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FALL 2007 EA-2A EXAM SOLUTIONS

These solutions do NOT reflect changes
due to passage of WREDA (12/2008)

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Fall 2007 EA-2A Exam Solutions

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

These solutions do not reflect changes due to passage of WRERA (12/2008)

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 24, 2009	Corrected solution for problem 25
October 17, 2009	Corrected solution for problem 11, 35 and 37
September 6, 2009	Corrected solution for problem 16
August 24, 2009	Corrected solution for problems 11 and 14
August 9, 2009	Corrected solution for problem 2
July 21, 2009	Corrected solution for problems 3, 11, 17 and 42
October 28, 2008	Corrected solution for problem 17
October 26, 2008	Revised notes at end of solution for problem 6, corrected solution for problem 11
October 2, 2008	Revised solutions for problems 3, 11, 15, 19, 33 and 47
September 29, 2008	Revised solutions for problems 4, 8, 9, 14, 17, 22, 27, 32, 39, 40, 41, 43, 44, 45 and 49
August 13, 2008	Original solutions

NOTES on 2007 exam

The 2007 exam was unique, since PPA 2006 had never been tested before. The difficulty was similar to the 2006 exam, and easier than the pre-2006 exams. This means that you had to get a higher number of points correct to pass in 2007 than on most of the earlier exams:

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

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. 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.
4. 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).
5. 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 offset the CB and PB.

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

1. Calculate the normal cost plus limit adjustments with interest to the earlier of the end of the plan year or the end of the tax year.
2. Calculate the Full Funding Limitation under Section 404 with interest to the end of the plan year. If this is less than the result of step one, then you can skip to step four.
3. Calculate the absolute minimum amount necessary to produce a non-negative credit balance in the Minimum Funding Standard Account. This is the “smallest amount to satisfy the minimum funding standard” as defined in exam condition 35. This may be increased by the amount of any "includible employer contribution."
4. The maximum deductible limit is the greater of (1) and (3), but not greater than (2).
5. If the Unfunded Current Liability limit 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 – Page 1

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

The key to this problem is knowing how to calculate the minimum required contribution (MRC) under IRC Section 430. The missing information in the problem is the amount of the CB at 01/01/2008.

You need to calculate the amount of the funding shortfall. Then you can determine the amount of the CB at 01/01/2008.

Funding Shortfall

The funding shortfall is defined as the excess of the funding target over the 430(f)(4)(B) assets, which equals the actuarial value of assets less the prefunding balance and the carryover balance. All plans start with a zero prefunding balance in 2008.

$$\begin{aligned}\text{Funding S/F} &= \text{Funding target} - (\text{AAV} - \text{CB} - \text{PB}) \\ &= 1,400,000 - (1,140,000 - \text{CB} - 0) \\ &= 260,000 + \text{CB}\end{aligned}$$

Shortfall Base Exemption

You really don't need to check if this plan satisfies the shortfall base exemption. Based on the fact that you are given the shortfall amortization charge for 2008, you can assume that this plan does not satisfy the shortfall base exemption.

Shortfall amortization installment

In this problem, you are given the shortfall amortization installment, as well as the amortization factor for the shortfall amortization installment.

The new shortfall base is equal to the Funding shortfall minus the present value of prior years' shortfall amortization installments. 2008 was the first year under the new PPA funding rules, so there are no prior shortfall amortization installments. The 2008 shortfall base is equal to the Funding shortfall.

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Problem 1 – Page 2

The 2008 Funding shortfall base is equal to the present value of the current year's shortfall amortization installment:

$$\begin{aligned}\text{S/F Base} &= 45,000 * 5.9982 \\ &= 269,919\end{aligned}$$

$$\begin{aligned}\text{Funding S/F} &= 260,000 + \text{CB} \\ \text{CB} &= 9,919\end{aligned}$$

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.

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

$$\begin{aligned}\text{MRC} &= \text{TNC} + \text{Shortfall amort charge} + \text{Waiver amort charge} \\ &= 25,000 + 45,000 + 0 \\ &= 70,000\end{aligned}$$

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

$$\begin{aligned}\text{Smallest contr} &= \text{MRC} - \text{CB} - \text{PB} \\ &= 70,000 - 9,919 \\ &= 60,081\end{aligned}$$

Answer is B

NOTE

If you are curious, you could check to see if this plan satisfies the shortfall base exemption. As mentioned earlier, this plan apparently does not satisfy the shortfall base exemption.

I will define the “modified funding shortfall” as the modified funding target less the modified assets. If the “modified funding shortfall” is less than or equal to zero, then you would not have to set up the Shortfall base for 2008:

- Modified funding target: the applicable percentage times the funding target
- In the absence of any information to the contrary, you can assume the applicable percentage is 92%
- Modified assets: if the prefunding balance is used to reduce 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 1 – Page 3

NOTE - Continued

$$\begin{aligned}\text{Modified S/F} &= 92\% * (\text{Funding target}) - (\text{AAV} - 0) \\ &= .92 * 1,400,000 - 1,140,000 \\ &= 148,000\end{aligned}$$

Since the modified shortfall is greater than zero, the plan is not eligible for the shortfall base exemption.

If a plan is not eligible for the applicable percentage below 100%, you don't need to do any extra calculations for the Shortfall base exemption. Unless there is a huge carryover balance, the "modified funding shortfall" will be greater than zero.

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Problem 2

Revised 08/09/09

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

The key to this problem is knowing how to calculate the required minimum contribution under IRC Section 430. 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.

In this problem, you need to allow for the fact that the actual contribution is paid after the valuation date. It needs to be increased with interest at the effective interest rate for the period from the valuation date to the date of payment.

$$\begin{aligned}\text{MRC} &= \text{TNC} + \text{Shortfall amort charge} + \text{Waiver amort charge} \\ &= 38,000 + 33,500 + 0 \\ &= 71,500\end{aligned}$$

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

$$\begin{aligned}\text{Smallest contr} &= \text{MRC} - \text{CB} - \text{PB} \\ &= 71,500 - 7,550 \\ &= 63,950\end{aligned}$$

If the contribution was paid at 01/01/2008, the amount would be 63,950. Since X is paid at 09/15/2009, it will be greater. It has to be increased with interest at the effective rate for 20.5 months:

$$\begin{aligned}63,950 &= X \cdot (1.0580)^{-20.5/12} \\ X &= 63,950 \cdot (1.0580)^{20.5/12} \\ &= 70,416\end{aligned}$$

Answer is B

NOTE

In adjusting the contribution, you must allow for a partial year’s interest. 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:

$$\begin{aligned}X &= 63,950 \cdot [1 + (5.8\%)(20.5/12)] \\ &= 70,286\end{aligned}$$

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Problem 3 – Page 1

Revised 10/02/08

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

Deductible Limit

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

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

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

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

$$\begin{aligned}\text{Cushion amount} &= 50\%(1,000,000) + (1,200,000 - 1,000,000) \\ \text{Cushion amount} &= 500,000 + 200,000 \\ &= 700,000\end{aligned}$$

Now you can calculate the deductible limit:

Unit Credit normal cost	80,000
+ Funding target	1,000,000
+ Cushion amount	700,000
Sub-total	1,780,000
Less unreduced AAV	915,000
Deductible limit for 2008	865,000

Alternative Deductible Limit: At-Risk

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

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

I have added the descriptive term “Final” to the At-Risk items in this definition. The reason is due to exam condition 47. That condition states that the “At-Risk Funding target” and “At-Risk Target normal cost” given in the problem’s data refer to the values before applying the weighting factors shown in IRC 430(i)(5).

At-Risk Plan?

There is a complicated technique to determine whether a plan is in At-Risk status. This is based on valuation results for the prior year, which you are not given in this problem. The safest assumption is that this plan is not At-Risk for 2008.

Alternative Deductible Limit: At-Risk

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

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

At-Risk Target normal cost for IRC 404	80,000
At-Risk Funding target for IRC 404	1,500,000
Less unreduced AAV	915,000
Deductible limit at 01/01/08	665,000

This is less than the previously calculated deductible limit. The final deductible limit is 865,000.

Answer is C

NOTE:

The impact of the At-Risk calculations in this problem is fairly small. If you decided to apply the weighting factors shown in IRC 430(i)(5), you would still end up with a smaller value for the At-Risk definition of the deductible limit. The final deductible limit is still 865,000.

Problem 4 – Page 1**Revised 09/29/08**

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:

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

The sole participant is born 01/01/63, so their age is 45 at 01/01/08. Based on the default exam conditions, normal retirement age is 65.

Data as of	01/01/08
Age	45
Past service	15

The participant's annual accrued benefit is 30,000, calculated as $2,000 \times 15$. Based on the exam conditions, the benefit is assumed payable monthly, starting at normal retirement age.

At-Risk definition

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

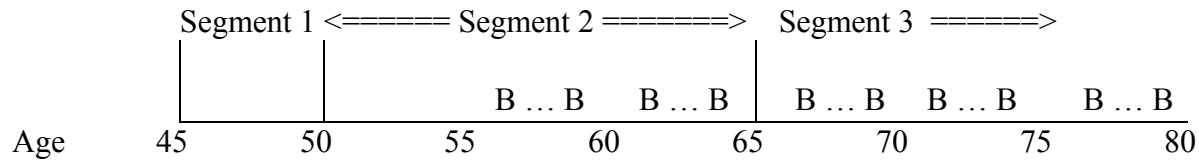
One key point of the problem is that the problem asks for the At-Risk Funding target (prior to the loading factors). The At-Risk Funding target is based on the assumption that all participants who become eligible for retirement within 11 years from the valuation date will retire at the earliest possible age (but not before the end of the current plan year). In addition, the Funding target and Target normal cost must be based on the most valuable benefit payment form (the one with the highest present value).

The participant will be eligible for unreduced retirement at age 55, since they will have 25 years of service at that point. The At-Risk Funding target is based on the 30,000 benefit, assumed payable at age 55.

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Problem 4 – Page 2

The participant is currently 10 years from retirement, so their benefit payments will be valued using the second and third segment rates:



Here is the formula for the At-Risk Funding target using monthly annuity rates, and no pre-retirement mortality:

$$\text{Age 45 PV} = 30,000 * [(1.06)^{-10} (\ddot{a}_{55:10|}^{(12)} \text{ at } 6.0\%) + (1.07)^{-10} ({}_{10|}\ddot{a}_{55}^{(12)} \text{ at } 7.0\%)]$$

Notice that the second annuity actually starts 20 years from the valuation date. For the first 10 years, the discount uses interest only. For the next 10 years, there is a discount for both interest and post-retirement mortality.

$$\begin{aligned} \ddot{a}_{55:10|}^{(12)} \text{ at } 6.0\% &= \ddot{a}_{55}^{(12)} \text{ at } 6.0\% - {}_{10|}\ddot{a}_{55}^{(12)} \text{ at } 6.0\% \\ &= [(\ddot{a}_{55} \text{ at } 6.0\% - \frac{11}{24}) - (D_{65} / D_{55} \text{ at } 6.0\%) * (\ddot{a}_{65} \text{ at } 6.0\% - \frac{11}{24})] \\ &= [(N_{55} / D_{55} \text{ at } 6.0\% - \frac{11}{24}) - (D_{65} / D_{55} \text{ at } 6.0\%) * \{N_{65} / D_{65} \text{ at } 6.0\% - \frac{11}{24}\}] \\ &= [(601,124 / 44,586) - \frac{11}{24}) - (23,980 / 44,586) * \{(265,833 / 23,980) - \frac{11}{24}\}] \\ &= 7.3083 \\ {}_{10|}\ddot{a}_{55}^{(12)} \text{ at } 7.0\% &= [(D_{65} / D_{55} \text{ at } 7.0\%) * (\ddot{a}_{65} \text{ at } 7.0\% - \frac{11}{24})] \\ &= [(D_{65} / D_{55} \text{ at } 7.0\%) * \{N_{65} / D_{65} \text{ at } 7.0\% - \frac{11}{24}\}] \\ &= [(20,568 / 42,007) * \{(223,488 / 20,568) - \frac{11}{24}\}] \\ &= 5.0958 \end{aligned}$$

$$\begin{aligned} \text{Age 45 PV} &= 30,000 * [(1.06)^{-10} (7.3083) + (1.07)^{-10} (5.0958)] \\ &= 30,000 * 6.6714 \\ &= 200,141 \end{aligned}$$

Answer is B

NOTES:

1. The easy way to miss this problem is to get confused about the handling of the segment interest rates, or the pre-retirement mortality. There is no mortality prior to age 55, but you do allow for mortality after age 55.
2. This is the first problem since 1999 where you had to know how to use commutation functions to generate annuity values.

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Problem 5 – Page 1

The key to this problem is knowing how to calculate the At-Risk value of the Funding target. You also need to know the definition of the Shortfall base under IRC 430.

At-Risk Plan?

There is a complicated technique to determine whether a plan is in At-Risk status. In this problem, you are told that the plan is At-Risk for 2008.

Calculation of At-Risk values

You can't calculate the value of the Funding shortfall yet. The reason is due to exam condition 47. That condition states that the "At-Risk Funding target" and "At-Risk Target normal cost" given in the problem's data refer to the values before applying the weighting factors shown in IRC 430(i)(5).

2008 is the first year that a plan could be in At-Risk status (no plan could be in At-Risk status prior to 2008). The "Final" At-Risk values will equal the sum of 20% times the At-Risk value and (1-20%) times the non-At-Risk value:

"Final" At-Risk values

$$\begin{aligned}\text{Funding Target} &= 20\%*(12,400,000) + 80\%*(12,000,000) \\ &= 12,080,000\end{aligned}$$

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. All plans start with a zero prefunding balance in 2008.

$$\begin{aligned}\text{Funding S/F} &= \text{Funding target} - (\text{AAV} - \text{CB} - \text{PB}) \\ &= 12,080,000 - (6,000,000 - 0 - 0) \\ &= 6,080,000\end{aligned}$$

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Problem 5 – Page 2

Shortfall Base Exemption

You should think about whether this plan satisfies the shortfall base exemption.

I will define the “modified funding shortfall” as the modified funding target less the modified assets. If the “modified funding shortfall” is less than or equal to zero, then you would not have to set up the Shortfall base for 2008:

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

$$\begin{aligned}\text{Modified S/F} &= 92\% * (\text{Funding target}) - (\text{AAV} - 0) \\ &= .92 * 12,080,000 - 6,000,000 \\ &= 5,113,600\end{aligned}$$

The “modified funding shortfall” is greater than zero. This plan does not meet the shortfall base exemption. The Shortfall amortization base for 2008 is equal to the Funding shortfall for 2008, which is 6,080,000.

