

2010 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 2010 shortfall amortization base.

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Problem 33 – Page 2

The shortfall amortization charge is defined as the sum of all the shortfall amortizations. You are told there were no shortfall amortization bases from prior years, so the shortfall amortization charge is equal to 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.

$$\begin{aligned}\text{MRC} &= \text{TNC} + \text{Shortfall amort charge} + \text{Waiver amort charge} \\ &= 50,500 + 0 + 0 \\ &= 50,500\end{aligned}$$

Smallest amount

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

$$\begin{aligned}\text{Smallest contr} &= \text{MRC} - \text{CB} - \text{PB} \\ &= 50,500 - 5,000 - 0 \\ &= 45,500\end{aligned}$$

Answer is A

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Problem 34

This is a straightforward problem on calculating the Top Heavy (T-H) minimum. The problem does not tell you the T-H averaging period. Based on IRC 416(c)(1)(D)(i), the T-H averaging period can not exceed five consecutive years.

In the absence of any specific data in the problem, you should assume the T-H averaging period is five years. This is convenient, since the plan benefit is also based on a five year average:

$$\begin{aligned}\text{FAE5} &= (48,000 + 51,000 + 54,000 + 57,000 + 60,000) / 5 \\ &= 54,000\end{aligned}$$

The plan benefit is based on years of service, which goes back to Smith's hire date. The T-H minimum is based on years the plan has been T-H, which goes back to the 2002 plan year.

	Smith
Effective date	Unknown
Hire date	01/01/1997
Service at 01/01/10	13
5 year average comp	54,000
Plan accrued benefit	$1.0\%(13)(54,000)$ $= 7,020$
Top Heavy service	8
Top Heavy comp	54,000
T-H minimum	$2.0\%*(8)(54,000)$ $= 8,640$
Final accrued benefit	8,640

Answer is B

NOTE

The problem states that Smith is not a key employee. This is important, since you must give the T-H minimum benefit to all non-key employees. But you do not have to give the T-H minimum to key employees.

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Problem 35 – Page 1

The key to this problem is knowing how to do calculations under the Aggregate (AGG) cost method. Another point of the problem is handling of the credit balance.

The normal cost is equal to the present value of future normal costs (PVNC) divided by the average temporary annuity for active participants. In this problem, you are given the present value of future compensation.

In the absence of any other information, you can assume that the benefits are pay related. You must calculate the average temporary annuity including a salary scale.

Under the Aggregate method, there is no unfunded accrued liability. The general formula for the PVNC allows for any prior amortization bases, which could include waiver amortization bases, or bases due to a change away from the “shortfall method”.

Since you are given both the actuarial asset value and the market value, there is one thing you should check. The actuarial value of assets must be within 20% of the market value. If the AAV was more than $600,000 = 120\%(500,000)$, then you would have to limit it to 600,000.

$$\begin{aligned}\text{AGG PVNC} &= \text{PVB} - \text{AAV} - (\text{O/S 431 bases} - \text{CB}) \\ &= 2,500,000 - 570,000 - (0 - 25,000) \\ &= 1,955,000\end{aligned}$$

$$\begin{aligned}\text{PVE/E} &= 15,000,000 / 1,000,000 \\ &= 15.0\end{aligned}$$

$$\begin{aligned}\text{AGG NC} &= 1,955,000 / 15.0 \\ &= 130,333\end{aligned}$$

Based on exam condition 37, you should assume that no extensions of amortization periods have been granted. You can't check the Full Funding Limitation, since you don't know the value of the Entry Age normal cost or accrued liability.

Now you have enough information to complete the 2010 MFSA:

2010 Minimum Funding Standard Account			
Charges		Credits	
Normal Cost	130,333	Credit Balance	25,000
		12/31/10 smallest	x
6% interest	7,820	6% interest	1,500
Total charges	138,153	Total credits	26,500 + x

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Problem 35 – Page 2

“The smallest amount that satisfies the minimum funding standard” is equal to the excess of the MFSA charges over the credits at 12/31/10.

The 12/31/10 “smallest amount” is $138,153 - 26,500 = 111,653$.

Answer is D

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Problem 36

The key to this problem is knowing the investment G/L formula. The problem does not specify the cost method, but that does not affect the solution. You can do a calculation of the asset G/L for any cost method.

Since you are given both the actuarial asset value and the market value, there is one thing you should check. The actuarial value of assets must be within 20% of the market value.

If the 01/01/09 AAV was more than $1,140,000 = 120\%(950,000)$, then you would have to limit it to 1,140,000. If the 01/01/10 AAV was more than $1,320,000 = 120\%(1,100,000)$, then you would have to limit it to 1,320,000. You can safely use the AAV given for both years.

$$\text{Inv G/L} = {}_e\text{AAV}_1 - \text{AAV}_1$$

$$\begin{aligned} 01/10 {}_e\text{AAV}_1 &= (1+i) * (\text{AAV}_0) - (\text{benefit payments} + \text{interest}) + (\text{contributions} + \text{interest}) \\ &= 1.06(1,000,000) - 100,000[1+.06(6/12)] + 200,000[1+.06(9/12)] \\ &= 1,166,000 \end{aligned}$$

This calculation is based on simple interest. The alternative solution based on using compound interest is shown below.

$$\begin{aligned} \text{Inv G/L} &= {}_e\text{AAV}_1 - \text{AAV}_1 \\ &= 1,166,000 - 1,200,000 \end{aligned}$$

$$\text{Gain} = 34,000$$

Answer is D

NOTE

You could use compound interest to calculate the expected asset value. This must produce a result that is in the same answer range:

$$\begin{aligned} 01/10 {}_e\text{AAV}_1 &= (1+i) * (\text{AAV}_0) - (\text{benefit payments} + \text{interest}) + (\text{contributions} + \text{interest}) \\ &= 1.06(1,000,000) - 100,000(1.06)^{6/12} + 200,000(1.06)^{9/12} \\ &= 1,165,978 \end{aligned}$$

$$\text{Inv G/L} = 1,165,978 - 1,200,000$$

$$\text{Gain} = 34,022$$

Answer is D

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Problem 37 – Page 1

Similar to 2007 #07

This is a relatively straightforward 415 problem. The key point of the problem is knowing that the §415 limits are reduced for service (and participation) less than 10 years.

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 12/31/09

Age	58
Service	6 years
Participation	5 years

PLAN BENEFIT

The plan benefit is based on the five year final average pay. You need to apply the §401(a)(17) limit to each year of pay. 2009 is the only year's pay that is limited:

Year	Total Pay	Limited Pay
2005	170,000	170,000
2006	200,000	200,000
2007	190,000	190,000
2008	200,000	200,000
2009	250,000	245,000

$$\begin{aligned} \text{5 year final average pay} &= (170,000 + 200,000 + 190,000 + 200,000 + 245,000)/5 \\ &= 201,000 \end{aligned}$$

$$\begin{aligned} \text{Accrued benefit} &= 201,000 * 5 * 10\% \\ &= 100,500 \end{aligned}$$

There is a trick to this calculation. Note that the plan benefit is based on years of participation, not years of service.

415 COMP LIMIT

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

$$\begin{aligned} \text{3 year final average pay} &= (190,000 + 200,000 + 245,000)/3 \\ &= 211,667 \end{aligned}$$

$$\begin{aligned} \text{\$415 compensation limit} &= 211,667 * (6/10) \\ &= 127,000 \end{aligned}$$

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Problem 37 – Page 2

415 DOLLAR LIMIT

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

$$\begin{aligned}\$415 \text{ dollar limit during 2009} &= 195,000 * (5/10) && \text{for ages 62-65} \\ &= 97,500\end{aligned}$$

The 415 limit on a life annuity basis is the lesser of the compensation limit of 127,000 and the dollar limit of 97,500. The final plan benefit is limited to 97,500.

Answer is A

NOTE

If you did the calculation of the plan accrued benefit incorrectly, it does not matter. Of course, that assumes you did the correct calculation of the 415 limit.

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Problem 38 – Page 1

Revised 10/11/10

The key to this problem is knowing how to calculate the deductible limit under IRC 404(o). This is quite similar to question 28 on the 2009 exam. The main difference is that this problem does not test anything on the relationship between the plan year and the fiscal year.

Since you are given both the actuarial asset value (AAV) and the market value, there is one thing you should check. The AAV must be within 10% of the market value. If the 01/01/10 AAV was less than $90\%(950,000) = 855,000$ or greater than $110\%(950,000) = 1,045,000$, then you would have to limit the AAV to fall within the 10% corridor.

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.

The maximum deductible limit is defined under 404(o)(2)(A):

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

The problem gives you the funding target on two sets of assumptions. One uses the At-Risk assumptions, and has been provided for use in an alternative definition of the deductible limit.

Cushion Amount

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. Since this plan’s benefit is not based on pay, the second item is equal to zero.

$$\begin{aligned}\text{Cushion amount} &= 50\%(\text{Funding target}) + \text{zero} \\ &= .5(1,100,000) \\ &= 550,000\end{aligned}$$

Now you can calculate the deductible limit. This calculation uses the non At-Risk funding target. This plan is not in At-Risk status, based on exam condition 47.

