



SoftwarePolish

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

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

FALL 2013 EA-2F EXAM SOLUTIONS

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Fall 2013 EA-2F Exam Solutions

These solutions were prepared based on the law as in effect at May 31, 2013. The Pension Protection Act of 2006 (PPA 2006) was included on the syllabus for the first time on the 2007 exam.

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

Revision History:

September 3, 2019	Corrected solution for problem 31
September 7, 2018	Corrected solutions for problems 31 and 39
October 19, 2016	Corrected solutions for problems 21, 29, 46 and 56
October 15, 2015	Corrected solutions for problems 6, 25 and 44
September 8, 2015	Corrected solutions for problems 13, 23, 28, 46 and 55
August 5, 2015	Corrected solutions for problems 31, 41 and 45
July 16, 2015	Corrected solutions for problems 12, 16 and 42
October 29, 2014	Corrected solutions for problems 21, 27, 49 and 52
August 4, 2014	Original solutions

<u>Exam</u> <u>Year</u>	<u>Pass</u> <u>Mark</u>	<u>Percentage</u> <u>Who passed</u>
2013	103	43.8
2012	103	42.9
2011	111	48.7
2010	109	45.8
2009	107	46.7
2008	112	58.2
2007	112	53.3
2006	113	58.6

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

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

Modified assets

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

Based on 2013 exam conditions 31 and 32, the plan sponsor does elect to apply both the CB and the PB against the MRC. As a result, you should set up the modified asset as AAV - PB. In general, the only time you should not do this is when the problem states that the plan sponsor does not elect to apply the CB and the PB against the MRC, or when the plan's funding ratio for the prior year is less than 80% (see note 6 on next page).

Modified funding target

This is equal to the "applicable percentage" times the funding target. Starting in 2011, the applicable percentage became 100%, which simplifies things considerably. In most problems, the modified funding shortfall is identical to the funding shortfall.

4. If the plan satisfies 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 new Shortfall base, as well as the new Shortfall amortization installment.

The new shortfall base is equal to

- 100% times the Funding target
- Minus the Actuarial asset value reduced by both CB and PB
- Minus the present value of prior years' shortfall and waiver amortization installments

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

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Single employer minimum contribution steps - continued:

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

Funding ratio

2013 exam condition 31 states that the plan sponsor's funding ratio for the prior year was at least 80%, so they are eligible to apply both the CB and the PB against the MRC. If a problem gives you the prior year's valuation results, you should not rely on exam condition 31. You should check the "funding ratio" for the prior year to be sure that the plan can apply the CB and the PB towards the MRC:

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

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

1. Calculate the normal cost plus limit adjustments with interest to the earlier of the end of the plan year or the end of the tax year.
2. Calculate the Full Funding Limitation under Section 404 with interest to the end of the plan year. If this is less than the result of step one, then you can skip to step four.
3. Calculate the absolute minimum amount necessary to produce a non-negative credit balance in the Minimum Funding Standard Account. This is the "smallest amount to satisfy the minimum funding standard" as defined in 2013 exam condition 35. This may be increased by the amount of any "includible employer contribution."
4. The maximum deductible limit is the greater of (1) and (3), but not greater than (2).
5. The UCL limit is equal to $140\% \times (\text{Current Liability}) - \text{AAV}$. If this exceeds the deductible limit in step 4, then the final deductible limit will equal the UCL limit. This UCL limit ignores recent benefit improvements for small plans with highly compensated employees.

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Problem 1

This problem is a simple one on setting actuarial assumptions.

I. FALSE

In general, the salary scale X should reflect both productivity and merit increases.

II. FALSE

Per item III, the taxable wage base increase Z is calculated using the rate of increase in national average wages. For most industries, the salary scale X should exceed the national average. Based on past history, the rate of inflation Y often exceeds the rate of increase in national average wages.

III. TRUE

The Social Security taxable wage base increase Z is calculated using the rate of increase in national average wages.

Only item III is true.

Answer is E

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Problem 2

This problem is a simple one on timing of changes in actuarial assumptions.