Answer is B

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Problem 6 – Page 1

This problem asks for “the maximum possible funding standard carryover balance”. Based on exam conditions 30 and 31, the plan sponsor does elect to offset both the funding standard carryover balance (CB) and the prefunding balance (PB).

The key to this problem is knowing how to adjust the funding standard carryover balance from one year to the next. You also need to adjust the contribution to reflect payment after the valuation date.

You need to calculate the amount of the funding shortfall. Then you can determine the amount of the minimum required contribution (MRC) at 01/01/2008.

Funding Shortfall

The funding shortfall is defined as the excess of the funding target over the 430(f)(4)(B) assets, which equals the actuarial value of assets less the prefunding balance and the carryover balance. All plans start with a zero prefunding balance in 2008.

$$\begin{aligned}\text{Funding S/F} &= \text{Funding target} - (\text{AAV} - \text{CB} - \text{PB}) \\ &= 12,000,000 - (11,000,000 - 1,224,500 - 0) \\ &= 2,224,500\end{aligned}$$

Shortfall Base Exemption

You should check to see if this plan satisfies the shortfall base exemption.

I will define the “modified funding shortfall” as the modified funding target less the modified assets. If the “modified funding shortfall” is less than or equal to zero, then you would not have to set up the Shortfall base for 2008:

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

$$\begin{aligned}\text{Modified S/F} &= 92\% * (\text{Funding target}) - (\text{AAV} - 0) \\ &= .92 * 12,000,000 - 11,000,000 \\ &= 40,000\end{aligned}$$

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Problem 6 – Page 2

Shortfall amortization installment

This plan does not satisfy the shortfall base exemption, so you must set up the 2008 shortfall amortization base. In this problem, you are given the amortization factor for the shortfall amortization installment.

The new shortfall base is equal to the Funding shortfall minus the present value of prior years' shortfall amortization installments. 2008 was the first year under the new PPA funding rules, so there are no prior shortfall amortization installments. The 2008 shortfall base is equal to the Funding shortfall.

$$\begin{aligned}\text{S/F amort} &= 2,224,500 / 5.9982 \\ &= 370,861\end{aligned}$$

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.

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

$$\begin{aligned}\text{MRC} &= \text{TNC} + \text{Shortfall amort charge} + \text{Waiver amort charge} \\ &= 800,000 + 370,861 + 0 \\ &= 1,170,861\end{aligned}$$

Funding Standard Carryover Balance

You are told that the employer contributes 10,000 at 12/31/2008, and that the plan sponsor applies the minimum amount of the CB to meet the minimum funding standard.

You must discount the contribution back to the valuation date in order to compare it to the CB and the MRC. To adjust the contribution to the valuation date, you must use the effective rate of interest:

$$\begin{aligned}\text{PV of contrib} &= 10,000 * (1.057)^{-1} \\ &= 9,461\end{aligned}$$

$$\begin{aligned}\text{Remaining CB} &= 1,224,500 + 9,461 - 1,170,861 \\ &= 63,099\end{aligned}$$

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Problem 6 – Page 3

Revised 10/26/08

The final step is to adjust the 01/01/2008 CB forward to 01/01/2009. This adjustment is done using the actual rate of return on assets for 2008:

$$\begin{aligned} 01/2009 \text{ CB} &= 63,099 * (1.0489) \\ &= 66,185 \end{aligned}$$

Answer is C

NOTE

If a plan is not eligible for the applicable percentage below 100%, you don't need to do any extra calculations for the Shortfall base exemption. Unless there is a huge carryover balance, the "modified funding shortfall" will be greater than zero.

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Problem 7

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 12/31/08

Age	56
Service	5 years
Participation	5 years

PLAN BENEFIT

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

Year	Total Pay	Limited Pay
2008	280,000	230,000
2007	250,000	225,000
2006	170,000	170,000

$$\begin{aligned} \text{3 year final average pay} &= (230,000 + 225,000 + 170,000)/3 \\ &= 208,333 \end{aligned}$$

$$\begin{aligned} \text{Accrued benefit} &= 208,333 * 5 * 10\% \\ &= 104,167 \end{aligned}$$

415 COMP LIMIT

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

$$\begin{aligned} \text{\$415 compensation limit} &= 208,333 * (5/10) \\ &= 104,167 \end{aligned}$$

415 DOLLAR LIMIT

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

$$\begin{aligned} \text{\$415 dollar limit during 2008} &= 185,000 * (5/10) && \text{for ages 62-65} \\ &= 92,500 \end{aligned}$$

The 415 limit on a life annuity basis is the lesser of the compensation limit of 104,167 and the dollar limit of 92,500. The final plan benefit is limited to 92,500.

Answer is B

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Problem 8 – Page 1

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

You are told that the 2008 contribution was “the smallest amount that satisfies the minimum funding standard”. This means that both the CB and the PB are equal to zero at 01/01/2009.

Funding Shortfall

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

$$\begin{aligned}\text{Funding S/F} &= \text{Funding target} - (\text{AAV} - \text{CB} - \text{PB}) \\ &= 11,000,000 - (10,500,000 - 0 - 0) \\ &= 500,000\end{aligned}$$

Shortfall Base Exemption

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

Since the plan did set up a shortfall base for 2008, this plan is not eligible for the applicable percentage below 100%. Since the CB is zero, the “modified funding shortfall” will be greater than zero. This plan does not meet the shortfall base exemption.

Shortfall amortization installment

You must set up the 2009 shortfall amortization base. The new shortfall base is equal to the Funding shortfall minus the present value of prior years’ shortfall amortization installments:

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

You are given the amount of the shortfall amortization charge for 2008. The shortfall is amortized over 7 years from 2008, so there are 6 years left at 01/01/2009.

Unlike most other problems on the exam, you are not given the amortization factor. You should calculate the amortization factor based on the 1st and 2nd segment interest rates for 2009. They are both equal in this problem, which makes the calculation fairly simple.

$$\begin{aligned}\text{O/S S/F Amort} &= 185,000 * \ddot{a}_{\overline{6}|.06} \\ &= 964,287\end{aligned}$$

Problem 8 – Page 2**Revised 09/29/08**

$$\begin{aligned}\text{S/F Amort base} &= \text{Funding target} - (\text{O/S S/F Amort}) - (\text{AAV} - \text{CB} - \text{PB}) \\ &= 11,000,000 - 964,287 - (10,500,000 - 0 - 0) \\ &= -464,287\end{aligned}$$

The new Shortfall amortization installment is based on using 7 years at the 6% rate for 2009:

$$\begin{aligned}\text{S/F installment} &= -464,287 / \ddot{a}_{\overline{7}|.06} \\ &= -78,462\end{aligned}$$

Shortfall amortization charge

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

$$\begin{aligned}\text{S/F amort charge} &= 185,000 - 78,462 \\ &= 106,538\end{aligned}$$

Answer is C**NOTE**

On some of the exam problems, they give you the amortization factor for the shortfall amortization installments. On other problems such as this one, the interest rates are the same for the first two segments.

If the interest rates are different, there are several ways you can calculate the seven year annuity. Assume that j is the 1st segment rate, and k is the 2nd segment rate:

$$\begin{aligned}\ddot{a}_{\overline{7}|j \& k} &= \ddot{a}_{\overline{5}|j} + \ddot{a}_{\overline{7}|k} - \ddot{a}_{\overline{5}|k} \\ &= 1 + (1+j)^{-1} + (1+j)^{-2} + (1+j)^{-3} + (1+j)^{-4} + (1+k)^{-5} + (1+k)^{-6} \\ &= \ddot{a}_{\overline{5}|j} + (1+k)^{-5} + (1+k)^{-6}\end{aligned}$$

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Problem 9

Revised 09/29/08

Since this is a multiemployer plan, the gain / loss amortization base must be calculated. The key to this problem is knowing the non-investment G/L formula and the formula for the total G/L.

The problem does not specify the cost method, but it does not matter. The G/L calculations are the same for all individual cost methods.

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

$$\begin{aligned}01/2008 {}_e\text{AL}_1 &= (1+i)(\text{NC}_0 + \text{AL}_0) - (\text{actual benefit payments} + \text{interest}) \\ &= 1.07(100,000 + 550,000) - 1.035(35,000) \quad (\text{simple interest}) \\ &= 659,275\end{aligned}$$

$$\begin{aligned}\text{Non-inv Gain} &= {}_e\text{AL}_1 - \text{AL}_1 \\ &= 659,275 - 700,000\end{aligned}$$

$$\text{Non-inv Loss} = 40,725$$

$$\begin{aligned}{}_e\text{UAL}_1 &= (1+i)(\text{NC}_0 + \text{UAL}_0) - (\text{contribution} + \text{interest}) \\ &= 1.07(100,000 + 50,000) - [1 + (4/12)(.07)](100,000) \quad (\text{simple interest}) \\ &= 160,500 - 102,333 = 58,167\end{aligned}$$

$$\begin{aligned}\text{UAL} &= \text{AL} - \text{AAV} \\ &= 700,000 - 575,000 = 125,000\end{aligned}$$

$$\begin{aligned}\text{Total G/L} &= {}_e\text{UAL}_1 - \text{UAL}_1 \\ &= 58,167 - 125,000\end{aligned}$$

$$\text{Total Loss} = 66,833$$

$$\begin{aligned}\text{Inv Loss} &= \text{Total Loss} - \text{Non-inv Loss} \\ &= 66,833 - 40,725 = 26,108\end{aligned}$$

$$\begin{aligned}\text{Ratio} &= (\text{Inv Loss}) / (\text{Total Loss}) \\ &= 26,108 / 66,833 \\ &= 39.06\%\end{aligned}$$

Answer is D

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.
2. You could calculate the investment G/L directly using the formula for the expected AAV:
$${}_e\text{AAV}_1 = (1+i)(\text{AAV}_0) + (\text{contribution} + \text{interest}) - (\text{actual benefit payments} + \text{interest})$$

Fall 2007 EA-2A Exam Solutions

Problem 10 – Page 1

Similar to 2007 EA-2B #29

This is a typical §415 problem. The key point of the problem is the calculation of the optional form adjustment factor for the §415 limit.

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 01/01/08

Age	60
Service	7 years
Participation	6 years

PLAN BENEFIT

The plan benefit is not based on pay. The first step is to calculate the accrued benefit payable at age 62. Then apply the early retirement reduction for age 60.

$$\begin{aligned}\text{Accrued benefit} &= 12 * 9,250 \\ &= 111,000\end{aligned}$$

$$\begin{aligned}\text{Early ret benefit at 60} &= 111,000 * (1 - 4.55\%(62-60)) \\ &= 111,000 * (.9090) \\ &= 100,899\end{aligned}$$

415 COMP LIMIT

You need to apply the §401(a)(17) limit to each year of pay. But the participant's pay has never exceeded the 401(a)(17) limit.

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

$$\begin{aligned}\text{\$415 compensation limit} &= 150,000 * (7/10) \\ &= 105,000\end{aligned}$$

415 DOLLAR LIMIT

The third step is calculation of the §415 dollar limit under §415(b)(1)(A). The dollar limit is reduced when participation is less than ten years. Under EGTRRA, the dollar limit is available unreduced between ages 62 and 65:

$$\begin{aligned}\text{\$415 dollar limit during 2008} &= 185,000 * (6/10) && \text{for ages 62-65} \\ &= 111,000\end{aligned}$$

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Problem 10 – Page 2

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

The problem states that there is no forfeiture upon pre-retirement death. You should use the $v^2 (\ddot{a}_{62}^{(12)} / \ddot{a}_{60}^{(12)})$ factors to reduce the dollar limit prior to age 62 on the mandated basis.

$$\text{Actuarial reduction from 62 to 60} = v^2 (\ddot{a}_{62}^{(12)} / \ddot{a}_{60}^{(12)})$$

$$\begin{aligned} \text{Mandated basis 5.0\% "applicable"} &= (1.05)^{-2} (12.67978 / 13.25082) \\ &= .86794 \end{aligned}$$

Plan basis reduction factor

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

$$\begin{aligned} \text{Plan basis reduction} &= (\text{Plan benefit at 60}) / (\text{Plan benefit at 62}) \\ &= 100,899 / 111,000 \\ &= .9090 \end{aligned}$$

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Problem 10 – Page 3

$$\begin{aligned}\$415 \text{ dollar limit at age 60} &= 111,000 * \text{lesser of } [.86794 \text{ or } .9090] \\ &= 96,341\end{aligned}$$

$$\begin{aligned}\text{Final life annuity } \$415 \text{ limit at age 60} &= \text{lesser of } 100,899 \text{ and } 96,341 \\ &= 96,341\end{aligned}$$

Answer is B

NOTES:

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.

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Problem 10 – Page 4

NOTES - Continued

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

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

Problem 11 – Page 1

Similar to 2002 #21

Revised 10/17/09

The approved asset valuation methods in Section 3 of Revenue Procedure 2000-40 are:

- (11) Average value without phase-in
- (12) Average value with phase-in
- (15) Smoothed market value without phase-in
- (16) Smoothed market value with phase-in
- (17) Average value with alternative phase-in.

The plan can change to these asset valuation methods, and get automatic approval for the change in method. The 1.412(c)(2)-1 regulation describes the general requirements for an acceptable asset valuation method.

The Study Note (E2A-62-02) discusses the theory behind various methods, as well as variations which may be acceptable under the regulation, but which do not get automatic approval. If you change to one of these other methods, you would have to apply for approval under Revenue Procedure 2000-40.

Subsequent to PPA 2006, the only plans eligible for these asset valuation methods are multi-employer plans. For single employer plans, IRC 430(g)(3)(B) allows use of the average market value over not more than 24 months. The details of the calculations are in the proposed 430 regulations, which are not on the EA-2A exam syllabus.

For all of these methods, a corridor must be applied for the final actuarial value of assets. For multi-employer plans, the asset corridor is much wider than for single employer plans. The bottom of the corridor is the lesser of 80% of market value, or 85% of the average market value of assets. The top of the corridor is the greater of 120% of market value, or 115% of the average market value of assets.

(15) Smoothed market value without phase-in

This method is described in broad terms in Revenue Procedure 2000-40. The Study Note (E2A-62-02) gives a numerical example of the calculation on page 3-4. The basic idea is that you determine a gain or loss each year based on the expected value of assets versus the market value.