Target normal cost	90,000
+ Funding target	1,100,000
+ Cushion amount	550,000
Sub-total	1,740,000
Less unreduced AAV	900,000
Deductible limit	840,000

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Problem 38 – Page 2

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

This calculation uses values determined as if the plan is in At-Risk status. The problem gives you the values of the normal cost and funding target for use in this alternate deductible limit definition.

At-Risk Target normal cost	100,000
+ At-Risk Funding target	1,300,000
Sub-total	1,400,000
Less unreduced AAV	900,000
Deductible limit	500,000

The alternate definition does not produce a higher value for the deductible limit. The final deductible limit is 840,000.

Answer is D

NOTES

1. 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. If there had been prior changes in the \$25 benefit level, then you could make an allowance for future increases, based on IRC 404(o)(3)(A)(ii)(II):

“(II) if the plan does not base benefits for service to date on compensation, increases in benefits which are expected to occur in succeeding plan years (determined on the basis of the average annual increase in benefits over the 6 immediately preceding plan years).”
2. Some prior exam problems have not given you the At-Risk values of the target normal cost and funding target. 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.

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Problem 39

Revised 10/28/11

The key to this problem is knowing just a little bit about cash balance plans. In addition, you must know how to calculate the Funding target under IRC Section 430.

The main point of this problem is determining whether the participant becomes eligible for the death benefit. If they do, then you would include that value in the Funding target.

At 01/01/10, the participant is age 61 with one year of service. When they reach age 65, the participant will have 5 years of service. At that point they will be eligible for the death benefit.

But you don't really care about the death benefit at that point. In general, retirement decrements occur at the beginning of the year. The participant would be assumed to retire at age 65, and receive a lump sum.

The Funding target is the present value at 01/01/10 of the lump sum they would receive at age 65:

Valuation date	01/01/2010
Age	61
Past service	1
Account balance	200,000

Age	65
Past service	5
Account balance	252,495 = 200,000(1.06) ⁴

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 lump sum payment at 65 is calculated using the first segment rate of 5%:

$$\begin{aligned} \text{FT} &= \text{PV of AB} \\ &= 252,495(D_{65} / D_{61}) \\ &= 252,495(1+i)^{-4}({}_4p_{61}) \\ &= 252,495(1.05)^{-4}(.98237) \\ &= 204,066 = \text{Funding target} \end{aligned}$$

Answer is D

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Problem 40

This is a "blast from the past" - it has been many years since they tested anything from the SOA study notes on mortality tables and selection of actuarial assumptions.

I. FALSE

An individual annuity mortality table will reflect better (lower) mortality rates. This is due to the selection process of the insurance company in issuing the individual annuity policies. Table A will not match the mortality characteristics of the general population, or the multiemployer plan.

II. FALSE

An individual annuity mortality table will have lower mortality rates than the group annuity table. This is due to the selection process of the insurance company in issuing the individual annuity policies. There is very little selection in setting up group annuity policies, so Table B will be a closer match to the mortality characteristics of the general population.

III. TRUE

A group annuity mortality table will have lower mortality rates than a table based on the general population. There is very little selection in setting up group annuity policies, but there is enough so that Table B will have lower mortality rates than Table C.

Only item three is true.

Answer is D

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Problem 41 – Page 1

Similar to 2008 #39

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:

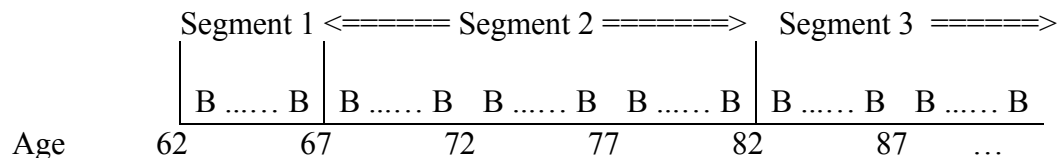
$$\text{Age } x \text{ PV} = \text{Benefit} \{ \ddot{a}_{x:\overline{5}|} \text{ at } 5.0\% + (1.06)^{-5} ({}_5 p_x) \ddot{a}_{x+5:\overline{15}|} \text{ at } 6.0\% + (1.07)^{-20} ({}_{20} p_x) \ddot{a}_{x+20} \text{ at } 7.0\% \}$$

You need to calculate the Funding target at 01/01/2010 allowing for retirement decrements at ages 62 and 65. The first step is to determine the accrued benefit at the valuation date, under the plan prior to the amendment. The accrued benefit is calculated using the \$25 per month benefit:

Valuation date	01/01/2010
Age	62
Past service	35
Accrued benefit	(12)(35)(25) = 10,500

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 at the first decrement age of 62. Their benefit payments will be valued using all three segment rates:



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 benefits commence. Discounting values from the assumed retirement ages back to the valuation date must be done on an interest-only basis.

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Problem 41 – Page 2

Here is the formula for the Funding target using monthly annuity rates. Since the participant already has 30 years of service, they are eligible for unreduced benefits at age 62:

OLD PLAN

$$\begin{aligned} \text{Age 62 FT} = 10,500[& (.40)(\ddot{a}_{62:\overline{5}|}^{(12)}_{seg_1} + {}_5|\ddot{a}_{62:\overline{15}|}^{(12)}_{seg_2} + {}_{20}|\ddot{a}_{62}^{(12)}_{seg_3}) \\ & + (.60)({}_3|\ddot{a}_{62:\overline{2}|}^{(12)}_{seg_1} + {}_5|\ddot{a}_{62:\overline{15}|}^{(12)}_{seg_2} + {}_{20}|\ddot{a}_{62}^{(12)}_{seg_3})] \end{aligned} \quad \text{(incorrect)}$$

As written, this formula for the Funding target is misleading. It appears you can combine the last two annuities on each line, but you really can not. This is due to different assumptions for mortality between pre-retirement and post-retirement. Here is the correct expression:

$$\begin{aligned} \text{Age 62 FT} = 10,500[& (.40)\{ \ddot{a}_{62:\overline{5}|}^{(12)}_{seg_1} + (1.06)^{-5}({}_5p_{62})\ddot{a}_{67:\overline{15}|}^{(12)}_{seg_2} + (1.07)^{-20}({}_{20}p_{62})\ddot{a}_{82}^{(12)}_{seg_3} \} \\ & + (.60)\{ (1.05)^{-3}\ddot{a}_{65:\overline{2}|}^{(12)}_{seg_1} + (1.06)^{-5}({}_2p_{65})\ddot{a}_{67:\overline{15}|}^{(12)}_{seg_2} \\ & \quad + (1.07)^{-20}({}_{17}p_{65})\ddot{a}_{82}^{(12)}_{seg_3} \}] \end{aligned}$$

Now you need to express these annuities in terms of commutation functions. Here are the equivalent expressions based on the 40% retirement decrement at age 62:

$$\begin{aligned} \ddot{a}_{62:\overline{5}|}^{(12)}_{seg_1} &= (N_{62}^{(12)} - N_{67}^{(12)}) / D_{62} && \text{all at segment 1 rate} \\ \ddot{a}_{67:\overline{15}|}^{(12)}_{seg_2} &= (N_{67}^{(12)} - N_{82}^{(12)}) / D_{67} && \text{all at segment 2 rate} \\ (1.06)^{-5}({}_5p_{62})\ddot{a}_{67:\overline{15}|}^{(12)}_{seg_2} &= {}_5|\ddot{a}_{62:\overline{15}|}^{(12)}_{seg_2} && \text{all at segment 2 rate} \\ &= (D_{67} / D_{62}) * (N_{67}^{(12)} - N_{82}^{(12)}) / D_{67} && \text{all at segment 2 rate} \\ &= (N_{67}^{(12)} - N_{82}^{(12)}) / D_{62} && \text{all at segment 2 rate} \\ {}_{20}|\ddot{a}_{62}^{(12)}_{seg_3} &= (N_{82}^{(12)} / D_{62}) && \text{all at segment 3 rate} \end{aligned}$$

Here are the equivalent expressions based on the 60% retirement decrement at age 65:

$$\begin{aligned} \ddot{a}_{65:\overline{2}|}^{(12)}_{seg_1} &= (N_{65}^{(12)} - N_{67}^{(12)}) / D_{65} && \text{all at segment 1 rate} \\ (1.06)^{-5}({}_2p_{65})\ddot{a}_{67:\overline{15}|}^{(12)}_{seg_2} &= (1.06)^{-3}(D_{67} / D_{65})(N_{67}^{(12)} - N_{82}^{(12)}) / D_{67} && \text{all at segment 2 rate} \\ &= (1.06)^{-3}(N_{67}^{(12)} - N_{82}^{(12)}) / D_{65} && \text{all at segment 2 rate} \\ (1.07)^{-20}({}_{17}p_{65})\ddot{a}_{82}^{(12)}_{seg_3} &= (1.07)^{-3}(D_{82} / D_{65})(N_{82}^{(12)} / D_{82}) && \text{all at segment 3 rate} \\ &= (1.07)^{-3}(N_{82}^{(12)} / D_{65}) && \text{all at segment 3 rate} \end{aligned}$$

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Problem 41 – Page 3

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.