The actuarial value of assets is calculated using decreasing fractions of each of the prior year's gain or loss. With a two year average, the fraction is 1/2:

$$01/08 \text{ AAV} = 01/08 \text{ MVA} - 1/2(2007 \text{ G/L})$$

With a five year average, the fractions are 4/5, 3/5, 2/5 and 1/5:

$$01/08 \text{ AAV} = 01/08 \text{ MVA} - 4/5(2007 \text{ G/L}) - 3/5(2006 \text{ G/L}) - 2/5(2005 \text{ G/L}) - 1/5(2004 \text{ G/L})$$

These formulas are similar to those in Revenue Procedure 2000-40 and the AAV study note. They assume that gains are given as positive numbers, and losses are given as negative numbers.

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Problem 11 – Page 2

Revised 10/17/09

Smoothed market value - 5 years, without phase-in

Year	2003	2004	2005	2006	2007
Gain (loss)	500,000	(50,000)	(200,000)	(50,000)	200,000
Fraction	-	0.20	0.40	0.60	0.80
Unrecognized portion	-	(10,000)	(80,000)	(30,000)	160,000

The preliminary actuarial value of assets is the final market value at 1-1-2008 minus the total unrecognized portion of the G/L:

$$4,960,000 = 5,000,000 - (-10,000 - 80,000 - 30,000 + 160,000)$$

This preliminary AAV must be compared to the corridors. In the 1.412(c)(2)-1 regulation, it does not define the number of years to calculate the average market value. It only says the number of years can't exceed five. For this problem, I will assume the same number of years as is defined for the asset valuation method.

In the calculation of the AAV above, asset gains are treated as positive numbers, and asset losses are treated as negative numbers. This does not match the signs for the asset gains and losses given in the problem.

One trick to the problem is that the average market value of assets is equal to the preliminary AAV of 4,960,000. This is based on the analysis in the study note on Asset Valuation Methods, which shows there are two different calculation methods, each of which produces the same result.

The bottom of the corridor is the lesser of 80% of market value, or 85% of the average market value of assets:

$$\begin{aligned}\text{Bottom} &= \text{Lesser of } 80\%(5,000,000) \text{ or } 85\%(4,960,000) \\ &= 4,000,000\end{aligned}$$

The top of the corridor is the greater of 120% of market value, or 115% of the average market value of assets.

$$\begin{aligned}\text{Top} &= \text{Greater of } 120\%(5,000,000) \text{ or } 115\%(4,960,000) \\ &= 6,000,000\end{aligned}$$

The final actuarial value of assets is 4,960,000.

Smoothed market value - 2 years, without phase-in

Year	2007
Gain (loss)	200,000
Fraction	0.50
Unrecognized portion	100,000

The preliminary actuarial value of assets is the final market value at 1-1-2008 minus the total unrecognized portion of the G/L:

$$4,900,000 = 5,000,000 - (100,000)$$

This preliminary AAV must be compared to the corridors. Based on the prior calculations, it should be clear that the final actuarial value of assets is not affected by the corridors.

The difference in the AAV due to the method change is $60,000 = 4,960,000 - 4,900,000$.

Answer is C

NOTES

1. In the calculation of the AAV above, asset gains are treated as positive numbers, and asset losses are treated as negative numbers. This does not match the signs for the asset gains and losses given in the problem.
2. This problem was simpler than similar problems on earlier EA-2A exams. In prior exam problems, you had to determine the expected market value (and the gain or loss) each year.

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Problem 12

In IRC 430(g)(2)(A), it does say the valuation date should be the first day of the plan year, in general.

In IRC 430(g)(2)(B), there is an exception for small plans that allows them to have a valuation date. A small plan is defined as any plan with less than 101 participants on each day of the prior plan year.

Answer is B

Fall 2007 EA-2A Exam Solutions

Problem 13 – Page 1

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

The key to this problem is knowing how to calculate the minimum required contribution (MRC) under IRC Section 430. You need to calculate the amount of the funding shortfall. Then you can determine the amount of the MRC at 01/01/2008, as well as the “smallest amount”.

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. All plans start with a zero prefunding balance in 2008.

$$\begin{aligned}\text{Funding S/F} &= \text{Funding target} - (\text{AAV} - \text{CB} - \text{PB}) \\ &= 10,000,000 - (9,800,000 - 500,000 - 0) \\ &= 700,000\end{aligned}$$

Shortfall Base Exemption

You should check to see if this plan satisfies the shortfall base exemption.

I will define the “modified funding shortfall” as the modified funding target less the modified assets. If the “modified funding shortfall” is less than or equal to zero, then you would not have to set up the Shortfall base for 2008:

- Modified funding target: the applicable percentage times the funding target
- This plan had a 412(l) additional funding charge (AFC) for 2007. The plan is not eligible for the reduced applicable percentage, so that value is equal to 100%
- Modified assets: if the prefunding balance is used to reduce the minimum required contribution, the modified assets equal AAV - PB. Otherwise, the modified assets equal the AAV with no reduction.

$$\begin{aligned}\text{Modified S/F} &= 100\% * (\text{Funding target}) - (\text{AAV} - 0) \\ &= 1.0 * 10,000,000 - 9,800,000 \\ &= 200,000\end{aligned}$$

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Problem 13 – Page 2

Shortfall amortization installment

This plan does not satisfy the shortfall base exemption, so you must set up the 2008 shortfall amortization base. In this problem, you are given the shortfall amortization installment, as well as the amortization factor for the shortfall amortization installment.

The new shortfall base is equal to the Funding shortfall minus the present value of prior years' shortfall amortization installments. 2008 was the first year under the new PPA funding rules, so there are no prior shortfall amortization installments. The 2008 shortfall base is equal to the Funding shortfall.

The 2008 shortfall amortization installment is equal to the Funding shortfall base divided by the amortization factor given in the problem:

$$\begin{aligned}\text{S/F Base} &= 700,000 \\ \text{S/F Amort} &= 700,000 / 5.9982 \\ &= 116,702\end{aligned}$$

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.

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

$$\begin{aligned}\text{MRC} &= \text{TNC} + \text{Shortfall amort charge} + \text{Waiver amort charge} \\ &= 2,000,000 + 116,702 + 0 \\ &= 2,116,702\end{aligned}$$

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

$$\begin{aligned}\text{Smallest contr} &= \text{MRC} - \text{CB} - \text{PB} \\ &= 2,116,702 - 500,000 - 0 \\ &= 1,616,702\end{aligned}$$

Answer is C

NOTE

If a plan is not eligible for the applicable percentage below 100%, you don't need to do any extra calculations for the Shortfall base exemption. Unless there is a huge carryover balance, the “modified funding shortfall” will be greater than zero.

Fall 2007 EA-2A Exam Solutions

Problem 14 – Page 1

Similar to 2006 #11

Revised 09/29/08

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 PUC accrued liability at 01/01/2008. Under PUC, the accrued liability is defined as the present value of the “funding accrued benefit” (FAB):

$$AL = PV(FAB)$$

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.

Retired AL = PV of Early retirement benefit

Active AL = PV of FAB

Retired calculations

01/2008 Age 59

Past service 17

2007 pay (age 58) 63,000

01/2008 Final average pay $(63,000 + 62,000 + 60,000) / 3$
 $= 61,667$

Accrued benefit $1.0\%(17)(\text{Final average pay})$
 $1.0\%(17)(61,667) = 10,483$

Early retirement factor @ 59 $1 - 4*4\% - 2*6\% = .72$

Early retirement benefit $.72(10,483)$
 $= 7,548$

Retired AL $7,548 \ddot{a}_{59}^{(12)}$
 $= 7,548 * 11.26$
 $= 84,990$

Fall 2007 EA-2A Exam Solutions

Problem 15 – Page 1

Similar to 2005 #8

Revised 10/02/08

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 and the Plan change base.

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.

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

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

Now you need to calculate the amortization payments at the old 7.5% interest rate:

Base Description	Remaining Years 01/01/08	Outstanding 7.5%base at 01/01/08	7.5% amortization at 01/01/08
Plan chg base	29	377,201	$377,201 / \ddot{a}_{29 .075} = 30,000$
Gain base	14	-547,550	$-547,550 / \ddot{a}_{14 .075} = -60,000$
1-1-2008 Loss base	15	100,000	$100,000 / \ddot{a}_{15 .075} = 10,538$

Now you can set up the Minimum Funding Standard Account (MFSA) for 2008 using the old 7.5% interest rate:

2008 Minimum Funding Standard Account - 7.5%

Charges		Credits	
Normal Cost	NC	Credit Balance	0
Plan chg amortization	30,000	Gain amortization	60,000
Loss amortization	10,538	01/01/08 minimum	x
Total charges	NC + 40,538	Total credits	x + 60,000

The MFSA is set up with no interest to simplify the solution. The problem specifies that the contribution will be paid at 01/01/2008.

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Problem 15 – Page 2

Revised 10/02/08

“The smallest amount that satisfies the minimum funding standard” is equal to the excess of the MFSA charges over the credits at 01/01/08:

$$7.5\% \text{ smallest amount} = \text{NC} - 19,462$$

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 01/01/08	Outstanding 7.0%base at 01/01/08	7.0% amortization at 01/01/08
Plan chg base	29	377,201	$377,201 / \ddot{a}_{29 .07} = 28,713$
Gain base	14	-547,550	$-547,550 / \ddot{a}_{14 .07} = -58,514$
1-1-2008 Loss base	15	100,000	$100,000 / \ddot{a}_{15 .07} = 10,261$
1-1-2008 Assump base	15	190,000	$190,000 / \ddot{a}_{15 .07} = 19,496$

Now you can set up the Minimum Funding Standard Account (MFSA) for 2008 using the old 7.5% interest rate:

2008 Minimum Funding Standard Account - 7.0%			
Charges		Credits	
Normal Cost	NC + 20,000	Credit Balance	0
Assump amortization	19,496		
Plan chg amortization	28,713	Gain amortization	58,514
Loss amortization	10,261	01/01/08 minimum	x
Total charges	NC + 78,470	Total credits	x + 58,514

“The smallest amount that satisfies the minimum funding standard” is equal to the excess of the MFSA charges over the credits at 01/01/08.

$$7\% \text{ smallest amount} = \text{NC} + 19,956$$

The absolute value of the difference is $39,418 = \text{NC} + 19,956 - (\text{NC} - 19,462)$.

Answer is B

NOTE

You need to be extra careful when setting up the normal cost in the MFSA. It is too easy to forget the 20,000 increase due to the change in interest rate.

Problem 16

Revised 09/06/09

This problem is a simple one on minimum funding requirements for multiemployer plans.

ASSERTION

This is false. Multiemployer plans are not subject to the same valuation assumption requirements as single employer plans. See IRC 431(b)(6) and 430(h)(2).

REASON

This is true. This description of assumptions for multiemployer plans mirrors the language in IRC 431(c)(3)(A) and (B).

Answer is D

Fall 2007 EA-2A Exam Solutions

Problem 17 – Page 1

In some §404 problems, the hardest thing to get straight is which valuation corresponds to which tax year. Usually you are only given one set of valuation results, which is based on the correct valuation date.

The first step should be to calculate the normal cost plus limit adjustments. The ten year amortization bases include the initial accrued liability. The deductible limit is the normal cost plus limit adjustments brought forward with interest to the earlier of the end of the plan year, or the end of the tax year, which is 12/31/07.

Based on the information given in the problem, the §431 normal cost and PVNC both equal the §404 values. Based on the general exam conditions, you can assume that all prior contributions have been deducted, so the assets and unfunded accrued liability values are the same under both §404 and §431. Based on exam condition #27, the §431 values are given in exam problems.

You should use the §431 equation of balance to solve for the Initial Accrued Liability. The plan was set up in 2005, which is 2 years before 2007. There are 28 years remaining in the amortization base under §431:

$$01-01-07 \text{ UAL} = \text{O/S } 431 \text{ bases} - \text{CB} - \text{ARA}$$

$$800,000 = \text{IAL} * (\ddot{a}_{\overline{28}|.07} / \ddot{a}_{\overline{30}|.07}) - 0 - 0$$

$$\text{IAL} = 817,924$$

$$\begin{aligned} \text{Limit adjustment} &= 817,924 / \ddot{a}_{\overline{10}|.07} \\ &= 108,835 \end{aligned}$$

$$\begin{aligned} \text{Deductible limit} &= (200,000 + 108,835) * [1.07] \\ &= 330,454 \end{aligned}$$

The second step is to check the Full Funding Limitation under 404:

$$\begin{aligned} \text{\$404 "ERISA" FFL} &= (1+i)*(EANC + EAN AL) - (1+i)*(\text{lesser MVA, AAV}) \\ &= 1.07*(100,000 + 1,000,000 - 450,000) \\ &= 695,500 \end{aligned}$$

$$\begin{aligned} \text{\$404 "RPA 94" FFL} &= .90 (12/31 \text{ CL}) - (1+i)*(AAV) && \text{(if no benefit payments)} \\ &= .90*(1.06)*(200,000 + 540,000) - 1.07*(500,000) \\ &= 170,960 \end{aligned}$$

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Revised 10/28/08

The final 404 FFL is the greater of the two values, or 695,500. The 404 FFL does not apply, and the deductible limit remains 330,454.

The third step would be to calculate “the smallest amount that satisfies the minimum funding standard” under §431. There is only one amortization base for the IAL, which will be amortized over 30 years under §431. The 431 minimum contribution will be less than 330,454.

The main point of the problem is that you should calculate the §404 unfunded current liability (UCL). There are no specific details of how to calculate this value in §404, but it is generally done on an end of year basis.

You need to follow the same logic as used above for the §404 FFL. One key to the solution is that multiemployer plans use 140% of the current liability in the calculation:

$$\begin{aligned}\text{\$404 "RPA 94" UCL} &= 140\%*(12/31 \text{ CL}) - (1+i)*(AAV) && \text{(if no benefit payments)} \\ &= (1.40)*(1.06)*(200,000 + 540,000) - 1.07*(500,000) \\ &= 563,160\end{aligned}$$

The 404 UCL produces the final result for the deductible limit, since it exceeds the previously calculated value of 330,454.

The excise tax is 10% of the non-deductible contribution. Based on the usual definitions, the excise tax would be calculated as follows:

$$\begin{aligned}\text{Excise tax} &= 10\%*(900,000 - 563,160) \\ &= 33,684\end{aligned}$$

Unfortunately, that calculation produces the wrong answer. The official answer is based on the assumption that the employer elected the alternate excise tax definition under 4972(c)(7):

“4972(c)(7) Defined benefit plan exception

In determining the amount of nondeductible contributions for any taxable year, an employer may elect for such year not to take into account any contributions to a defined benefit plan except, in the case of a multiemployer plan, to the extent that such contributions exceed the full-funding limitation (as defined in section 431(c)(6))... For purposes of this paragraph, the deductible limits under section 404(a)(7) shall first be applied to amounts contributed to defined contribution plans and then to amounts described in this paragraph. If an employer makes an election under this paragraph for a taxable year, paragraph (6) shall not apply to such employer for such taxable year.”

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Problem 17 – Page 3

Revised 07/21/09

A key aspect of this problem is that there are two excise tax exemptions available in IRC 4972(c). Under PPA 2006, multiemployer plans are not subject to the deduction limits in IRC 404(a)(7). That means they are not eligible for the excise tax exemption under 4972(c)(6).

The only excise tax exemption for multiemployer plans is that under 4972(c)(7). You should determine the amount of contributions subject to the excise tax as those contributions that exceed the 404 Full Funding Limitation calculated previously:

Contributions not subject to excise tax: 695,500 FFL

$$\begin{aligned}\text{Excise tax} &= 10\% \times (900,000 - 695,500) \\ &= 20,450\end{aligned}$$

Answer is A

NOTES:

1. The date that the 900,000 contribution is paid does not affect the final answer. As described in the 1.404(a)-14 regulation, you can contribute the full amount of the deductible limit at any time during the plan year.
2. The IRC 4972 excise tax exemptions for single employer plans are far more complicated. The default is defined under 4972(c)(6), and there is another alternative defined under 4972(c)(7).

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Problem 18 – Page 1

The key to this problem is knowing how to calculate the Funding target, Target normal cost and the Shortfall amortization base at 01/01/2008 under IRC Section 430. The plan had a 5,000 funding standard carryover balance (CB) at 01/01/2008. All plans start with a zero prefunding balance (PB) in 2008.

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

The problem tells you that the plan sponsor does not elect to offset both the CB and the PB against the minimum contribution under IRC 430. This overrides exam conditions 30 and 31, and is consistent with the fact that the problem asks you to calculate the “minimum required contribution”.

Valuation calculations

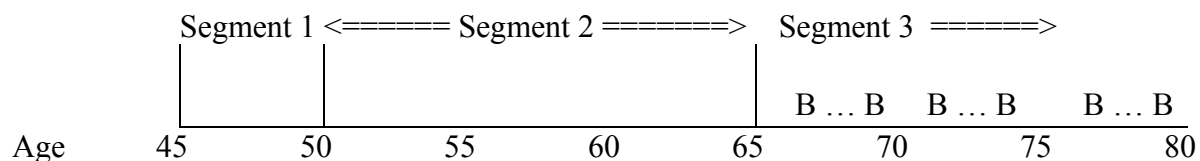
You need to calculate both the Funding target and the Target normal cost at 01/01/2008. These items are the Unit Credit accrued liability and the Unit Credit normal cost, respectively.

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

Valuation date	01/01/2008	01/01/2009
Age	45	46
Past service	15	16
Valuation pay	100,000	100,000*1.05
Accrued benefit	2%(15)(100,000) = 30,000	2%(16)(105,000) = 33,600

$$\Delta AB = 3,600$$

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



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Problem 18 – Page 2

$$\begin{aligned}AL &= \text{PV of AB} \\&= 30,000(D_{65} / D_{45}) \ddot{a}_{65}^{(12)} \\&= 30,000(1+i)^{-20}({}_{20}p_{45}) \ddot{a}_{65}^{(12)} \\&= 30,000(1.07)^{-20}(8.0) \\&= 62,021 = \text{Funding target}\end{aligned}$$

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.

$$\begin{aligned}NC &= \text{PV of } (\Delta AB) \\&= 3,600(D_{65} / D_{45}) \ddot{a}_{65}^{(12)} \\&= 3,600(1.07)^{-20}(8.0) \\&= 7,442 = \text{Target normal cost}\end{aligned}$$

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.

$$\begin{aligned}\text{Funding S/F} &= \text{Funding target} - (\text{AAV} - \text{CB} - \text{PB}) \\&= 62,021 - (60,000 - 5,000 - 0) \\&= 7,021\end{aligned}$$

Shortfall Base Exemption

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

- Modified funding target: the applicable percentage times the funding target
- In the absence of any information to the contrary, you can assume the applicable percentage is 92%
- Modified assets: if the prefunding balance is used to reduce 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 18 – Page 3

$$\begin{aligned}\text{Modified S/F} &= 92\% * (\text{Funding target}) - (\text{AAV} - 0) \\ &= .92 * 62,021 - 60,000 \\ &= -2,941\end{aligned}$$

Shortfall amortization installment

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

Minimum Required Contribution

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

$$\begin{aligned}\text{MRC} &= \text{TNC} + \text{Shortfall amort charge} + \text{Waiver amort charge} \\ &= 7,442 + 0 + 0 \\ &= 7,442\end{aligned}$$

Answer is B

NOTE

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

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

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

Problem 19 – Page 1

Revised 10/02/08

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

At-Risk Plan?

There is a complicated technique to determine whether a plan is in At-Risk status. Since this plan has less than 500 participants, the plan can not be in At-Risk status for 2008.

Deductible Limit

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

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

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

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

Valuation calculations

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

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

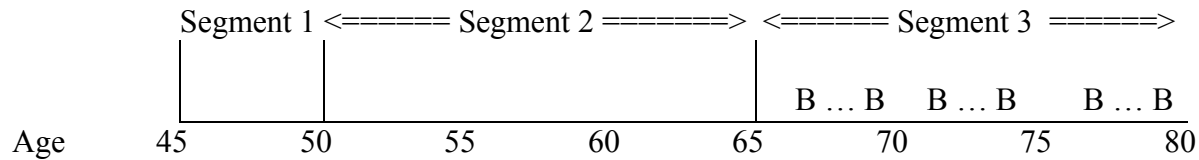
Valuation date	01/01/2008	01/01/2009
Age	45	46
Past service	15	16
Valuation pay	60,000	60,000*1.05
Accrued benefit	2%(15)(60,000) = 18,000	2%(16)(63,000) = 20,160

$$\Delta AB = 2,160$$

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Problem 19 – Page 2

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



$$\begin{aligned}\text{UC AL} &= \text{PV of AB} \\ &= 18,000(D_{65} / D_{45}) \ddot{a}_{65}^{(12)} \\ &= 18,000(1+i)^{-20}({}_{20}p_{45}) \ddot{a}_{65}^{(12)} \\ &= 18,000(1.07)^{-20}(8.0) \\ &= 37,212 = \text{Funding target}\end{aligned}$$

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.

$$\begin{aligned}\text{UC NC} &= \text{PV of } (\Delta \text{ AB}) \\ &= 2,160(D_{65} / D_{45}) \ddot{a}_{65}^{(12)} \\ &= 2,160(1.07)^{-20}(8.0) \\ &= 4,465 = \text{Target normal cost}\end{aligned}$$

Projected Unit Credit calculations

You also need to determine the Projected Unit Credit accrued liability at 01/01/2008. Under PUC, the accrued liability is defined as the present value of the “funding accrued benefit” (FAB):

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

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

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

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Problem 19 – Page 3

Revised 10/02/08

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.

$$\begin{aligned}\text{Age 44 pay} & 60,000 \\ \text{Funding Accrued benefit} & 2\%(15)(\text{Final pay}) \\ & 2\%(15)(60,000)(1.05)^{20} \\ & = 47,759\end{aligned}$$

$$\begin{aligned}\text{PUC AL} & 47,759(D_{65} / D_{45}) \ddot{a}_{65}^{(12)} \\ & 47,759(1.07)^{-20}(8.0) \\ & = 98,735\end{aligned}$$

Deductible Limit Calculations

Now that you have the PUC accrued liability, you can determine the cushion amount and the deductible limit:

$$\begin{aligned}\text{Cushion amount} & = 50\%(37,212) + (98,735 - 37,212) \\ \text{Cushion amount} & = 18,606 + 61,523 \\ & = 80,129\end{aligned}$$

Now you can calculate the deductible limit:

Target normal cost	4,465
+ Funding target	37,212
+ Cushion amount	80,129
Sub-total	<hr/> 121,806
Less unreduced AAV	<hr/> 40,000
Deductible limit for 2008	<hr/> 81,806

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

Based on the information given in this problem, there is no difference between the At-Risk values and the given values of the Funding Target and the Target normal cost.

Problem 19 – Page 4**Revised 10/02/08**

There is no impact due to the additional retirement assumptions under 430(i)(1)(B). The reason is that there is no early retirement benefit, and you are not given any optional forms of benefit payment.

The only other component of the At-Risk values is the load factors. Since the plan is treated as At-Risk for only one year, the load factors do not apply at all.

There is no difference between the non At-Risk values and the At-Risk values. You don't need to do any additional calculations. Just in case you're not 100% sure, here is the deductible limit under the At-Risk definition:

$$\begin{aligned}\text{Deduct. amount} &= 4,465 + 37,212 - 40,000 \\ &= 1,677\end{aligned}$$

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:

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

In this problem the Funding shortfall for 2008 is zero, since the AAV exceeds the funding target:

$$\begin{aligned}\text{Funding S/F} &= \text{Funding target} - (\text{AAV} - \text{CB} - \text{PB}) \\ &= 37,212 - (40,000 - 1,000 - 0) \\ &= (\text{limited to zero})\end{aligned}$$

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

$$\begin{aligned}\text{ALT MRC} &= \text{TNC} + \text{Funding target} - (\text{AAV} - \text{CB} - \text{PB}) \\ &= 4,465 + 37,212 - (40,000 - 1,000 - 0)\end{aligned}$$

This amount is clearly less than the previously calculated deductible limit of 81,806.

Answer is D

Fall 2007 EA-2A Exam Solutions

Problem 20 – Page 1

The key to this problem is knowing how to calculate the Funding target, Target normal cost and the Shortfall amortization base at 01/01/2008 under IRC Section 430. The plan had a 1,000 funding standard carryover balance (CB) at 01/01/2008. All plans start with a zero prefunding balance (PB) in 2008.

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

The problem tells you that the plan sponsor does not elect to offset both the CB and the PB against the minimum contribution under IRC 430. This overrides exam conditions 30 and 31, and is consistent with the fact that the problem asks you to calculate the “minimum required contribution”.

Valuation calculations

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

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

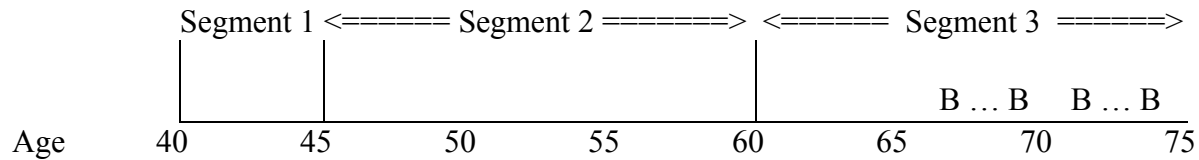
Valuation date	01/01/2008	01/01/2009
Age	40	41
Past service	11	12
Valuation pay	80,000	80,000*1.05
Accrued benefit	2%(11)(80,000) = 17,600	2%(12)(84,000) = 20,160

$$\Delta AB = 2,560$$

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Problem 20 – Page 2

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



$$\begin{aligned}\text{UC AL} &= \text{PV of AB} \\ &= 17,600(D_{65} / D_{40}) \ddot{a}_{65}^{(12)} \\ &= 17,600(1+i)^{-25}({}_{25}p_{40}) \ddot{a}_{65}^{(12)} \\ &= 17,600(1.07)^{-25}(8.0) \\ &= 25,942 = \text{Funding target}\end{aligned}$$

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.

$$\begin{aligned}\text{UC NC} &= \text{PV of } (\Delta \text{ AB}) \\ &= 2,560(D_{65} / D_{40}) \ddot{a}_{65}^{(12)} \\ &= 2,560(1.07)^{-25}(8.0) \\ &= 3,773 = \text{Target normal cost}\end{aligned}$$

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:

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

In this problem the Funding shortfall for 2008 is zero, since the AAV exceeds the funding target:

$$\begin{aligned}\text{Funding S/F} &= \text{Funding target} - (\text{AAV} - \text{CB} - \text{PB}) \\ &= 25,942 - (28,000 - 1,000 - 0) \\ &= (\text{limited to zero})\end{aligned}$$

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Problem 20 – Page 3

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

$$\begin{aligned}\text{ALT MRC} &= \text{TNC} + \text{Funding target} - (\text{AAV} - \text{CB} - \text{PB}) \\ &= 3,773 + 25,942 - (28,000 - 1,000 - 0) \\ &= 2,715\end{aligned}$$

Answer is B

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Problem 21 – Page 1

This problem asks for the amount by which the contribution of 200,000 exceeds “the smallest amount that satisfies the minimum funding standard”. Based on exam condition 35, this “smallest amount” is calculated by offsetting both the funding standard carryover balance (CB) and the prefunding balance (PB) against the minimum contribution under IRC 430. Based on exam conditions 30 and 31, the plan sponsor does elect to offset both the CB and the PB.

The key to this problem is knowing how to adjust the contribution to reflect payment after the valuation date. You need to calculate the amount of the funding shortfall. Then you can determine the amount of the minimum required contribution (MRC) at 01/01/2008.

Funding Shortfall

The funding shortfall is defined as the excess of the funding target over the 430(f)(4)(B) assets, which equals the actuarial value of assets less the prefunding balance and the carryover balance. All plans start with a zero prefunding balance in 2008.

$$\begin{aligned}\text{Funding S/F} &= \text{Funding target} - (\text{AAV} - \text{CB} - \text{PB}) \\ &= 1,000,000 - (900,000 - 10,000 - 0) \\ &= 110,000\end{aligned}$$

Shortfall Base Exemption

You should check to see if this plan satisfies the shortfall base exemption.

I will define the “modified funding shortfall” as the modified funding target less the modified assets. If the “modified funding shortfall” is less than or equal to zero, then you would not have to set up the Shortfall base for 2008:

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

$$\begin{aligned}\text{Modified S/F} &= 92\% * (\text{Funding target}) - (\text{AAV} - 0) \\ &= .92 * 1,000,000 - 900,000 \\ &= 20,000\end{aligned}$$

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Problem 21 – Page 2

Shortfall amortization installment

This plan does not satisfy the shortfall base exemption, so you must set up the 2008 shortfall amortization base. In this problem, you are given the amortization factor for the shortfall amortization installment.