OLD PLAN

$$\begin{aligned} \text{Age 62 FT} = 10,500[& (.40)\{ (N_{62}^{(12)} - N_{67}^{(12)}) / D_{62} && \text{at seg}_1 \\ & + (N_{67}^{(12)} - N_{82}^{(12)}) / D_{62} && \text{at seg}_2 \\ & + (N_{82}^{(12)} / D_{62}) && \text{at seg}_3\} \\ & + (.60)\{ (1.05)^{-3}(N_{65}^{(12)} - N_{67}^{(12)}) / D_{65} && \text{at seg}_1 \\ & + (1.06)^{-3}(N_{67}^{(12)} - N_{82}^{(12)}) / D_{65} && \text{at seg}_2 \\ & + (1.07)^{-3}(N_{82}^{(12)} / D_{65}) && \text{at seg}_3\}] \end{aligned}$$

With practice, you should be able to write down the formula for the Funding target using commutation functions without bothering to do the prior work in this problem. Note that the denominators correspond to the assumed benefit commencement age for each retirement decrement. The subscripts for the N_x commutation factors correspond to the age at the beginning of each interest rate segment.

OLD PLAN

$$\begin{aligned} \text{Age 62 FT} = & 10,500[(.40)\{ \frac{5,755 - 3,758}{457} + \frac{1,847 - 257}{254} + \frac{114}{142} \} \\ & + (.60)\{ (1.05)^{-3} \frac{4,487 - 3,758}{386} + (1.06)^{-3} \frac{1,847 - 257}{208} + (1.07)^{-3} \frac{114}{113} \}] \\ = & 10,500[.40\{ 4.3698 + 6.2598 + .8028 \} + .60\{ 1.6314 + 6.4182 + .8235 \}] \\ = & 10,500[4.5730 + 5.3239] \\ = & 103,918 \end{aligned}$$

New PLAN

$$\begin{aligned} \text{Age 62 FT} &= 103,918(30/25) \\ &= 124,701 \end{aligned}$$

The change in the funding target is $20,784 = 124,701 - 103,918$.

Answer is B

NOTE

If you aren't completely comfortable with commutation functions, I think this is one of the hardest problems on the exam!

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Problem 42 – Page 1

Revised 10/11/10

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

The key to this problem is knowing how to calculate the Shortfall amortization base at 01/01/2010 under IRC Section 430. The plan had a CB of zero and a PB of zero at 01/01/2010.

Since you are given both the actuarial asset value (AAV) and the market value, there is one thing you should check. The AAV must be within 10% of the market value. If the 01/01/10 AAV was less than $90\%(2,700,000) = 2,430,000$ or greater than $110\%(2,700,000) = 2,970,000$, then you would have to limit the AAV to fall within the 10% corridor.

2010 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.

$$\begin{aligned}\text{Funding S/F} &= \text{Funding target} - (\text{AAV} - \text{CB} - \text{PB}) \\ &= 3,400,000 - (2,970,000 - 0 - 0) \\ &= 430,000\end{aligned}$$

2010 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 2010:

- Modified funding target: the applicable percentage times the funding target
- You are told that this plan was subject to 412(l) in 2007. 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 $\text{AAV} - \text{PB}$. Otherwise, the modified assets equal the AAV with no reduction.

$$\begin{aligned}\text{Modified S/F} &= 100\% * (\text{Funding target}) - (\text{AAV} - 0) \\ &= 1.00 * (3,400,000) - (2,970,000 - 0) \\ &= 430,000\end{aligned}$$

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Problem 42 – Page 2

2010 Shortfall amortization installment

The plan is not eligible for the shortfall base exemption. You have to set up the 2010 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:

$$\begin{aligned}\text{S/F Amort base} &= (\text{Applicable \%}) * (\text{Funding target}) - (\text{AAV-CB-PB}) - (\text{PV of PY Amortizations}) \\ &= 1.00 * 3,400,000 - (2,970,000 - 0 - 0) - (\text{PV of PY Amortizations}) \\ &= 430,000 - (\text{PV of PY Amortizations})\end{aligned}$$

You must calculate the present value of the 2008 and 2009 amortization installments. You are given both the 5 year annuity factor and the 6 year annuity factor:

$$\begin{aligned}\text{PV of amort} &= 30,000 * 4.5460 + 25,000 * 5.2932 \\ &= 268,710\end{aligned}$$

$$\begin{aligned}\text{2010 S/F base} &= 430,000 - 268,710 \\ &= 161,290\end{aligned}$$

$$\begin{aligned}\text{S/F amort} &= 161,290 / 5.9982 \\ &= 26,890\end{aligned}$$

$$\begin{aligned}\text{S/F charge} &= 30,000 + 25,000 + 26,890 \\ &= 81,890\end{aligned}$$

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.

$$\begin{aligned}\text{MRC} &= \text{TNC} + \text{Shortfall amort charge} + \text{Waiver amort charge} \\ &= 80,000 + 81,890 + 0 \\ &= 161,890\end{aligned}$$

Answer is C

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Problem 43 – Page 1

The key to this problem is knowing how to do calculations under the Aggregate (AGG) cost method. The normal cost is equal to the present value of future normal costs (PVNC) divided by the average temporary annuity for active participants. In this problem, you are given the present value of future compensation.

In the absence of any other information, you can assume that the benefits are pay related. You must calculate the average temporary annuity including a salary scale.

Under the Aggregate method, there is no unfunded accrued liability. The general formula for the PVNC allows for any prior amortization bases, which could include waiver amortization bases, or bases due to a change away from the “shortfall method”.

$$\begin{aligned}\text{AGG PVNC} &= \text{PVB} - \text{AAV} - (\text{O/S 431 bases} - \text{CB}) \\ &= 1,800,000 - \text{AAV} - (0 - 0)\end{aligned}$$

$$\text{AGG NC} = \text{PVNC} / (\text{PVE}/E)$$

The problem asks for the change in the normal cost due to the investment experience. An asset gain of X will produce a decrease of X in the PVNC.

$$\begin{aligned}\Delta \text{NC} &= \Delta \text{PVNC} / (\text{PVE}/E) \\ &= \Delta \text{AAV} / (\text{PVE}/E)\end{aligned}$$

The problem gives you last year's asset value and all the cash flows for 2009. You need to calculate both the expected and actual asset values at 01/01/2010.

$$\text{Asset G/L} = {}_e\text{AAV}_1 - \text{AAV}_1$$

$$\begin{aligned}01/10 {}_e\text{AAV}_1 &= (1+i) * (\text{AAV}_0) - (\text{benefit payments} + \text{interest}) + (\text{contributions} + \text{interest}) \\ &= 1.07(900,000) - 60,000[1+.07(6/12)] + 35,000[1+.07(9/12)] \\ &\quad + 35,000[1+.07(6/12)] + 35,000[1+.07(3/12)] + 35,000[1+.07(0/12)] \\ &= 1.07(900,000) - 60,000[1.035] + 35,000[4+.07(18/12)] \\ &= 1,044,575\end{aligned}$$

$$\begin{aligned}01/10 \text{AAV}_1 &= (1.055) * (\text{AAV}_0) - (\text{benefit payments} + \text{interest}) + (\text{contributions} + \text{interest}) \\ &= 1.055(900,000) - 60,000[1.0275] + 35,000[4+.055(18/12)] \\ &= 1,030,738\end{aligned}$$

$$\begin{aligned}\text{Asset loss} &= 1,044,575 - 1,030,738 \\ &= 13,838\end{aligned}$$

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Problem 43 – Page 2

$$\begin{aligned}\text{PVE/E} &= 3,250,000 / 150,000 \\ &= 21.6667\end{aligned}$$

$$\begin{aligned}\Delta\text{NC} &= 13,838 / 21.6667 \\ &= 639\end{aligned}$$

Answer is B

NOTE

You could use compound interest to calculate the expected asset value. This must produce a result that is in the same answer range:

$$\begin{aligned}01/10 \text{ } {}_e\text{AAV}_1 &= (1+i) * (\text{AAV}_0) - (\text{benefit payments} + \text{interest}) + (\text{contributions} + \text{interest}) \\ &= 1.07(900,000) - 60,000[1.07]^{6/12} + 35,000[1.07]^{9/12} \\ &\quad + 35,000[1.07]^{6/12} + 35,000[1.07]^{3/12} + 35,000[1.07]^{0/12} \\ &= 1.07(900,000) - 60,000[1.0344] + 35,000[4.1035] \\ &= 1,044,559\end{aligned}$$

$$\begin{aligned}01/10 \text{ AAV}_1 &= (1.055) * (\text{AAV}_0) - (\text{benefit payments} + \text{interest}) + (\text{contributions} + \text{interest}) \\ &= 1.055(900,000) - 60,000[1.055]^{6/12} + 35,000[1.055]^{9/12} \\ &\quad + 35,000[1.055]^{6/12} + 35,000[1.055]^{3/12} + 35,000[1.055]^{0/12} \\ &= 1.055(900,000) - 60,000[1.0271] + 35,000[4.0816] \\ &= 1,030,727\end{aligned}$$

$$\begin{aligned}\text{Asset loss} &= 1,044,559 - 1,030,727 \\ &= 13,831\end{aligned}$$

$$\begin{aligned}\Delta\text{NC} &= 13,831 / 21.6667 \\ &= 638\end{aligned}$$

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Problem 44 – 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. This is a new plan, which was established at 01/01/08. As a result, it had a zero funding standard carryover balance (CB) at 01/01/2008.