The new shortfall base is equal to the Funding shortfall minus the present value of prior years' shortfall amortization installments. 2008 was the first year under the new PPA funding rules, so there are no prior shortfall amortization installments. The 2008 shortfall base is equal to the Funding shortfall.

$$\begin{aligned}\text{S/F amort} &= 110,000 / 5.9982 \\ &= 18,339\end{aligned}$$

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.

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

$$\begin{aligned}\text{MRC} &= \text{TNC} + \text{Shortfall amort charge} + \text{Waiver amort charge} \\ &= 100,000 + 18,339 + 0 \\ &= 118,339\end{aligned}$$

Funding Standard Carryover Balance

You are told that the employer contributes 200,000 at 12/31/2008, and that the plan sponsor applies the entire CB to meet the minimum funding standard.

$$\begin{aligned}\text{MRC} - \text{CB} &= 118,339 - 10,000 \\ &= 108,339\end{aligned}$$

You must discount the actual contribution back to the valuation date in order to compare it to the CB and the MRC. To adjust the contribution to the valuation date, you must use the effective rate of interest:

$$\begin{aligned}\text{PV of contrib} &= 200,000 * (1.0575)^{-1} \\ &= 189,125\end{aligned}$$

$$\begin{aligned}01/01/08 \text{ X} &= 189,125 - 108,339 \\ &= 80,786\end{aligned}$$

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Problem 21 – Page 3

This problem asks for the amount at 12/31/08 by which the contribution of 200,000 exceeds “the smallest amount that satisfies the minimum funding standard”. You should use the effective rate of interest to adjust the value of X from the valuation date to 12/31/08:

$$\begin{aligned} 12/31/08 \text{ X} &= 80,786(1.0575) \\ &= 85,432 \end{aligned}$$

Answer is C

NOTES:

1. The actual return on plan assets of 15% is extraneous information in this problem.
2. You could have simply done the calculation at 12/31/08. Just be careful that you use the effective rate of interest to adjust the “smallest amount” to 12/31/08.

$$\begin{aligned} \text{MRC} - \text{CB} &= 118,339 - 10,000 \\ &= 108,339 \end{aligned}$$

$$\begin{aligned} 12/31 \text{ value} &= 108,339(1.0575) \\ &= 114,568 \end{aligned}$$

$$\begin{aligned} 12/31/08 \text{ X} &= 200,000 - 114,568 \\ &= 85,432 \end{aligned}$$

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Problem 22

Revised 09/29/08

The key to this problem is knowing the definition for a plan to be in At-Risk status. One part of the definition is that a plan must have at least 501 participants for one day of the prior plan year.

The second part of the definition is based on values of the Funding target attainment percentage (FTAP) for the prior year. A plan is At-Risk for a year if

1. The FTAP for the prior year (on a non-At-Risk basis) is less than 80%, and
2. The FTAP for the prior year (using 430(i)(1)(B) assumptions) is less than 70%

There is a transition rule which reduces the 80% for years prior to 2011. For 2009, the first threshold is reduced to 70%:

1. The FTAP for the 2008 year (on a non-At-Risk basis) is less than 70%, and
2. The FTAP for the 2008 year (using the 430(i)(1)(B) assumptions) is less than 70%

The problem does not give you the data to calculate the 2008 FTAP on a non-At-Risk basis.

Based on the At-Risk values given, you can determine that the FTAP for the 2008 year (using 430(i)(1)(B) assumptions) is greater than 70%:

$$\begin{aligned}\text{FTAP using 430(i)(1)(B)} &= \frac{\text{AAV} - \text{CB} - \text{PB}}{\text{Funding Target (430(i)(1)(B))}} \\ &= \frac{770,000 - 60,000 - 0}{1,000,000} \\ &= 71.0\%\end{aligned}$$

The FTAP for the 2008 year (using 430(i)(1)(B) assumptions) is greater than 70%. As a result, the plan is NOT in At-Risk status for 2009.

Answer is B

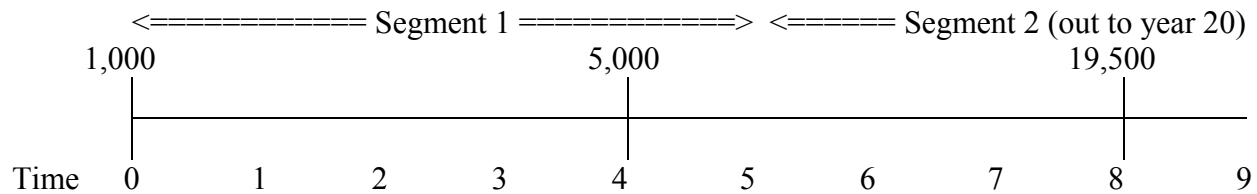
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Problem 23 – Page 1

Revised 09/29/08

The key to this problem is knowing the definition for the effective rate of interest. It is the single rate of interest that reproduces the value of the Funding target. The Funding target is calculated using three different segment rates of interest.

Based on the data in the problem, the benefit payments will be valued using the first and second segment rates:



$$\begin{aligned} \text{FT} &= \text{PV of AB} \\ &= 1,000(1.05)^0 + 5,000(1.05)^{-4} + 19,500(1.06)^{-8} \\ &= 17,348 \end{aligned}$$

Let j be the effective rate of interest. You should generate the same present value using the effective rate of interest to discount all the benefit payments:

$$\begin{aligned} 17,348 &= 1,000(1+j)^0 + 5,000(1+j)^{-4} + 19,500(1+j)^{-8} \\ 16,348 &= 5,000(1+j)^{-4} + 19,500(1+j)^{-8} \\ 16,348 &= 5,000x + 19,500x^2 \quad (\text{let } x = (1+j)^{-4}) \end{aligned}$$

There are several ways to work the problem, all of which remind me of the EA-1 exam:

1. The quick way is to use the built-in cash flow feature of your calculator. If you were taking the EA-1 exam, I would expect you to be familiar with that capability.
2. Use trial and error, based on the answer ranges given
3. Use the quadratic formula
4. Use iteration

You'll get the same answer regardless of your choice. My preference is to use the quadratic formula:

$$ax^2 + bx + c = 0$$

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

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Problem 23 – Page 2

$$\begin{aligned} 16,348 &= 5,000x + 19,500x^2 \\ 0 &= 19,500x^2 + 5,000x - 16,348 \end{aligned}$$

$$\begin{aligned} x &= \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} \\ &= \frac{-5,000 \pm \sqrt{(5,000)^2 - 4(19,500)(-16,348)}}{2(19,500)} \\ &= \frac{-5,000 \pm 36,058}{39,000} \\ &= .7963 \quad (\text{ignore the negative result}) \end{aligned}$$

$$\begin{aligned} (1+j)^{-4} &= .7963 \\ 1+j &= 1.05858 \end{aligned}$$

Answer is D

NOTES:

1. One easy way to miss this problem is to not read it carefully. If you miss the fact the payments are at the beginning of the year, you would incorrectly discount the 2nd and 3rd payments for 5 years and 9 years.
2. For the trial and error approach, take a look at the answer ranges. The first two segment rates are 5% and 6%. The largest of the three benefit payments is discounted using 6%, so the effective rate should be closer to 6% than 5%. The first trial is to calculate the present value using 5.95% (top of the D range):

$$\begin{aligned} 16,348 &= 5,000(1+j)^{-4} + 19,500(1+j)^{-8} \\ 16,249 &= 5,000(1.0595)^{-4} + 19,500(1.0595)^{-8} \end{aligned}$$

This result shows that the interest rate is just slightly less than 5.95%. Now try the present value using 5.70% (bottom of the D range)

$$16,520 = 5,000(1.0570)^{-4} + 19,500(1.0570)^{-8}$$

The effective rate of interest must be greater than 5.70% and less than 5.95% , so the answer is D.

(continued on next page)

Problem 23 – Page 3

3. If you have the HP-12C, here is the solution using the calculator:

```
f [CLR] [REG]
-16,348 g [CF0]
  5,000 g [CFj]
 19,500 g [CFj]
F [IRR]
```

After about 5 seconds, you get 25.573. This means that you have

$$(1+j)^4 = \frac{125.573}{100.000} \qquad 1+j = 1.05858$$

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Problem 24

Similar to 2005 EA-2B #40

This problem is a simple one on Top Heavy (T-H) minimums. If employees participate in both a top-heavy DB plan and a top-heavy DC plan, minimum benefits do not have to be provided in both plans.

There are four safe harbor alternatives discussed in Q&A M-12 of the 1.416 regulation.

- Provide T-H minimum only in DB plan
- Provide T-H minimum in DB plan, but offset the DB minimum by equivalent level benefit under the DC plan (cheaper than 1)
- Prove through analysis of comparability of benefits (see RR 81-202) that the plans provide benefits $>$ DB minimums
- Provide contributions + forfeitures \geq 5% of compensation under DC plan

I. FALSE

For a DC plan (without a DB plan) the T-H minimum is an allocation of 3% (or the lowest allocation percent for any key employee). The problem tells you that the participant is covered under both a DB and a DC plan. To satisfy the T-H minimum for both plans, the DC plans needs a minimum allocation of 5%.

II. TRUE

This item in the problem matches the third alternative above.

III. TRUE

This item in the problem matches the second alternative above.

Both items II and III are true

Answer is C

Problem 25

Revised 10/24/09

This problem is a simple one on minimum funding requirements for multiemployer plans.

I. FALSE

This is the only tricky one of the bunch. In general, this seems to be true - but there is an exception.

The rule in 431(b)(7)(G) says that a plan amendment providing "short term benefits" over a period less than 15 years would be funded over that shorter period.

II. TRUE

The alternative minimum funding standard was in IRC 412(g) prior to the passage of PPA. It is now gone, except for a reference in IRC 431(b)(3)(D):

“ ... determined under the alternative minimum funding standard under section 412(g) (as in effect on the day before the date of the enactment of the Pension Protection Act of 2006) ...”

III. TRUE

See IRC 431(c)(3)(A)

Both items II and III are true

Answer is C

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Problem 26

This problem is a simple one on minimum funding requirements for single employer plans.

Here is the text from IRC 430(h)(4):

(4) Probability of benefit payments in the form of lump sums or other optional forms
For purposes of determining any present value or making any computation under this section, there shall be taken into account--

(A) the probability that future benefit payments under the plan will be made in the form of optional forms of benefits provided under the plan (including lump sum distributions, determined on the basis of the plan's experience and other related assumptions), and

(B) any difference in the present value of such future benefit payments resulting from the use of actuarial assumptions, in determining benefit payments in any such optional form of benefits, which are different from those specified in this subsection.

ASSERTION

This is false, due to the language in 430(h)(4)(A).

REASON

This is false, due to the language in 430(h)(4)(B).

Both items are false

Answer is E

Problem 27

Revised 09/29/08

FALSE

The key to this problem is knowing the definition for a plan to be in At-Risk status. One part of the definition is that a plan must have at least 501 participants for one day of the prior plan year.

The second part of the definition is based on values of the Funding target attainment percentage (FTAP) for the prior year. A plan is At-Risk for a year if

1. The FTAP for the prior year (on a non-At-Risk basis) is less than 80%, and
2. The FTAP for the prior year (using 430(i)(1)(B) assumptions) is less than 70%

There is a transition rule which reduces the 80% for years prior to 2011. For 2009, the first threshold is reduced to 70%:

1. The FTAP for the 2008 year (on a non-At-Risk basis) is less than 70%, and
2. The FTAP for the 2008 year (using the 430(i)(1)(B) assumptions) is less than 70%

Since the 2008 FTAP on a non-At-Risk basis is greater than 70%, the plan is not in At-Risk status for 2009.

Answer is B

NOTE

The information about the 412(l) additional funding charge for 2007 is extraneous, and does not affect the solution.

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Problem 28

You need to use the actuarial equation of balance to solve for the amount of the new plan change base. Then you can calculate the amortization payment for the base.

$$\begin{aligned} 01/01/08 \text{ UAL} &= \text{AL} - \text{AAV} \\ &= 9,710,000 - 9,238,000 \\ &= 472,000 \end{aligned}$$

$$\begin{aligned} 01/01/08 \text{ UAL} &= \text{O/S 431 bases} - \text{CB} - \text{ARA} \\ &= 110,000 + 15,000 + \text{Plan change} - 60,000 - 0 \\ &= 65,000 + \text{Plan change} \end{aligned}$$

$$\begin{aligned} 472,000 &= 65,000 + \text{Plan change} \\ \text{Plan change} &= 407,000 \end{aligned}$$

Now you need to determine the amortization for the new plan change 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.

$$\begin{aligned} \text{Plan amort} &= 407,000 / \ddot{a}_{\overline{15}|.07} \\ &= 41,763 \end{aligned}$$

Answer is D

This seems very short for a 4 point question.

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Problem 29

You need to use the actuarial equation of balance to solve for the amount of the accrued liability. You need to use the amortization payments to calculate the outstanding amounts for the loss base and the assumption change base.

$$\begin{aligned} 01/01/08 \text{ UAL} &= \text{AL} - \text{AAV} \\ &= \text{AL} - 991,600 \\ \text{AL} &= \text{UAL} + 991,600 \end{aligned}$$

$$\begin{aligned} 01/01/08 \text{ UAL} &= \text{O/S 431 bases} - \text{CB} - \text{ARA} \\ &= 404,600 + \text{Loss base} + \text{Assump base} - 75,500 - 0 \end{aligned}$$

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.

$$\begin{aligned} \text{Loss base} &= 6,770 * \ddot{a}_{\overline{15}|.07} \\ &= 65,977 \end{aligned}$$

$$\begin{aligned} \text{Assump base} &= 8,180 * \ddot{a}_{\overline{15}|.07} \\ &= 79,718 \end{aligned}$$

$$\begin{aligned} \text{UAL} &= 404,600 + \text{Loss base} + \text{Assump base} - 75,500 - 0 \\ &= 404,600 + 65,977 + 79,718 - 75,500 - 0 \\ &= 474,795 \end{aligned}$$

$$\begin{aligned} \text{AL} &= \text{UAL} + 991,600 \\ &= 1,466,395 \end{aligned}$$

Answer is B

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Problem 30 – Page 1

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

The key to this problem is knowing how to calculate the minimum required contribution (MRC) under IRC Section 430. You need to calculate the amount of the funding shortfall. Then you can determine the amount of the MRC at 01/01/2008, as well as the “smallest amount”.