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.

Valuation calculations

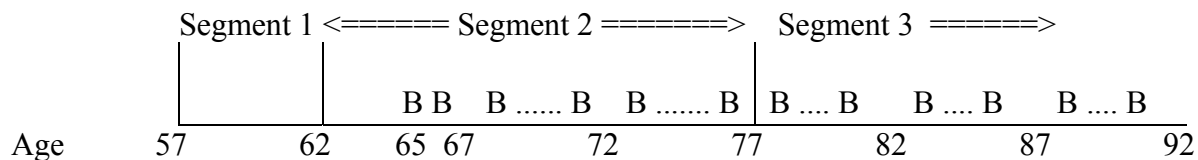
You need to calculate both the Funding target and the Target normal cost at 01/01/2010. These items are the Unit Credit accrued liability and the Unit Credit normal cost, respectively.

You are told that there is only one participant at 01/01/10. The first step is to determine the accrued benefit at the valuation date, and the benefit accrual during 2010:

Valuation date	01/01/2010
Age	57
Past service	2
Accrued benefit	$2(75)(12) = 1,800$

$$\Delta AB = 900 = 12(75)$$

The participant is currently 8 years from retirement, so their benefit payments will be valued using the second and third segment rates:



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Problem 44 – Page 2

$$\begin{aligned} \text{AL} &= \text{PV of AB} \\ &= 1,800[(1.05)^{-8} (N_{65}^{(12)} - N_{77}^{(12)}) / D_{65} \quad \text{at seg}_2 \\ &\quad + (1.06)^{-8} (N_{77}^{(12)} / D_{65}) \quad \text{at seg}_3] \\ &= 1,800[(1.05)^{-8} \frac{(44,770 - 12,564)}{3,838} + (1.06)^{-8} \frac{(5,750)}{2,073}] \\ &= 1,800[5.6796 + 1.7403] \\ &= 13,356 \\ \text{NC} &= \text{PV of } (\Delta \text{AB}) \\ &= 13,356 * (900 / 1,800) \\ &= 6,678 \end{aligned}$$

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.

$$\begin{aligned} \text{Funding S/F} &= \text{Funding target} - (\text{AAV} - \text{CB} - \text{PB}) \\ &= 13,356 - (10,000 - 0 - 200) \\ &= 3,556 \end{aligned}$$

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 2010:

- Modified funding target: the applicable percentage times the funding target
- This is a post-PPA plan, since the effective date is 01/01/2008. 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 (MRC), the modified assets equal AAV - PB. Otherwise, the modified assets equal the AAV with no reduction.

The key point of the problem is whether you can apply the PB towards the MRC. It is unusual that the problem gives you valuation results for both 2009 and 2010. You should not rely on exam condition 30, since you can determine the value of the 2009 funding ratio.

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Problem 44 – Page 3

The problem gives you the value of the 2009 funding target attainment percentage (FTAP):

$$\begin{aligned} \text{2009 FTAP} &= \frac{(\text{AAV} - \text{CB} - \text{PB})}{\text{Non at-risk FT}} \\ &= (\text{AAV} - 0 - 0) / \text{FT} \\ &= 75\% \end{aligned}$$

The 2009 funding ratio is similar to the FTAP. The only difference is that it does not offset the assets by the CB. Since this plan had a zero CB at 01/01/09, the 2009 funding ratio is identical to the 2009 FTAP of 75%. This means that the plan sponsor can not apply the PB towards the MRC.

$$\begin{aligned} \text{Modified S/F} &= 100\% * (\text{Funding target}) - (\text{AAV} - 0) \\ &= 1.00 * 13,356 - (10,000 - 0) \\ &= 3,356 \end{aligned}$$

2010 Shortfall amortization installment

The plan is not eligible for the shortfall base exemption. You have to set up the 2010 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:

$$\begin{aligned} \text{S/F Amort base} &= (\text{Applicable \%}) * (\text{Funding target}) - (\text{AAV} - \text{CB} - \text{PB}) - (\text{PV of PY Amortizations}) \\ &= 1.00 * 13,356 - (10,000 - 0 - 200) - (\text{PV of PY Amortizations}) \\ &= 3,556 - (\text{PV of PY Amortizations}) \end{aligned}$$

You must calculate the present value of the 2008 and 2009 amortization installments. This plan was established in 2008, and the participant was hired in 2008. Their accrued benefit was zero at 01/01/08, so the 2008 funding shortfall was also zero.

The problem gives you the 2009 funding shortfall, so you can calculate the 2009 amortization installment. The amortization must be calculated using the factor based on the 2009 segment rates:

$$\begin{aligned} \text{2009 amort} &= 1,600 / 5.9982 \\ &= 267 \end{aligned}$$

$$\begin{aligned} \text{PV of amort} &= 267 * 5.4134 \\ &= 1,444 \end{aligned}$$

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Problem 44 – Page 4

$$\begin{aligned} \text{2010 S/F base} &= 3,556 - 1,444 \\ &= 2,112 \end{aligned}$$

$$\begin{aligned} \text{S/F amort} &= 2,112 / 6.1596 \\ &= 343 \end{aligned}$$

$$\begin{aligned} \text{S/F charge} &= 267 + 343 \\ &= 610 \end{aligned}$$

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.

$$\begin{aligned} \text{MRC} &= \text{TNC} + \text{Shortfall amort charge} + \text{Waiver amort charge} \\ &= 6,678 + 610 + 0 \\ &= 7,288 \end{aligned}$$

The problem asks for “the smallest amount that satisfies the minimum funding standard”. Since the plan can not apply the PB towards the MRC, the "smallest amount" is also equal to 7,288.

Answer is C

Fall 2009 EA-2A Exam Solutions

Problem 45 – Page 1

The key to this problem is knowing how to calculate the deductible limit under IRC 404(o). This is quite similar to question 28 on the 2009 exam. The main difference is that this problem does not test anything on the relationship between the plan year and the fiscal year.

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.

The maximum deductible limit is defined under 404(o)(2)(A):

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

The problem gives you the funding target on two sets of assumptions. One uses the At-Risk assumptions, and has been provided for use in an alternative definition of the deductible limit.

Cushion Amount

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.

$$\begin{aligned}\text{Cushion amount} &= 50\%(\text{FT}) + \Delta\text{FT due to pay increases} \\ &= .5(400,000) + 65,000 \\ &= 265,000\end{aligned}$$

Now you can calculate the deductible limit. This calculation uses the non At-Risk funding target. This plan is not in At-Risk status, based on exam condition 47.

Target normal cost	50,000
+ Funding target	400,000
+ Cushion amount	265,000
Sub-total	715,000
Less unreduced AAV	350,000
Deductible limit	365,000

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Problem 45 – Page 2

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

This calculation uses values determined as if the plan is in At-Risk status. The problem gives you the values of the normal cost and funding target for use in this alternate deductible limit definition.

At-Risk Target normal cost	60,000
+ At-Risk Funding target	600,000
Sub-total	<u>660,000</u>
Less unreduced AAV	<u>350,000</u>
Deductible limit	310,000

The alternate definition does not produce a higher value for the deductible limit. The final deductible limit is 365,000.

Answer is D

NOTE

Some prior exam problems have not given you the At-Risk values of the target normal cost and funding target. 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.

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Problem 46 – Page 1

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

The key to this problem is knowing how to calculate the Shortfall amortization base at 01/01/2010 under IRC Section 430. The plan was set up after PPA 2006, so the CB is equal to zero. The plan has a PB equal to 100,000 at 01/01/2010.

2010 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.

$$\begin{aligned}\text{Funding S/F} &= \text{Funding target} - (\text{AAV} - \text{CB} - \text{PB}) \\ &= 2,100,000 - (2,125,000 - 0 - 100,000) \\ &= 75,000\end{aligned}$$

2010 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 2010:

- Modified funding target: the applicable percentage times the funding target
- This is a post-PPA plan, since the effective date is 01/01/2008. 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 $\text{AAV} - \text{PB}$. Otherwise, the modified assets equal the AAV with no reduction.

$$\begin{aligned}\text{Modified S/F} &= 100\% * (\text{Funding target}) - (\text{AAV} - \text{PB}) \\ &= 1.00 * (2,100,000) - (2,125,000 - 100,000) \\ &= 75,000\end{aligned}$$

The modified shortfall calculation above offsets the entire PB against the AAV. 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 PB is equal to zero.

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Problem 46 – Page 2

2010 Shortfall amortization installment

The plan is not eligible for the shortfall base exemption. You have to set up the 2010 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:

$$\begin{aligned}\text{S/F Amort base} &= (\text{Applicable \%}) * (\text{Funding target}) - (\text{AAV-CB-PB}) - (\text{PV of PY Amortizations}) \\ &= 1.00 * 2,100,000 - (2,125,000 - 0 - 100,000) - (\text{PV of PY Amortizations}) \\ &= 75,000 - (\text{PV of PY Amortizations})\end{aligned}$$

You must calculate the present value of the 2009 amortization installment of 28,000. You are given the 6 year annuity factor:

$$\begin{aligned}\text{PV of amort} &= 28,000 * 5.2932 \\ &= 148,210\end{aligned}$$

$$\begin{aligned}\text{2010 S/F base} &= 75,000 - 148,210 \\ &= -73,210\end{aligned}$$

$$\begin{aligned}\text{S/F amort} &= -73,210 / 5.9982 \\ &= -12,205\end{aligned}$$

$$\begin{aligned}\text{S/F charge} &= 28,000 - 12,205 \\ &= 15,795\end{aligned}$$

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.

$$\begin{aligned}\text{MRC} &= \text{TNC} + \text{Shortfall amort charge} + \text{Waiver amort charge} \\ &= 205,000 + 15,795 + 0 \\ &= 220,795\end{aligned}$$

Answer is C

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Problem 47

Similar to 2008 #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 01/01/2010. 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
01-01-10 Age	62	59	55
Accrued benefit	725	375	150
Early retirement Reduction factor	$1 - (65-62)(6\%) = .82$	$1 - (65-59)(6\%) = .64$	$1 - (65-59)(6\%) - (59-55)(5\%) = .44$
Early Ret Benefit	$.82(725) = 594.50$	$.64(375) = 240.00$	$.44(150) = 66.00$
Retirement annuity	$\ddot{a}_{62}^{(12)}$	$\ddot{a}_{59}^{(12)}$	$\ddot{a}_{55}^{(12)}$
PVB as retiree	$594.50*(12.40) = 7,372$	$240.00*(13.00) = 3,120$	$66.00*(13.70) = 904$

Active AL calculations

Name	Smith	Jones	Brown
01-01-10 Age	62	59	55
Accrued benefit	725	375	150
Accrued liability	$725(1.06)^{-3} \ddot{a}_{65}^{(12)} = 7,122$	$375(1.06)^{-6} \ddot{a}_{65}^{(12)} = 3,093$	$150(1.06)^{-10} \ddot{a}_{65}^{(12)} = 980$
Gain or Loss?	Loss	Loss	Gain

Both Smith's and Jones' retirements cause an experience loss.

Answer is A

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Problem 48 – Page 1

The problem asks for the "smallest amount" at 01/01/10. Based on exam conditions 30 and 31, the plan sponsor elects to offset both the CB and the PB against the minimum contribution under IRC 430. Based on exam condition 35, the "smallest amount" reflects offsetting both the CB and the PB against the minimum contribution.

The key to this problem is knowing how to calculate the Shortfall amortization base at 01/01/2010 under IRC Section 430. The plan has a CB equal to zero, and a PB equal to 20,000 at 01/01/2010.

2010 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.

$$\begin{aligned}\text{Funding S/F} &= \text{Funding target} - (\text{AAV} - \text{CB} - \text{PB}) \\ &= 1,000,000 - (910,000 - 0 - 20,000) \\ &= 110,000\end{aligned}$$

2010 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 2010:

- 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 96%
- 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.

$$\begin{aligned}\text{Modified S/F} &= 96\% * (\text{Funding target}) - (\text{AAV} - \text{PB}) \\ &= .96 * (1,000,000) - (910,000 - 20,000) \\ &= 70,000\end{aligned}$$

The modified shortfall calculation above offsets the entire PB against the AAV. 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 PB is equal to zero.

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Problem 48 – Page 2

2010 Shortfall amortization installment

The plan is not eligible for the shortfall base exemption. You have to set up the 2010 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:

$$\begin{aligned}\text{S/F Amort base} &= (\text{Applicable \%}) * (\text{Funding target}) - (\text{AAV-CB-PB}) - (\text{PV of PY Amortizations}) \\ &= .96 * 1,000,000 - (910,000 - 0 - 20,000) - (\text{PV of PY Amortizations}) \\ &= 70,000 - (\text{PV of PY Amortizations})\end{aligned}$$

You must calculate the present value of the 2009 amortization installment of 15,000. You are given the 6 year annuity factor:

$$\begin{aligned}\text{PV of amort} &= 15,000 * 5.3295 \\ &= 79,943\end{aligned}$$

$$\begin{aligned}\text{2010 S/F base} &= 70,000 - 79,943 \\ &= -9,943\end{aligned}$$

$$\begin{aligned}\text{S/F amort} &= -9,943 / 6.0757 \\ &= -1,636\end{aligned}$$

$$\begin{aligned}\text{S/F charge} &= 15,000 - 1,636 \\ &= 13,364\end{aligned}$$

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.

$$\begin{aligned}\text{MRC} &= \text{TNC} + \text{Shortfall amort charge} + \text{Waiver amort charge} \\ &= 75,000 + 13,364 + 0 \\ &= 88,364\end{aligned}$$

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Problem 48 – Page 3

Smallest amount

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

$$\begin{aligned}\text{Smallest contr} &= \text{MRC} - \text{CB} - \text{PB} \\ &= 88,364 - 0 - 20,000 \\ &= 68,364\end{aligned}$$

Answer is D

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Problem 49 – Page 1

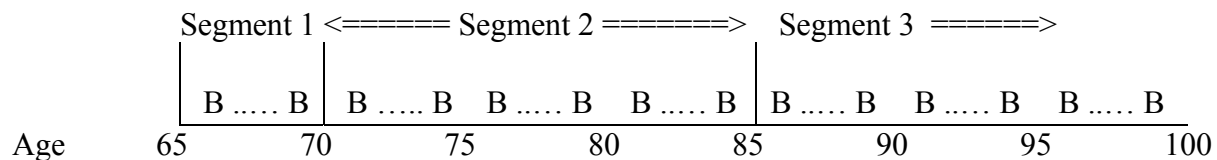
This is a basic question on your understanding of segment interest rates. Under PPA 2006, you would calculate the present value of a stream of annual benefit payments for a life annuity payable to a person age x (currently in pay status) as follows:

$$\begin{aligned} \text{Present value} &= \sum_{t=0}^4 (1.0500)^{-t} {}_t p_x^{(T)} (\text{Benefit Payment}_{x+t}) \\ &+ \sum_{t=5}^{19} (1.0600)^{-t} {}_t p_x^{(T)} (\text{Benefit Payment}_{x+t}) \\ &+ \sum_{t=20}^{\omega-x} (1.0650)^{-t} {}_t p_x^{(T)} (\text{Benefit Payment}_{x+t}) \end{aligned}$$

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.

01/01/2010 Age 65
Accrued benefit 25,000

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 at normal retirement age, so their benefit payments will be valued using the all three segment rates:



$$\begin{aligned} \text{Plan Lump sum} &= 25,000 \ddot{a}_{65}^{(12)} \\ &= 25,000(11.31) \\ &= 282,750 \end{aligned}$$

$$\begin{aligned} 417(e) \text{ Lump sum} &= 25,000[(N_{65}^{(12)} - N_{70}^{(12)}) / D_{65} \quad \text{at seg}_1 \\ &\quad + (N_{70}^{(12)} - N_{85}^{(12)}) / D_{65} \quad \text{at seg}_2 \\ &\quad + (N_{85}^{(12)}) / D_{65} \quad \text{at seg}_3] \\ &= 25,000[\frac{(713,162 - 482,841)}{51,213} + \frac{(240,861 - 149,149)}{28,999} + \frac{(103,844)}{21,866}] \\ &= 25,000[4.4973 + 3.1626 + 4.7491] \end{aligned}$$

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Problem 49 – Page 2

417(e) Lump sum = 310,225

The final lump sum is the greater of the two values, which is 310,225.

Answer is C

NOTE

In this problem, you are given the 417(e) segment rates. Even though the problem does not clarify how the 417(e) rates were determined, they must reflect 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. 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%

Problem 50 – Page 1

Revised 10/28/11

This is a fairly straightforward question on IRC 414(l). Unlike most prior 414(l) problems, this one involves a spinoff to a plan that is outside of the controlled group. That means that the special rules in 414(l)(2) do not apply.

The general rule in 414(l)(1) does apply. Each participant in the spinoff must have a benefit (if the plan terminated immediately after the spinoff) that is at least as great as the benefit they would receive if the plan terminated immediately prior to the spinoff.

The question states that the plan is 100% funded under IRC 414(l). The asset transfer for each participant must be at least as great as the present value of their benefit at the spinoff date.

The main point of the problem is that the 414(l) calculations assume the earliest retirement age. You need to determine each participant's earliest retirement age. If a participant has less than 20 years of service at retirement, they can't receive their benefit until age 65. Otherwise, they can receive their benefit as early as age 55.

The trick to this question is that you don't use their service at 01/01/10. You must allow for the fact that they will continue to earn eligibility service in future years.

There are no early retirement reduction factors. The early retirement benefit is the same as the accrued benefit. Then you can calculate the present value of the early retirement benefit, which is also the amount of the asset transfer upon spinoff.