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. All plans start with a zero prefunding balance in 2008.

$$\begin{aligned}\text{Funding S/F} &= \text{Funding target} - (\text{AAV} - \text{CB} - \text{PB}) \\ &= 5,000,000 - (4,200,000 - 125,000 - 0) \\ &= 925,000\end{aligned}$$

Shortfall Base Exemption

You should check to see if this plan satisfies the shortfall base exemption.

I will define the “modified funding shortfall” as the modified funding target less the modified assets. If the “modified funding shortfall” is less than or equal to zero, then you would not have to set up the Shortfall base for 2008:

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

$$\begin{aligned}\text{Modified S/F} &= 92\% * (\text{Funding target}) - (\text{AAV} - 0) \\ &= .92 * 5,000,000 - 4,200,000 \\ &= 400,000\end{aligned}$$

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Problem 30 – Page 2

Shortfall amortization installment

This plan does not satisfy the shortfall base exemption, so you must set up the 2008 shortfall amortization base. In this problem, you are given the amortization factor for the shortfall amortization installment.

The new shortfall base is equal to the Funding shortfall minus the present value of prior years' shortfall amortization installments. 2008 was the first year under the new PPA funding rules, so there are no prior shortfall amortization installments. The 2008 shortfall base is equal to the Funding shortfall.

$$\begin{aligned}\text{S/F amort} &= 925,000 / 5.9982 \\ &= 154,213\end{aligned}$$

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.

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

$$\begin{aligned}\text{MRC} &= \text{TNC} + \text{Shortfall amort charge} + \text{Waiver amort charge} \\ &= 200,000 + 154,213 + 0 \\ &= 354,213\end{aligned}$$

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

$$\begin{aligned}\text{Smallest contr} &= \text{MRC} - \text{CB} - \text{PB} \\ &= 354,213 - 125,000 - 0 \\ &= 229,213\end{aligned}$$

Answer is C

NOTE

If a plan is not eligible for the applicable percentage below 100%, you don't need to do any extra calculations for the Shortfall base exemption. Unless there is a huge carryover balance, the “modified funding shortfall” will be greater than zero.

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Problem 31

The key to this problem is knowing the formulas for the non-investment G/L. Another key point is whether you understand how to use the commutation functions given in the problem.

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

Smith is retired, so their normal cost in the prior formula is zero. There is a liability gain is caused by the death of Smith.

One trick to the problem is that Smith still has a liability after death. The benefit payments continue after death due to the certain period.

Data as of	01/01/07
Age	60
Certain period	5
Benefit	15,000 = 12(1,250)

$$\begin{aligned}{}_eAL_1 &= (1.07)*(0 + 15,000*\ddot{a}_{60:\overline{5}|}^{(12)} \text{ at } 7.0\%) - (1.07)*(15,000*\ddot{a}_{\overline{1}|}^{(12)} \text{ at } 7.0\%) \\ &= (1.07)*\{15,000*[\ddot{a}_{\overline{5}|}^{(12)} \text{ at } 7.0\% + {}_5|\ddot{a}_{60 \text{ at } 7.0\%}^{(12)}]\} - (1.07)*(15,000*\ddot{a}_{\overline{1}|}^{(12)} \text{ at } 7.0\%) \end{aligned}$$

$$AL_1 = 15,000*\ddot{a}_{\overline{4}|}^{(12)} \text{ at } 7.0\%$$

The above formulas are pretty messy to calculate. There is a trick that simplifies the solution a bit. There is no G/L associated with any benefit payments made during the certain period. The payments must be made regardless of whether Smith is alive or not.

Rewrite the prior formulas, but this time leave out all the benefit payments during the certain period. The resulting gain will be exactly the same value:

$$\begin{aligned}{}_eAL_1 &= (1.07)*\{15,000*{}_5|\ddot{a}_{60 \text{ at } 7.0\%}^{(12)}\} - 0 \\ AL_1 &= 0 \quad \text{(both ignore benefits during the certain period)}\end{aligned}$$

$$\begin{aligned}\text{Gain} &= {}_eAL_1 - AL_1 \\ &= (1.07)*\{15,000*{}_5|\ddot{a}_{60 \text{ at } 7.0\%}^{(12)}\} \\ &= 1.07(15,000)(N_{65}^{(12)} / D_{60}) \\ &= 115,622\end{aligned}$$

Answer is D

Problem 32

Revised 09/29/08

This problem is a simple one on minimum funding requirements for single employer plans.

I. TRUE

In general, the Minimum Required Contribution (MRC) is defined as the sum of three items, and is determined as of the valuation date:

$$\text{MRC} = \text{Target NC} + \text{Shortfall amortization charge} + \text{Waiver amortization charge}$$

If the plan was not an “Underfunded Plan” in the prior year, then the employer may elect to apply the prefunding balance and the carryover balance towards the MRC. IRC 430(f)(3)(C) defines an “Underfunded Plan” as one where the ratio of (AAV - PB) to the Funding Target (on non At-Risk basis) is less than 80%.

II. TRUE

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.

III. FALSE

All plans are required to use the three varying segment interest rates to calculate the value of the Funding target and the Total normal cost. See IRC 430(h)(2)(B) and 430(h)(2)(C).

The effective interest rate is defined in IRC 430(h)(2)(A) as the single rate that reproduces the value of the Funding target. The effective interest rate is only used to adjust contributions paid before or after the valuation date, in order to compare them to the MRC (which is always defined as of the valuation date).

Both items I and II are true

Answer is A

NOTE

In general, you don't have to worry about Item I on calculation problems (non True/False). This is due to exam condition 30:

“(30) Where a prefunding or carryover balance exists, the plan was at least 80% funded in the prior year and is therefore eligible to credit the balance(s) against the otherwise-applicable minimum required contribution.”

Fall 2007 EA-2A Exam Solutions

Problem 33 – Page 1

Similar to 2006 #1

Revised 10/02/08

The key to this problem is handling the multiple retirement decrements correctly in calculating the present value of the future benefits.

Age 53 at 01/01/08

Past Service 14 years

Service at 65 26 years

Age 52 pay 17,000

There are two retirement decrements at ages 63 and 64. You need to allow for the probability of survival to retirement age. At each retirement age, you need to calculate the early retirement benefit.

The PVB must be calculated as a complicated summation:

$$\text{PVB} = \sum_{t=0}^{12} v^t p_{53}^{(T)} q_{53+t}^{(r)} (\text{ER Ben})_{53+t} \ddot{a}_{53+t}^{(12)}$$

The unreduced benefit is available at retirement ages 64 and above, when the participant has completed 25 years of service. You must calculate the early retirement factor at age 63:

$$\text{ER factor at 63} \quad .90 = [1 - 2(5\%)]$$

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

$$\begin{aligned} \text{Pay at 64} &= 17,000(1.03)^{12} \\ &= 24,238 \end{aligned}$$

$$\begin{aligned} \text{FAE at 65} &= 24,238 * (\ddot{a}_{\overline{3}|.03} / 3) \\ &= 23,539 \end{aligned}$$

$$\begin{aligned} \text{NRB at 65} &= 23,539(1.00)(2\%)(26) \\ &= 12,240 \end{aligned}$$

$$\begin{aligned} \text{ERB at 64} &= 23,539 * (1.03)^{-1} * (1.00)(2\%)(25) \\ &= 11,427 \end{aligned}$$

$$\begin{aligned} \text{ERB at 63} &= 23,539 * (1.03)^{-2} * (.90)(2\%)(24) \\ &= 9,585 \end{aligned}$$

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Problem 33 – Page 2

The final step is to evaluate the summation shown previously. You only need to do calculations at the ages with retirement decrements:

		(1)	(2)	(3)		(4)	(5)	(6)
t	$53+t$	v^t	${}_t p_{53}^{(T)}$	${}_t q_{53+t}^{(r)}$	${}_t p_{53+t}^{(T)}$	ERB_{53+t}	$\ddot{a}_{53+t}^{(12)}$	$(1)(2)(3)(4)(5)$
10	63	.5083	1.000	0.25	0.75	9,585	12.36	15,056
11	64	.4751	0.750	0.50	0.50	11,427	11.49	23,391
12	65	.4440	0.375	1.00	0.00	12,240	10.60	<u>21,603</u>
								60,050

Answer is C

NOTE

There is a lot of arithmetic in this problem. One easy way to miss it is to not be careful enough in calculating the probability of survival to each age.

Fall 2007 EA-2A Exam Solutions

Problem 34 – Page 1

Similar to 2006 #31

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

Age 49 at 01/01/08

Past Service 23 years

There are two retirement decrements at ages 55 and 62. You need to allow for the probability of survival to retirement age. At each retirement age, you need to calculate the early retirement benefit.

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

$$AL = \sum_{t=6}^{16} v^t p_{49}^{(T)} q_{49+t}^{(r)} (ER \text{ Ben})_{49+t} \ddot{a}_{49+t}^{(12)}$$

You must calculate the early retirement factor at ages 55 and 62:

$$\text{ER factor at 62} \quad .80 = [1 - 3(12)(1/180)]$$

$$\text{ER factor at 55} \quad .50 = [1 - 5(12)(1/180) - 5(12)(1/360)]$$

It is less confusing if you calculate the early retirement benefit at each age before putting together the rest of the summation. The Unit Credit accrued liability uses the participant's accrued benefit at the valuation date (not the projected benefit, as in the prior problem).

$$\begin{aligned} \text{NRB at 65} &= 12(23)(35) \\ &= 9,660 \end{aligned}$$

$$\begin{aligned} \text{ERB at 62} &= 9,660 * (.80) \\ &= 7,728 \end{aligned}$$

$$\begin{aligned} \text{ERB at 55} &= 9,660 * (.50) \\ &= 4,830 \end{aligned}$$

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Problem 34 – Page 2

The final step is to evaluate the summation shown previously. You only need to do calculations at the ages with retirement decrements:

		(1)	(2)	(3)		(4)	(5)	(6)
t	$49+t$	v^t	${}_t p_{49}^{(T)}$	${}_t q_{49+t}^{(r)}$	${}_t p_{49+t}^{(T)}$	ERB_{49+t}	$\ddot{a}_{49+t}^{(12)}$	$(1)(2)(3)(4)(5)$
6	55	.6663	1.000	0.40	0.60	4,830	13.66	17,586
13	62	.4150	0.600	0.80	0.20	7,728	12.85	19,780
16	65	.3387	0.120	1.00	0.00	9,660	10.50	<u>4,123</u>
								41,489

Answer is B

NOTE

There is a lot of arithmetic in this problem. One easy way to miss it is to not be careful enough in calculating the probability of survival to each age.

Problem 35 – Page 1

Revised 10/17/09

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

The key to this problem is knowing how to calculate the minimum required contribution (MRC) under IRC Section 430. You need to calculate the amount of the funding shortfall. Then you can determine the amount of the MRC at 01/01/2008, as well as the “smallest amount”.

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. All plans start with a zero prefunding balance in 2008.

One thing to be careful of is that the problem gives you the market value as 940,000. You should check to be sure that the actuarial asset value is within 10% of the market value:

$$110\% \text{ of MVA} = 1.10(940,000) = 1,034,000$$

Now you can safely use the given AAV of 990,000 for the rest of the calculations.

$$\begin{aligned}\text{Funding S/F} &= \text{Funding target} - (\text{AAV} - \text{CB} - \text{PB}) \\ &= 1,050,000 - (990,000 - 10,000 - 0) \\ &= 70,000\end{aligned}$$

Shortfall Base Exemption

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

- Modified funding target: the applicable percentage times the funding target
- This plan had a 412(l) additional funding charge (AFC) for 2007. The plan is not eligible for the reduced applicable percentage, so that value is equal to 100%
- Modified assets: if the prefunding balance is used to reduce the minimum required contribution, the modified assets equal AAV - PB. Otherwise, the modified assets equal the AAV with no reduction.

$$\begin{aligned}\text{Modified S/F} &= 100\% * (\text{Funding target}) - (\text{AAV} - 0) \\ &= 1.0 * 1,050,000 - 990,000 \\ &= 60,000\end{aligned}$$

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Problem 35 – Page 2

Shortfall amortization installment

This plan does not satisfy the shortfall base exemption, so you must set up the 2008 shortfall amortization base. In this problem, you are given the amortization factor for the shortfall amortization installment.

The new shortfall base is equal to the Funding shortfall minus the present value of prior years' shortfall amortization installments. 2008 was the first year under the new PPA funding rules, so there are no prior shortfall amortization installments. The 2008 shortfall base is equal to the Funding shortfall.

$$\begin{aligned}\text{S/F amort} &= 70,000 / 5.9982 \\ &= 11,670\end{aligned}$$

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.

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

$$\begin{aligned}\text{MRC} &= \text{TNC} + \text{Shortfall amort charge} + \text{Waiver amort charge} \\ &= 49,000 + 11,670 + 0 \\ &= 60,670\end{aligned}$$

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

$$\begin{aligned}\text{Smallest contr} &= \text{MRC} - \text{CB} - \text{PB} \\ &= 60,670 - 10,000 - 0 \\ &= 50,670\end{aligned}$$

Answer is D

NOTE

If a plan is not eligible for the applicable percentage below 100%, you don't need to do any extra calculations for the Shortfall base exemption. Unless there is a huge carryover balance, the “modified funding shortfall” will be greater than zero.

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Problem 36 – Page 1

This problem is a simple one on minimum funding requirements for single employer plans.

I. TRUE

If the plan was not an “Underfunded Plan” in the prior year, then the employer may elect to apply the prefunding balance and the carryover balance towards the Minimum Required Contribution (MRC).

IRC 430(f)(3)(C) defines an “Underfunded Plan” as one where the ratio of (AAV - PB) to the Funding Target (on non At-Risk basis) is less than 80%:

$$\begin{aligned}\text{Funded pct} &= 580,000 / 600,000 \\ &= 96.7\%\end{aligned}$$

Since this is not an underfunded plan in 2008, the sponsor can apply the CB towards the MRC for 2009.

II. FALSE

Since there are less than 500 participants, this plan would never meet the definition of At-Risk status. See IRC 430(i)(6).

III. TRUE

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. All plans start with a zero prefunding balance in 2008.

$$\begin{aligned}\text{Funding S/F} &= \text{Funding target} - (\text{AAV} - \text{CB} - \text{PB}) \\ &= 600,000 - (580,000 - 20,000 - 0) \\ &= 40,000\end{aligned}$$

You should think about whether this plan satisfies the shortfall base exemption. If it does, then there will be no shortfall amortization charge for 2008.