Name	Smith	Jones	Brown
01-01-10 age	55	50	55
01-01-10 past service	20	15	10
Age with 20 years of service	55	55	65
Earliest retirement age	55	55	65
Present value factor	$\ddot{a}_{55}^{(12)}$	$(D_{55}/D_{50})\ddot{a}_{55}^{(12)}$ $= (1.07)^{-5}\ddot{a}_{55}^{(12)}$	$(D_{65}/D_{55})\ddot{a}_{65}^{(12)}$ $= (1.07)^{-10}\ddot{a}_{65}^{(12)}$

With no pre-retirement mortality, it is incorrect to use the D_{x+n}/D_x terms. You should use interest-only discount factors prior to benefit commencement.

You do use the commutation functions to calculate each participant's annuity factor.

Smith

$$\begin{aligned}\ddot{a}_{55}^{(12)} &= N_{55}^{(12)}/D_{55} \\ &= 2,724,628/229,697 \\ &= 11.8618\end{aligned}$$

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Revised 10/28/11

Jones

$$\begin{aligned}(1.07)^{-5} N_{55}^{(12)} / D_{55} &= (.7130)(2,724,628/229,697) \\ &= 8.4573\end{aligned}$$

Brown

$$\begin{aligned}(1.07)^{-10} N_{65}^{(12)} / D_{65} &= (.5083)(1,089,694/109,332) \\ &= 5.0667\end{aligned}$$

Name	Smith	Jones	Brown
Monthly accrued benefit	1,500	1,125	750
Present value of benefits	$11.8618(12)(1,500)$ $= 213,513$	$8.4573(12)(1,125)$ $= 114,174$	$5.0667(12)(750)$ $= 45,600$

The total PVB is 373,287. This is also the minimum asset transfer under IRC 414(l).

Answer is E

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Problem 51

Similar to 2007 #33

Revised 09/19/12

The key to this problem is handling the multiple retirement decrements correctly in calculating the present value of benefits as an active employee. The trick to the question is that the retirement decrements occur at the end of the year. This is very unusual.

The key to this problem is interpreting the data for $l_{61+t}^{(r)}$ you are given. The value of 580 for $l_{62}^{(r)}$ means that the probability of retiring at the end of the year they attain age 61 is $(690-580)/690$, or 15.94%. The value of zero for $l_{63}^{(r)}$ means that everyone retires at the end of the year they attain age 62.

Age 61 at 01/01/10
Past Service 1 year

There are two retirement decrements, which you can consider occurring at ages 62 and 63 (at the beginning of the year). You need to allow for the probability of survival to retirement age. At each retirement age, you need to calculate the early retirement benefit. There are no early retirement reductions, so the retirement benefit will equal the projected benefit.

The PVB must be calculated as a complicated summation:

$$PVB = \sum_{t=1}^2 v^t {}_t p_{61}^{(T)} q_{61+t}^{(r)} (ER \text{ Ben})_{61+t} \ddot{a}_{61+t}^{(12)}$$

It is less confusing if you calculate the early retirement benefit at each age before putting together the rest of the summation:

$$\begin{aligned} \text{ERB at 62} &= 2(12)(30) \\ &= 720 \end{aligned}$$

$$\begin{aligned} \text{ERB at 63} &= 3(12)(30) \\ &= 1,080 \end{aligned}$$

The final step is to evaluate the summation shown previously:

	(1)	(2)	(3)		(4)	(5)	(6)
t	$61+t$	v^t	$p_{61+t}^{(T)}$	$q_{61+t}^{(r)}$	$p_{61+t}^{(T)}$	ERB_{61}	$\ddot{a}_{61+t}^{(12)}$
1	62	.9346	1.0000	0.1594	0.8406	720	10.68
2	63	.8734	0.8406	1.0000	0.0000	1,080	10.46
							<u>8,294</u>
							9,440

Answer is A

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Problem 52 – 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:

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

You need to calculate the Funding target at 01/01/2010 allowing for normal retirement age 65. The first step is to determine the accrued benefit at the valuation date:

Valuation date	01/01/2010
Age	61
Past service	10
Accrued benefit	(12)(100)(10) = 12,000

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's benefit payments will be valued using all three segment rates:

	Segment 1 <=====					Segment 2 =====>					Segment 3 =====>				
	B B					B B B B B B					B B B B				
Age	61	65	66	71	76	81	86	...							

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 benefits commence. Discounting values from normal retirement age back to the valuation date must be done on an interest-only basis.

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Problem 52 – Page 2

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

$$\text{Age 61 FT} = 12,000 \left({}_4\ddot{a}_{61:\overline{1}|}^{(12)}_{\text{seg}_1} + {}_5\ddot{a}_{61:\overline{15}|}^{(12)}_{\text{seg}_2} + {}_{20}\ddot{a}_{81\text{seg}_3}^{(12)} \right) \quad (\text{incorrect})$$

This expression is not correct, since the deferred annuities are over-simplified. The deferral must reflect the difference in assumptions between pre-retirement mortality and post-retirement mortality. Here is the correct expression:

$$\text{Age 61 FT} = 12,000 \left[(v^4) \ddot{a}_{65:\overline{1}|}^{(12)}_{\text{seg}_1} + (v^5 {}_1p_{65}) \ddot{a}_{66:\overline{15}|}^{(12)}_{\text{seg}_2} + (v^{20} {}_{16}p_{65}) \ddot{a}_{81\text{seg}_3}^{(12)} \right]$$

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

$$(v^4) \ddot{a}_{65:\overline{1}|}^{(12)}_{\text{seg}_1} = (1.05)^{-4} (N_{65}^{(12)} - N_{66}^{(12)}) / D_{65} \quad \text{all at segment 1 rate}$$

$$\begin{aligned} (v^5 {}_1p_{65}) \ddot{a}_{66:\overline{15}|}^{(12)}_{\text{seg}_2} &= (1.06)^{-4} (D_{66} / D_{65}) (N_{66}^{(12)} - N_{81}^{(12)}) / D_{66} \quad \text{all at segment 2 rate} \\ &= (1.06)^{-4} (N_{66}^{(12)} - N_{81}^{(12)}) / D_{65} \quad \text{all at segment 2 rate} \end{aligned}$$

$$\begin{aligned} (v^{20} {}_{16}p_{65}) \ddot{a}_{81\text{seg}_3}^{(12)} &= (1.07)^{-4} (D_{81} / D_{65}) (N_{81}^{(12)} / D_{81}) \quad \text{all at segment 3 rate} \\ &= (1.07)^{-4} (N_{81}^{(12)} / D_{65}) \quad \text{all at segment 3 rate} \end{aligned}$$

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.

$$\begin{aligned} \text{Age 61 FT} &= 12,000 \left[(1.05)^{-4} (N_{65}^{(12)} - N_{66}^{(12)}) / D_{65} \quad \text{at seg}_1 \right. \\ &\quad + (1.06)^{-4} (N_{66}^{(12)} - N_{81}^{(12)}) / D_{65} \quad \text{at seg}_2 \\ &\quad \left. + (1.07)^{-4} (N_{81}^{(12)} / D_{65}) \quad \text{at seg}_3 \right] \end{aligned}$$

With practice, you should be able to write down the formula for the Funding target using commutation functions without bothering to do the prior work in this problem. Note that the denominators correspond to the assumed benefit commencement age. The subscripts for the N_x commutation factors correspond to the age at the beginning of each interest rate segment.

$$\text{Age 61 FT} = 12,000 \left[(1.05)^{-4} \frac{(45,046 - 41,286)}{3,862} + (1.06)^{-4} \frac{(20,438 - 3,099)}{2,085} + (1.07)^{-4} \frac{(1,390)}{1,132} \right]$$

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Problem 52 – Page 3

$$\begin{aligned}\text{Age 61 FT} &= 12,000[.8010 + 6.5871 + .9368] \\ &= 99,898\end{aligned}$$

Answer is B

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Problem 53 – Page 1

Revised 10/28/11

You have an unpaid minimum required contribution, and you must calculate the excise tax. The key point of the question is how you make interest adjustments to the unpaid contribution to reflect the payment date. In addition, exactly how do you calculate the amount subject to excise tax?

2008 Funding Shortfall

The problem states that the 2008 FTAP is 105%:

$$\text{FTAP} = \frac{(\text{AAV} - \text{CB} - \text{PB})}{\text{Non at-risk funding target}} = 105\%$$

The AAV at 01/01/08 exceeds 105% of the funding target. That means that the funding shortfall for 2008 is zero. The shortfall amortization payment is also zero.

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 (PB) and the carryover balance (CB).

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

This is a strange result. The problem does not give you the PB at 01/01/09, so you do not know the amount of the funding shortfall.

But the problem does give you the PB at 01/01/10, which is zero. Since the 2009 contribution is less than the minimum, the 01/01/10 PB must equal the 01/01/09 PB brought forward with the 2009 effective interest rate of 6%. That means the 01/01/09 PB is zero, and the 01/01/09 funding shortfall is zero.