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Problem 36 – Page 2

I will define the “modified funding shortfall” as the modified funding target less the modified assets. If the “modified funding shortfall” is less than or equal to zero, then you would not have to set up the Shortfall base for 2008.

- Modified funding target: the applicable percentage times the funding target
- This plan had a 412(l) additional funding charge (AFC) for 2007. The plan is not eligible for the reduced applicable percentage, so that value is equal to 100%
- Modified assets: if the prefunding balance is used to reduce the minimum required contribution, the modified assets equal AAV - PB. Otherwise, the modified assets equal the AAV with no reduction.

$$\begin{aligned}\text{Modified S/F} &= 100\% * (\text{Funding target}) - (\text{AAV} - 0) \\ &= 1.0 * 600,000 - 580,000 \\ &= 20,000\end{aligned}$$

Since this value is not zero, the plan is not exempt. So they must set up a shortfall amortization base equal to the funding shortfall of 40,000.

Both items I and III are true

Answer is B

Problem 37 – Page 1

Revised 10/17/09

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

The key to this problem is knowing how to calculate the minimum required contribution (MRC) under IRC Section 430. You need to calculate the amount of the funding shortfall. Then you can determine the amount of the MRC at 01/01/2008, as well as the “smallest amount”.

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. All plans start with a zero prefunding balance in 2008.

One thing to be careful of is that the problem gives you the market value as 930,000. You should check to be sure that the actuarial asset value is within 10% of the market value:

$$110\% \text{ of MVA} = 1.10(930,000) = 1,023,000$$

Now you can safely use the given AAV of 990,000 for the rest of the calculations.

$$\begin{aligned}\text{Funding S/F} &= \text{Funding target} - (\text{AAV} - \text{CB} - \text{PB}) \\ &= 1,050,000 - (990,000 - 5,000 - 0) \\ &= 65,000\end{aligned}$$

Shortfall Base Exemption

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

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

$$\begin{aligned}\text{Modified S/F} &= 92\% * (\text{Funding target}) - (\text{AAV} - 0) \\ &= .92 * 1,050,000 - 990,000 \\ &= -24,000\end{aligned}$$

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Problem 37 – Page 2

Shortfall amortization installment

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

Minimum Required Contribution

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

$$\begin{aligned}\text{MRC} &= \text{TNC} + \text{Shortfall amort charge} + \text{Waiver amort charge} \\ &= 49,000 + 0 + 0 \\ &= 49,000\end{aligned}$$

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

$$\begin{aligned}\text{Smallest contr} &= \text{MRC} - \text{CB} - \text{PB} \\ &= 49,000 - 5,000 - 0 \\ &= 44,000\end{aligned}$$

Answer is A

NOTES:

1. If a plan is not eligible for the applicable percentage below 100%, you don’t need to do any extra calculations for the Shortfall base exemption. Unless there is a huge carryover balance, the “modified funding shortfall” will be greater than zero.
2. If you feel a sense of déjà vu, that is because this problem is almost identical to problem #35 on this exam.

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Problem 38

TRUE

The key to this problem is knowing the definition of the additional assumptions used to calculate the Funding target for a plan in At-Risk status.

The description in the problem is basically a direct quote from IRC 430(i)(1)(B)(i).

Answer is A

Problem 39

Revised 09/29/08

FALSE

The key to this problem is knowing the definition of the interest rate adjustments for the prefunding balance (PB) and the carryover balance (CB). The interest rate used to bring either balance forward from one valuation date to the next is based on the rate of return on plan assets.

See IRC 430(f)(8)

Answer is B

NOTE

The effective interest rate is used to adjust a contribution from the date of payment to the valuation date. Then it can be compared to the minimum required contribution as well as the PB and the CB.

Fall 2007 EA-2A Exam Solutions

Problem 40 – Page 1

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

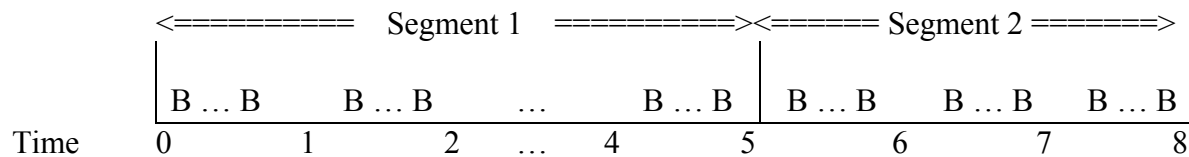
$$\begin{aligned} \text{Present value} &= \sum_{t=0}^4 (1.0500)^{-t} {}_t p_x^{(T)} (\text{Benefit Payment}_{x+t}) \\ &+ \sum_{t=5}^{19} (1.0600)^{-t} {}_t p_x^{(T)} (\text{Benefit Payment}_{x+t}) \\ &+ \sum_{t=20}^{\omega-x} (1.0700)^{-t} {}_t p_x^{(T)} (\text{Benefit Payment}_{x+t}) \end{aligned}$$

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

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

Based on the exam conditions, the benefit is assumed payable monthly, starting at normal retirement age. In this problem, you are valuing a monthly annuity certain.

The participant is already in pay status, so their benefit payments will be valued using the first and second segment rates. They retired two years ago, so there are eight years of benefit payments remaining.



The transition rule in IRC 430(h)(2)(G) allows you to slowly move from the current liability interest rate to the three segment interest rates. For years 2008 and 2009, you would use a 1/3 and 2/3 blend of the segment rates and the current liability rate. In 2010, the transition ends, and the valuation is based solely on the three segment interest rates.

In 2008 you add 1/3 of the segment rates to 2/3 of the current liability rate. The result is the transition definition of the three segment interest rates:

	Segment 1	Segment 2	Segment 3
Segment rate	5.0%	6.0%	7.0%
1/3*Segment rate	5/3%	6/3%	7/3%
Current liability rate	5.78%	5.78%	5.78%
2/3*CL rate	3.85%	3.85%	3.85%
Transition seg rate	5.5200%	5.8533%	6.1867%

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Problem 40 – Page 2

Revised 09/29/08

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

$$PV = 12(1,750) \left[\ddot{a}_{\overline{5}|at 5.52\%}^{(12)} + (1.058533)^{-5} \left(\ddot{a}_{\overline{3}|at 5.58533\%}^{(12)} \right) \right]$$

Once again, you are back doing calculations for the EA-1 exam. There are two ways to calculate the annuity. One involves converting the interest rate so the interest compounding period matches the payment period. The other way involves converting the payment period to match the interest compounding period.

I find it easier to use the first approach, which calculates monthly annuities based on monthly interest rates:

$$PV = 1,750 \left[\ddot{a}_{\overline{60}|at j} + (1+k)^{-60} \left(\ddot{a}_{\overline{36}|at k} \right) \right]$$

Where j and k are defined as follows:

$$\begin{array}{ll} 1.055200 = (1+j)^{12} & 1.058533 = (1+k)^{12} \\ 1+j = 1.004488 & 1+k = 1.004752 \end{array}$$

$$\begin{aligned} PV &= 1,750 \left[\ddot{a}_{\overline{60}|at .4488\%} + (1.058533)^{-5} \left(\ddot{a}_{\overline{36}|at .4752\%} \right) \right] \\ &= 1,750 [52.7341 + .7526(33.1743)] \\ &= 135,975 \end{aligned}$$

Answer is A

Problem 41

Revised 09/29/08

The key to this problem is knowing the definition for a plan to be in At-Risk status. One part of the definition is that a plan must have at least 501 participants for one day of the prior plan year.

The second part of the definition is based on values of the Funding target attainment percentage (FTAP) for the prior year. A plan is At-Risk for a year if

1. The FTAP for the prior year (on a non-At-Risk basis) is less than 80%, and
2. The FTAP for the prior year (using 430(i)(1)(B) assumptions) is less than 70%

There is a transition rule which reduces the 80% for years prior to 2011. But that does not affect this problem, since it asks about years 2011 through 2013.

I. TRUE

For 2011, you look at the FTAP values for 2010. The 2010 FTAP on a non-At-Risk basis is less than 80%, and the 2010 FTAP on an At-Risk basis is less than 70%

The plan is in At-Risk status for 2011.

II. TRUE

For 2012, you look at the FTAP values for 2011. The 2011 FTAP on a non-At-Risk basis is less than 80%, and the 2011 FTAP on an At-Risk basis is less than 70%

The plan is in At-Risk status for 2012.

III. FALSE

For 2013, you look at the FTAP values for 2012. The 2012 FTAP on a non-At-Risk basis is less than 80%, but the 2012 FTAP on an At-Risk basis is NOT less than 70%

The plan is NOT in At-Risk status for 2013.

Both items I and II are true

Answer is A

Fall 2007 EA-2A Exam Solutions

Problem 42 – Page 1

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

The key to this problem is knowing how to calculate the minimum required contribution (MRC) under IRC Section 430. You need to calculate the amount of the funding shortfall. Then you can determine the amount of the MRC at 01/01/2008, as well as the “smallest amount”.

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. All plans start with a zero prefunding balance in 2008.

$$\begin{aligned}\text{Funding S/F} &= \text{Funding target} - (\text{AAV} - \text{CB} - \text{PB}) \\ &= 5,500,000 - (5,000,000 - 100,000 - 0) \\ &= 600,000\end{aligned}$$

Shortfall Base Exemption

You should check to see if this plan satisfies the shortfall base exemption.

I will define the “modified funding shortfall” as the modified funding target less the modified assets. If the “modified funding shortfall” is less than or equal to zero, then you would not have to set up the Shortfall base for 2008:

- Modified funding target: the applicable percentage times the funding target
- This plan had a 412(l) additional funding charge (AFC) for 2007. The plan is not eligible for the reduced applicable percentage, so that value is equal to 100%
- Modified assets: if the prefunding balance is used to reduce the minimum required contribution, the modified assets equal AAV - PB. Otherwise, the modified assets equal the AAV with no reduction.

$$\begin{aligned}\text{Modified S/F} &= 100\% * (\text{Funding target}) - (\text{AAV} - 0) \\ &= 1.0 * 5,500,000 - 5,000,000 \\ &= 500,000\end{aligned}$$

Problem 42 – Page 2**Revised 07/21/09****Shortfall amortization installment**

This plan does not satisfy the shortfall base exemption, so you must set up the 2008 shortfall amortization base. In this problem, you are given the amortization factor for the shortfall amortization installment.

The new shortfall base is equal to the Funding shortfall minus the present value of prior years' shortfall amortization installments. 2008 was the first year under the new PPA funding rules, so there are no prior shortfall amortization installments. The 2008 shortfall base is equal to the Funding shortfall.

The 2008 shortfall amortization installment is equal to the Funding shortfall base divided by the amortization factor given in the problem:

$$\begin{aligned}\text{S/F Base} &= 600,000 \\ \text{S/F Amort} &= 600,000 / 5.9982 \\ &= 100,030\end{aligned}$$

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.

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

$$\begin{aligned}\text{MRC} &= \text{TNC} + \text{Shortfall amort charge} + \text{Waiver amort charge} \\ &= 200,000 + 100,030 + 0 \\ &= 300,030\end{aligned}$$

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

$$\begin{aligned}\text{Smallest contr} &= \text{MRC} - \text{CB} - \text{PB} \\ &= 300,030 - 100,000 - 0 \\ &= 200,030\end{aligned}$$

There is one minor trick to the problem. It asks for the smallest contribution at 12/31, not as of the valuation date.

$$\begin{aligned}\text{PV of X} &= 200,030 = X \cdot (1.0575)^{-1} \\ X &= 211,532\end{aligned}$$

Answer is C

Problem 43 – Page 1**Revised 09/29/08**

The key to this problem is knowing the gain / loss formulas.

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

Since Smith is retired, the NC is zero, and the AL is the same as their PVB. You only need to do one calculation of the expected accrued liability at 01/01/2008. It will be the same result for both sets of G/L calculations:

$$\begin{aligned}{}_eAL_1 &= (1+i)(AL_0 + NC_0) - (\text{actual benefit payments} + i) \\ &= (1.07)(AL_0 - 100,000)\end{aligned}$$

Data as of	01/01/07
Smith's age	70
Beneficiary age	67

$$\begin{aligned}AL_0 &= 100,000\{\ddot{a}_{70} + (50\%)[\ddot{a}_{67} - \ddot{a}_{67:70}]\} \\ &= 100,000\{7.60 + (50\%)[8.30 - 6.10]\} \\ &= 870,000\end{aligned}$$

$$\begin{aligned}{}_eAL_1 &= (1.07)(AL_0 - 100,000) \\ &= 823,900\end{aligned}$$

“Scenario X”

You need to calculate the gain if Smith survives and the beneficiary dies. In this case, the actual accrued liability at 01/01/2008 is a life annuity payable to Smith:

$$\begin{aligned}AL_1 &= 100,000\ddot{a}_{71} \\ &= 100,000(7.40) \\ &= 740,000\end{aligned}$$

$$\begin{aligned}\text{Gain} &= {}_eAL_1 - AL_1 \\ &= 823,900 - 740,000 \\ X &= 83,900\end{aligned}$$

Problem 43 – Page 2

Revised 09/29/08

“Scenario Y”

You need to calculate the gain if Smith dies and the beneficiary survives. In this case, the actual accrued liability at 01/01/2008 is a life annuity payable to Smith’s beneficiary for 50% of the benefit:

$$\begin{aligned}AL_1 &= 50,000 \ddot{a}_{68} \\&= 50,000(8.10) \\&= 405,000\end{aligned}$$

$$\begin{aligned}\text{Gain} &= {}_eAL_1 - AL_1 \\&= 823,900 - 405,000 \\Y &= 418,900\end{aligned}$$

Absolute value of $X + Y = 502,800$.

Answer is B

NOTE

Some prior exam questions required you to do additional calculations to derive annuity values that are not given in the problem’s data. For an example, see 2005 #24.

Problem 44

Revised 09/29/08

FALSE

The key to this problem is knowing the definition of the additional assumptions used to calculate the Funding target for a plan in At-Risk status. The At-Risk calculation requires you to value the “most valuable” form of benefit payment, but only for those participants expected to become eligible for early retirement within 11 years of the valuation date.

See IRC 430(i)(1)(B).