2009 Minimum required contribution

Since the funding shortfall is zero, 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):

$$\begin{aligned}01/2009 \text{ MRC} &= \text{TNC} + \text{Funding target} - (\text{AAV} - \text{CB} - \text{PB}) \\ &= 100,000 + 500,000 - (500,000 - 0 - 0) \\ &= 100,000\end{aligned}$$

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Problem 53 – Page 2

2009 unpaid minimum

The 2009 contribution of 50,000 is paid at 09/15/10. You should compare the discounted value (using the 2009 effective interest rate of 6.0%) against the MRC at 01/01/09:

$$\begin{aligned}\text{PV of contrib} &= 50,000 * (1.06)^{-20.5/12} && \text{(using compound interest)} \\ &= 45,263\end{aligned}$$

The unpaid minimum is the excess at 01/01/09 of the 100,000 MRC over 45,263, or 54,737. The excise tax is 10% of this amount, or 5,474.

Answer is A

NOTES

1. You will get the same answer range if you decided to use simple interest:

$$\begin{aligned}\text{PV of contrib} &= 50,000 * (1 + (20.5/12) * .06)^{-1} && \text{(using simple interest)} \\ &= 45,351\end{aligned}$$

The resulting excise tax is $10\%(100,000 - 45,351) = 5,465$

2. IRC 4971 defines the amount of the excise tax. But it does not have a clear definition of the precise date used to determine the unpaid minimum required contribution. The April 15, 2008 proposed regulation on IRC 4971 does define the unpaid minimum contribution as determined at the valuation date. The calculations in this problem follow example 1 at 54.4971(c)-1(f).

Problem 54 – Page 1

Revised 10/11/10

The key to this problem is knowing how to calculate the Funding target, Target normal cost and the Shortfall amortization base at 01/01/2010 under IRC Section 430. This plan has a zero funding standard carryover balance (CB) and prefunding balance (PB) at 01/01/2010.

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.

Valuation calculations

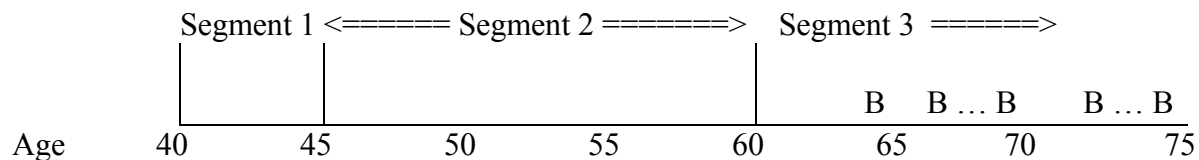
You need to determine values for the Funding target and the Target normal cost at 01/01/2010, based on Smith both as an active employee, and as a vested termination.

You are told that there is only one participant at 01/01/10. The first step is to determine the accrued benefit at the valuation date, and the termination date. Based on exam condition 10, service for both vesting and benefit accrual is credited based on elapsed time:

	Termination date	Valuation date	Valuation date
	07/01/2009	01/01/2010	01/01/2011
Status	Vested termination	Active employee	Active employee
Age	39.5	40.0	41.0
Past service	9.5	10.0	11.0
Accrued benefit	$9.5(75)(12) = 8,550$	$10.0(75)(12) = 9,000$	$11.0(75)(12) = 9,900$

$$\Delta \text{ Accrued benefit} = 900 = 12(75)$$

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



$$\begin{aligned}
 \text{VT AL} &= \text{PV of vested benefit} \\
 &= 8,550(D_{65} / D_{40}) \ddot{a}_{65}^{(12)} \\
 &= 8,550(1+i)^{-25} {}_{(25)p_{40}} (N_{65}^{(12)} / D_{65}) \\
 &= 8,550(1.06)^{-25} (1.0)(22,323/2,073) \\
 &= 21,452 = \text{Funding target}
 \end{aligned}$$

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Problem 54 – Page 2

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 6%, and they are all discounted to the valuation date at 6%. With no pre-retirement decrements, the D/D terms are only based on the 6% interest rate.

As a vested termination, there is no change in the accrued benefit during 2010.

VT NC = PV of change in accrued benefit = zero

Funding Shortfall - Vested termination

You are told that the Funding target attainment percentage (FTAP) was 95% at 01/01/10. Since Smith terminated at 07/01/09, this FTAP is based on Smith as a terminated employee.

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

$$\text{FTAP} = \frac{\text{AAV} - \text{CB} - \text{PB}}{\text{Funding target}} = 95\%$$

$$\begin{aligned} .95(21,452) &= \text{AAV} - \text{CB} - \text{PB} \\ \text{AAV} &= 20,380 \end{aligned}$$

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.

$$\begin{aligned} \text{Funding S/F} &= \text{Funding target} - (\text{AAV} - \text{CB} - \text{PB}) \\ &= 21,452 - (20,380 - 0 - 0) \\ &= 1,073 \end{aligned}$$

Shortfall Base Exemption - Vested termination

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 2010:

- 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 96%
- Modified assets: if any portion of the prefunding balance is applied toward the minimum required contribution (MRC), the modified assets equal AAV - PB. Otherwise, the modified assets equal the AAV with no reduction.

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Problem 54 – Page 3

$$\begin{aligned}\text{Modified S/F} &= 96\%(\text{Funding target}) - (\text{AAV} - 0) \\ &= .96*21,452 - (20,380 - 0) \\ &= 215\end{aligned}$$

2010 Shortfall amortization installment - Vested termination

The plan is not eligible for the shortfall base exemption. You typically would determine the 2010 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:

$$\begin{aligned}\text{S/F Amort base} &= (\text{Applicable \%}) * (\text{Funding target}) - (\text{AAV} - \text{CB} - \text{PB}) - (\text{PV of PY Amortizations}) \\ &= .96*21,452 - (20,380 - 0 - 0) - (\text{PV of PY Amortizations}) \\ &= 215 - (\text{PV of PY Amortizations})\end{aligned}$$

Since the problem asks for the change in the MRC for 2010, you do not need to worry about the prior years' shortfall and waiver amortization installments. You only need to determine the formula for the shortfall amortization base if Smith had not terminated at 07/01/09.

"Minimum Required Contribution" - Vested termination

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:

$$\text{MRC} = \text{TNC} + \text{Shortfall amort charge} + \text{Waiver amort charge}$$

We don't know the prior years' amortizations, so we are calculating a different value:

$$\begin{aligned}\text{S/F amort} &= 215 / 6.1596 \\ &= 35\end{aligned}$$

$$\begin{aligned}\text{"MRC"} &= \text{TNC} + 2010 \text{ Shortfall amortization installment} \\ &= 0 + 35 \\ &= 35\end{aligned}$$

Valuation calculations - Active employee

$$\begin{aligned}\text{Act AL} &= \text{PV of accrued benefit} \\ &= 9,000(D_{65} / D_{40}) \ddot{a}_{65}^{(12)} \\ &= (9,000/8,550)*21,452 \\ &= 22,581 = \text{Funding target}\end{aligned}$$

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$$\begin{aligned}\text{Act NC} &= \text{PV of change in accrued benefit} \\ &= 900(D_{65} / D_{40}) \ddot{a}_{65}^{(12)} \\ &= (900/9,000) * 22,581 \\ &= 2,258 = \text{Target normal cost}\end{aligned}$$

Funding Shortfall - Active employee

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.

$$\begin{aligned}\text{Funding S/F} &= \text{Funding target} - (\text{AAV} - \text{CB} - \text{PB}) \\ &= 22,581 - (20,380 - 0 - 0) \\ &= 2,201\end{aligned}$$

Shortfall Base Exemption - Active employee

You should think about whether this plan satisfies the shortfall base exemption. OK, we're done! Since the plan did not satisfy the exemption when Smith was a vested termination, it is not exempt when Smith is treated as an active employee.

2010 Shortfall amortization installment - Active employee

The plan is not eligible for the shortfall base exemption. You typically would determine the 2010 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:

$$\begin{aligned}\text{S/F Amort base} &= (\text{Applicable \%}) * (\text{Funding target}) - (\text{AAV} - \text{CB} - \text{PB}) - (\text{PV of PY Amortizations}) \\ &= .96 * 22,581 - (20,380 - 0 - 0) - (\text{PV of PY Amortizations}) \\ &= 1,298 - (\text{PV of PY Amortizations})\end{aligned}$$

"Minimum Required Contribution" - Active employee

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:

$$\text{MRC} = \text{TNC} + \text{Shortfall amort charge} + \text{Waiver amort charge}$$

We don't know the prior years' amortizations, so we are calculating a different value:

$$\begin{aligned}\text{S/F amort} &= 1,298 / 6.1596 \\ &= 211\end{aligned}$$

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Revised 10/11/10

$$\begin{aligned}\text{"MRC"} &= \text{TNC} + 2010 \text{ Shortfall amortization installment} \\ &= 2,258 + 211 \\ &= 2,469\end{aligned}$$

The decrease in the MRC is $2,434 = 2,469 - 35$.

Answer is D

NOTE

This seems like a tremendous amount of effort for a three point problem!

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Problem 55

This is a straightforward question on the At-risk definitions in IRC 430(i).

I. TRUE

This is a correct statement.

See IRC 430(i)(2)(B).