Answer is B

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Problem 45 – Page 1

Similar to 2003 #15

Revised 09/29/08

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

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

You are given values of the normal cost and accrued liability before the plan amendment. The plan amendment created an increase of 10% in both items:

$$\begin{aligned}\text{Old plan NC} &= 22,000 \\ \text{New plan NC} &= 24,200 = 1.10(22,000) \\ \\ \text{Old plan AL} &= 270,000 \\ \text{New plan AL} &= 297,000 = 1.10(270,000) \\ \\ 01/01/08 \text{ UAL} &= 297,000 - 250,000 \\ &= 47,000 \\ \\ \text{Plan change} &= 297,000 - 270,000 \\ &= 27,000\end{aligned}$$

You have to calculate the experience G/L during 2007. 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 01/01/2008.

$$\begin{aligned}01/2008 \text{ UAL} &= \text{O/S 431 bases} - \text{CB} - \text{ARA} \\ 47,000 &= 45,900 + \text{Loss} + \text{Plan chg} - 3,000 - 0 \\ \\ -\text{Loss} &= 45,900 - 47,000 + 27,000 - 3,000 \\ \text{Gain} &= 22,900\end{aligned}$$

Fall 2007 EA-2A Exam Solutions

Problem 45 – Page 2

You are given the net amortization payment for the pre-2008 bases. The last step to set up the minimum funding standard account is to calculate the amortizations for the new bases:

$$\text{Gain Amort} = 2,350 = 22,900 \div \ddot{a}_{\overline{15}|.07}$$

$$\text{Plan Amort} = 2,771 = 27,000 \div \ddot{a}_{\overline{15}|.07}$$

Now you have enough information to complete the 2008 MFSA:

2008 Minimum Funding Standard Account			
Charges		Credits	
Normal Cost	24,200	Credit Balance	3,000
NET amortization	9,000	Gain amortization	2,350
PLAN amortization	2,771	12/31/08 minimum	X
7% interest	2,518	7% interest	375
Total charges	38,489	Total credits	5,724 + X

“The smallest amount that satisfies the minimum funding standard” is equal to the excess of the MFSA charges over the credits at 12/31/08.

The 12/31/08 “smallest amount” is $38,489 - 5,724 = 32,765$.

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

$$\begin{aligned}\text{\$431 "ERISA" FFL} &= (1+i) \cdot (\text{NC} + \text{AL}) - (1+i) \cdot [\text{lesser}(\text{MVA}, \text{AAV}) - \text{CB}] \\ &= 1.07 \cdot (24,200 + 297,000) - 1.07 \cdot (250,000 - 3,000) \\ &= 79,394\end{aligned}$$

Since the FFL exceeds the MFSA charges less the amortization credits, there is no FFL credit for 2008. The 2008 minimum contribution is unchanged at 32,765.

Answer is B

NOTE

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

Fall 2007 EA-2A Exam Solutions

Problem 46 – Page 1

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

The key to this problem is knowing how to calculate the minimum required contribution (MRC) under IRC Section 430. You need to calculate the amount of the funding shortfall. Then you can determine the amount of the MRC at 01/01/2008, as well as the “smallest amount”.

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. All plans start with a zero prefunding balance in 2008.

$$\begin{aligned}\text{Funding S/F} &= \text{Funding target} - (\text{AAV} - \text{CB} - \text{PB}) \\ &= 115,000 - (107,000 - 2,000 - 0) \\ &= 10,000\end{aligned}$$

Shortfall Base Exemption

You should check to see if this plan satisfies the shortfall base exemption.

I will define the “modified funding shortfall” as the modified funding target less the modified assets. If the “modified funding shortfall” is less than or equal to zero, then you would not have to set up the Shortfall base for 2008:

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

$$\begin{aligned}\text{Modified S/F} &= 92\% * (\text{Funding target}) - (\text{AAV} - 0) \\ &= .92 * 115,000 - 107,000 \\ &= -1,200\end{aligned}$$

Fall 2007 EA-2A Exam Solutions

Problem 46 – Page 2

Shortfall amortization installment

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

Minimum Required Contribution

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

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

$$\begin{aligned}\text{MRC} &= \text{TNC} + \text{Shortfall amort charge} + \text{Waiver amort charge} \\ &= 12,250 + 0 + 0 \\ &= 12,250\end{aligned}$$

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

$$\begin{aligned}\text{Smallest contr} &= \text{MRC} - \text{CB} - \text{PB} \\ &= 12,250 - 2,000 - 0 \\ &= 10,250\end{aligned}$$

There is one minor trick to the problem. It asks for the smallest contribution at 12/31, not as of the valuation date.

$$\begin{aligned}\text{PV of X} &= 10,250 = X \cdot (1.060)^{-1} \\ X &= 10,865\end{aligned}$$

Answer is B

Fall 2007 EA-2A Exam Solutions

Problem 47

Revised 10/02/08

The key to this problem is knowing the definition for a plan to be in At-Risk status. One part of the definition is that a plan must have at least 501 participants for one day of the prior plan year.

The second part of the definition is based on values of the Funding target attainment percentage (FTAP) for the prior year. A plan is At-Risk for a year if

1. The FTAP for the prior year (on a non-At-Risk basis) is less than 80%, and
2. The FTAP for the prior year (using 430(i)(1)(B) assumptions) is less than 70%

There is a transition rule which reduces the 80% for years prior to 2011. For 2009, the first threshold is reduced to 70%:

1. The FTAP for the 2008 year (on a non-At-Risk basis) is less than 70%, and
2. The FTAP for the 2008 year (using the 430(i)(1)(B) assumptions) is less than 70%

The FTAP is defined as the ratio of the plan assets (reduced by PB and CB) to liabilities:

$$\text{FTAP (non At-Risk)} = \frac{\text{AAV} - \text{CB} - \text{PB}}{\text{Funding Target (non At-Risk)}}$$

$$\text{FTAP using 430(i)(1)(B)} = \frac{\text{AAV} - \text{CB} - \text{PB}}{\text{Funding Target (430(i)(1)(B))}}$$

	Plan X	Plan Y	Plan Z
AAV	74,000	85,000	64,000
CB	12,000	0	4,000
AAV - CB	62,000	85,000	60,000
2008 partic. count	950	750	550
FT - non-At-Risk	112,000	106,000	95,000
FTAP non-At-Risk	55.4% = 62/112	80.2% = 85/106	63.2% = 60/95
FT - 430(i)(1)(B)	125,000	124,000	118,000
FTAP 430(i)(1)(B)	49.6% = 62/125	68.5% = 85/124	50.8% = 60/118
At-Risk in 2009?	YES	NO	YES

Both plans X and Z are in At-Risk status for 2009.

Answer is B

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Problem 48 – Page 1

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

The key to this problem is knowing how to calculate the minimum required contribution (MRC) under IRC Section 430. You need to calculate the amount of the funding shortfall. Then you can determine the amount of the MRC at 01/01/2008, as well as the “smallest amount”.

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. All plans start with a zero prefunding balance in 2008.

$$\begin{aligned}\text{Funding S/F} &= \text{Funding target} - (\text{AAV} - \text{CB} - \text{PB}) \\ &= 64,000 - (60,000 - 12,000 - 0) \\ &= 16,000\end{aligned}$$

Shortfall Base Exemption

You should check to see if this plan satisfies the shortfall base exemption.

I will define the “modified funding shortfall” as the modified funding target less the modified assets. If the “modified funding shortfall” is less than or equal to zero, then you would not have to set up the Shortfall base for 2008:

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

$$\begin{aligned}\text{Modified S/F} &= 92\% * (\text{Funding target}) - (\text{AAV} - 0) \\ &= .92 * 64,000 - 60,000 \\ &= -1,120\end{aligned}$$

Fall 2007 EA-2A Exam Solutions

Problem 48 – Page 2

Shortfall amortization installment

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

Minimum Required Contribution

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

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

$$\begin{aligned}\text{MRC} &= \text{TNC} + \text{Shortfall amort charge} + \text{Waiver amort charge} \\ &= 21,000 + 0 + 0 \\ &= 21,000\end{aligned}$$

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

$$\begin{aligned}\text{Smallest contr} &= \text{MRC} - \text{CB} - \text{PB} \\ &= 21,000 - 12,000 - 0 \\ &= 9,000\end{aligned}$$

There is one minor trick to the problem. It asks for the smallest contribution at 12/31, not as of the valuation date.

$$\begin{aligned}\text{PV of X} &= 9,000 = X \cdot (1.060)^{-1} \\ X &= 9,540\end{aligned}$$

Answer is A

Problem 49

Revised 09/29/08

FALSE

The key to this problem is knowing the restrictions on a plan that is Seriously Endangered. There is no limitation on the ability of the plan to pay lump sums.

IRC 432(d)(1) lists several restrictions that do apply:

- The plan sponsor is not allowed to enter into a collective bargaining agreement that reduces the rate of contributions, or excludes younger or newly hired employees from participation
- No plan amendments are allowed which increase the amount of benefits, the rate of benefit accrual, or the rate of vesting of benefits

Answer is B

NOTE

If a plan is in critical status, then benefit payments are limited. IRC 432(f) lists several restrictions that do apply:

- The plan can not pay
 - Any payment in excess of the straight life annuity monthly benefit, plus any Social Security supplement, or
 - Any payment for purchase of an irrevocable commitment from an insurer
 - Any other payment specified by the Secretary
- No plan amendments are allowed which increase the amount of benefits, or the rate of benefit accrual, unless the increase in benefits is paid by additional contributions that are not part of the rehabilitation plan

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Problem 50 – Page 1

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

The key to this problem is knowing how to calculate the minimum required contribution (MRC) under IRC Section 430. You need to calculate the amount of the funding shortfall. Then you can determine the amount of the MRC at 01/01/2008, as well as the “smallest amount”.

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. All plans start with a zero prefunding balance in 2008.

$$\begin{aligned}\text{Funding S/F} &= \text{Funding target} - (\text{AAV} - \text{CB} - \text{PB}) \\ &= 1,650,000 - (1,680,000 - 20,000 - 0) \\ &= \text{limited to zero}\end{aligned}$$

Shortfall Base

Since the Funding shortfall is zero, you don’t need to check the Shortfall base exemption. The reason is that all shortfall bases are considered fully amortized when the Funding shortfall is 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.

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

$$\begin{aligned}\text{ALT MRC} &= \text{TNC} + \text{Funding target} - (\text{AAV} - \text{CB} - \text{PB}) \\ &= 44,800 + 1,650,000 - (1,680,000 - 20,000 - 0) \\ &= 34,800\end{aligned}$$

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Problem 50 – Page 2

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

$$\begin{aligned}\text{Smallest contr} &= \text{MRC} - \text{CB} - \text{PB} \\ &= 34,800 - 20,000 - 0 \\ &= 14,800\end{aligned}$$

There is one minor trick to the problem. It asks for the smallest contribution at 12/31, not as of the valuation date.

$$\begin{aligned}\text{PV of X} &= 14,800 = X \cdot (1.0575)^{-1} \\ X &= 15,651\end{aligned}$$

Answer is A

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Problem 51 – Page 1

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

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

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

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

The active participants are all age 50 at 01/01/08. Based on the default exam conditions, normal retirement age is 65.

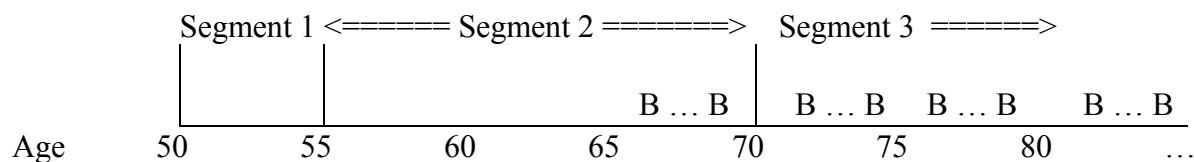
Data as of	01/01/08
Age	50
Past service	20

Each participant's annual accrued benefit is 2,400, calculated as $(20)(10)(12)$. Based on the exam conditions, the benefit is assumed payable monthly, starting at normal retirement age.

Funding Target

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

The participants are currently 15 years from retirement, so their benefit payments will be valued using the second and third segment rates:



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Problem 51 – Page 2

Here is the formula for the Funding target using monthly annuity rates, and no pre-retirement mortality:

$$\text{Age 50 PV} = 2,400 * [(1.06)^{-15} (\ddot{a}_{65:\overline{5}|}^{(12)} \text{ at } 6.0\%) + (1.07)^{-15} ({}_5|\ddot{a}_{65}^{(12)} \text{ at } 7.0\%)]$$

Notice that the second annuity actually starts 20 years from the valuation date. For the first 15 years, the discount uses interest only. For the next 5 years, there is a discount for both interest and post-retirement mortality.

$$\begin{aligned} \ddot{a}_{65:\overline{5}|}^{(12)} \text{ at } 6.0\% &= \ddot{a}_{65}^{(12)} \text{ at } 6.0\% - {}_5|\ddot{a}_{65}^{(12)} \text{ at } 6.0\% \\ &= (N_{65}^{(12)} / D_{65} \text{ at } 6.0\%) - (D_{70} / D_{65} \text{ at } 6.0\%) * (N_{70}^{(12)} / D_{70} \text{ at } 6.0\%) \\ &= (N_{65}^{(12)} - N_{70}^{(12)}) / D_{65} \text{ at } 6.0\% \\ &= (2,052 - 1,220) / 199 \\ &= 4.1809 \end{aligned}$$

$$\begin{aligned} {}_5|\ddot{a}_{65}^{(12)} \text{ at } 7.0\% &= (D_{70} / D_{65} \text{ at } 7.0\%) * (N_{70}^{(12)} / D_{70} \text{ at } 7.0\%) \\ &= (N_{70}^{(12)} / D_{65} \text{ at } 7.0\%) \\ &= 593 / 108 \\ &= 5.4907 \end{aligned}$$

$$\begin{aligned} \text{Age 50 PV} &= 2,400 * [(1.06)^{-15} (4.1809) + (1.07)^{-15} (5.4907)] \\ &= 2,400 * 3.7346 \\ &= 8,963 \end{aligned}$$

$$\begin{aligned} \text{Total PV} &= 100(8,963) \text{ for actives} + 750,000 \text{ for inactive} \\ &= 1,646,314 \end{aligned}$$

Answer is B

NOTE:

The easy way to miss this problem is to get confused about the handling of the segment interest rates, or the pre-retirement mortality. There is no mortality prior to age 65, but you do allow for mortality after age 65.

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