II. FALSE

This is almost correct. The 20% is multiplied by the number of consecutive years that the plan is in At-risk status.

See IRC 430(i)(5)(B).

III. FALSE

This is not correct.

See IRC 430(i)(3).

Only item I is true

Answer is B

Problem 56 – Page 1**Revised 10/15/12**

The key to this problem is knowing the non-investment G/L formula and the formula for the total G/L. The problem specifies the cost method as Unit Credit, but it does not matter. The G/L calculations are the same for all individual cost methods.

$$\begin{aligned}\text{Non-inv G/L} &= {}_e\text{AL}_1 - \text{AL}_1 \\ \text{Total G/L} &= {}_e\text{UAL}_1 - \text{UAL}_1\end{aligned}$$

The valuation results at 01/01/09 are based on the old benefit formula and the old mortality assumption. The valuation results at 01/01/10 reflect both the new benefit formula and the new mortality assumption.

The calculations of the gain and loss must use the 01/01/10 accrued liability prior to the change in the benefit formula (and the mortality assumption). The reason is that the expected values from 01/01/09 do not reflect those changes.

The problem states there is a 10% increase in the active accrued liability due to the plan change. It implies there is no change in the non-active liability due to the plan change.

The change in mortality assumption increases the active and non-active accrued liability by different percentages. You need to derive the 01/01/10 accrued liability prior to these changes:

$$01/2010 \text{ AL}_1 = \text{Active AL} + \text{non-active AL}$$

$$\begin{aligned}\text{Old plan} \\ 01/2010 \text{ AL}_1 &= (\text{Active AL})/1.10 + \text{non-active AL}\end{aligned}$$

$$\begin{aligned}\text{Old plan / old assumption} \\ 01/2010 \text{ AL}_1 &= [(\text{Active AL})/1.10]/1.07 + [\text{non-active AL}/1.05] \\ &= [(2,050,000)/1.10]/1.07 + [250,000/1.05] \\ &= 1,741,716 + 238,095 \\ &= 1,979,811\end{aligned}$$

$$\begin{aligned}\text{UAL} &= \text{AL} - \text{AAV} \\ &= 1,979,811 - 1,600,000 \\ &= 379,811\end{aligned}$$

$$\begin{aligned}{}_e\text{UAL}_1 &= (1+i)(\text{NC}_0 + \text{UAL}_0) - (\text{contribution} + \text{interest}) \\ &= 1.08(850,000 + 150,000) - [1+(3/12)(.08)](950,000) \quad (\text{simple interest}) \\ &= 111,000\end{aligned}$$

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$$\begin{aligned}\text{Total Loss} &= 379,811 - 111,000 \\ &= 268,811\end{aligned}$$

Answer is A

NOTES:

1. In the calculation of the expected values, you must allow for a partial year's interest on the benefit payments and contributions. In the absence of anything specific in the problem, you can choose to use either simple interest, or compound interest. Both methods of solution will produce a numerical result within the same answer range.

$$\begin{aligned}{}_e\text{UAL}_1 &= (1+i)(\text{NC}_0 + \text{UAL}_0) - (\text{contribution} + \text{interest}) \\ &= 1.08(150,000 + 850,000) - (950,000)(1.08)^{3/12} && \text{(compound interest)} \\ &= 111,545\end{aligned}$$

$$\begin{aligned}\text{Total Loss} &= 379,811 - 111,545 \\ &= 268,266\end{aligned}$$

Answer is A

2. You may interpret the percentage increase values differently than I did. If you simply add them together (instead of compounding them), the increase in the active accrued liability is only 17%. But this leads to a loss that falls into the wrong answer range.

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Problem 57

Similar to 2008 #01

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:

$$\begin{aligned} \text{AAV} &= 1,000,000 + 300,000(1.05)^{-8/12} \\ &= 1,290,399 \end{aligned}$$

Simple interest:

$$\begin{aligned} \text{AAV} &= 1,000,000 + 300,000[1 + 5.0\% * (8/12)]^{-1} \\ &= 1,290,323 \end{aligned}$$

Answer is B

NOTE

There was one minor trick to this question. The contribution of 25,000 was paid at 07/01/09, which is before the 01/01/10 valuation date. It is already included in the market value of assets given in the problem.

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Problem 58 – Page 1

This is a typical §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 12/31/09	Smith
Retirement age	57
Past service	8 years
Participation	6 years

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 retirement benefit payable at age 57

Year	2006	2007	2008	2009
Pay	200,000	230,000	250,000	250,000
401(a)(17) limit	220,000	225,000	230,000	245,000
Limited pay	200,000	225,000	230,000	245,000

The high consecutive four years are 2006 through 2009:

$$\begin{aligned}\text{High 4 year average pay} &= (200,000 + 225,000 + 230,000 + 245,000) / 4 \\ &= 225,000\end{aligned}$$

$$\begin{aligned}\text{Accrued benefit} &= 225,000 * 7.5\% * 8 \\ &= 135,000\end{aligned}$$

$$\begin{aligned}\text{Smith's early ret benefit at 57} &= 135,000 * (v^5 \ddot{a}_{62}^{(12)} / \ddot{a}_{57}^{(12)}) \\ &= 135,000 * (1.06)^{-5} * (11.61 / 12.74) \\ &= 91,932\end{aligned}$$

One minor trick is that the plan has a normal retirement age of 62.

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:

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Year	2006	2007	2008	2009
Pay	200,000	230,000	250,000	250,000
401(a)(17) limit	220,000	225,000	230,000	245,000
Limited pay	200,000	225,000	230,000	245,000

$$\begin{aligned}\text{High 3 year average pay} &= (225,000 + 230,000 + 245,000) / 3 \\ &= 233,333\end{aligned}$$

$$\begin{aligned}\text{3 year comp §415 limit} &= 233,333(8/10) \\ &= 186,667\end{aligned}$$

Since Smith has less than 10 years of service, their 415 comp limit is reduced on a pro-rata basis.

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. Smith has 6 years of participation service:

$$\begin{aligned}\text{§415 dollar limit during 2009} &= 195,000 * (6/10) && \text{for ages 62-65} \\ &= 117,000\end{aligned}$$

§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)	$v^{62-X} (\ddot{a}_{62}^{(12)} / \ddot{a}_X^{(12)})$

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You are told that the plan's death benefit is 100% of the present value of the accrued benefit. That means there will be no forfeiture on death.

You should use the $\ddot{a}_{57}^{(12)}$ and $\ddot{a}_{62}^{(12)}$ factors to reduce the dollar limit prior to age 62 on the mandated basis. In this problem, you are given values of these annuities at both 5% and 6% interest.

Mandated basis reduction factor

$$\begin{aligned}\text{Actuarial reduction from 62 to 57} &= (1.05)^{-5} [\ddot{a}_{62}^{(12)} / \ddot{a}_{57}^{(12)}] \\ &= (1.05)^{-5} * (12.68/14.06) \\ &= .7066\end{aligned}$$

Plan basis reduction factor

The plan basis reduction factor is the same actuarial reduction factor calculated for the plan early retirement benefit:

$$\begin{aligned}\text{Plan basis reduction from 62 to 57} &= (1.06)^{-5} [\ddot{a}_{62}^{(12)} / \ddot{a}_{57}^{(12)}] \\ &= (1.06)^{-5} * (11.61/12.74) \\ &= .6810\end{aligned}$$

Final benefit determination

$$\begin{aligned}\$415 \text{ dollar limit at age 57} &= 117,000 * \text{lesser of } [.7066 \text{ or } .6810] \\ &= 79,674\end{aligned}$$

$$\begin{aligned}\text{Life annuity } \$415 \text{ limit at 57} &= \text{lesser of 3 year comp limit and dollar limit} \\ &= \text{lesser of } 186,667 \text{ and } 79,674 \\ &= 79,674\end{aligned}$$

$$\begin{aligned}\text{Final benefit payable at age 57} &= \text{lesser of plan benefit and 415 limit} \\ &= \text{lesser of } 91,932 \text{ and } 79,674 \\ &= 79,674\end{aligned}$$

Answer is B

(see notes on next page)

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Problem 58 – Page 4

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.

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

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Problem 59

This is an unusual problem - you rarely see an inspection problem on the EA exams.

The plan has unreduced retirement benefits after attainment of age 60 with 30 years of service. The question asks which set of retirement rates "is the most appropriate" for a participant who is age 58 with 27 years of service. They will become eligible for the unreduced retirement benefits at age 61 with 30 years of service.

The point of the question is that you would expect the participant to retire before age 65, and to take advantage of the unreduced retirement benefits at age 61. Only tables II and III attempt to reflect the expected higher rates of retirement after 30 years of service. I would not consider the other three tables to reflect the anticipated future retirement experience.

The difference between table II and table III is the age with the higher early retirement rates. It makes no sense to use table III, since the higher retirement rate is at age 60. The participant is not eligible for the unreduced retirement benefits until age 61, so this table does not reflect the anticipated future retirement experience.

The only reasonable choice for retirement rates is table II. For this table, the higher retirement rate is at age 61, which matches the age that the participant is eligible for the unreduced retirement benefits.

Answer is B

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