ASSERTION

This is true, based on the reason given. There is an exception in case the assumptions or methods are found to be impermissible. See 1.430(d)-1(f)(1)(ii).

REASON

This is true. The problem states that the 2014 Schedule SB was filed on 03/15/2015. Once the Schedule SB is filed, the assumptions and methods are final for that year.

Answer is A

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Problem 3

FALSE

If you have enough past mortality experience, you can have plan-specific mortality tables.

See 1.430(h)(3)-2.

Answer is B

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Problem 4

This problem is a fairly tricky one on setting actuarial assumptions.

I. FALSE

This sounds plausible, but there is no such requirement in the 430 regulations.

II. FALSE

If the best assumption is NO salary increases, then you do not need to assume compensation increases. For a single employer plan, the valuation would only reflect salary increases for the current year.

III. TRUE

When optional form benefits can produce gains or losses, you must make an assumption of how many participants will elect that optional form (see IRC 430(h)(4)). For a single employer plan, the use of segment rates to value the funding target means that lump sums will always produce gains or losses.

Only item III is true.

Answer is D

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Problem 5

Similar to 2010 #25

This problem is a simple one on selection of funding assumptions.

ASSERTION

This is false. If a participant is entitled to post-retirement medical benefits, they would be more likely to retire early. This will increase the cost of the pension benefits.

REASON

This is false. Actuarial assumptions can (and should) reflect the actuary's best estimate of future experience.

Answer is E

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Problem 6 – Page 1

This is the first question asked on using end of year valuation dates. The key point is how you adjust the prefunding balance from 01/01 to the 12/31 valuation date.

The problem asks for the "smallest amount" at 09/15/15. Based on 2013 exam conditions 31 and 32, the plan sponsor elects to offset both the CB and the PB against the minimum contribution under IRC 430. Based on 2013 exam condition 35, the "smallest amount" reflects offsetting both the CB and the PB against the minimum required contribution (MRC).

Funding Shortfall

The first step is calculation of the funding shortfall. If this amount is zero, then the definition of the minimum required contribution (MRC) will be different.

By definition, the components of the funding shortfall are determined at the valuation date. You must adjust the prefunding balance from 01/01 to the 12/31 valuation date. When the valuation date is not the first day of the plan year, you must use the effective interest rate to adjust the balances.

$$12/31/14 \text{ PB} = (01/01/14 \text{ PB}) * (1 + 2014 \text{ EIR})$$

$$\begin{aligned} \text{Funding S/F} &= \text{Funding target} - (\text{AAV} - \text{CB} - \text{PB}) \\ &= 350,000 - (360,000 - 0 - 40,000 * 1.06) \\ &= 32,400 \end{aligned}$$

Shortfall Base Exemption

The transition rule for the applicable percentage expired at the end of the 2010 plan year. The modified funding shortfall is identical to the previously calculated Funding shortfall:

$$\begin{aligned} \text{Modified S/F} &= 100\% * (\text{Funding target}) - (\text{AAV} - \text{PB}) \\ &= 350,000 - (360,000 - 40,000 * 1.06) \\ &= 32,400 \end{aligned}$$

Shortfall amortization installment

The plan is not eligible for the shortfall base exemption. You have to set up the 2014 shortfall amortization base, which is equal to

1. 100% times the Funding target
2. Minus the Actuarial asset value reduced by both CB and PB
3. Minus the present value of prior years' shortfall and waiver amortization installments

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Problem 6 – Page 2

This problem states that the prior shortfall bases are zero. The 2014 shortfall base is the same as the Funding shortfall, or 32,400.

You must calculate the shortfall amortization installment for 2014. The problem gives the 7 year annuity factor:

$$\begin{aligned}\text{S/F amort} &= 32,400 / 5.9200 \\ &= 5,473\end{aligned}$$

$$\text{S/F charge} = 5,473$$

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

Minimum Required Contribution

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

$$\begin{aligned}\text{MRC} &= \text{TNC} + \text{Shortfall amort charge} + \text{Waiver amort charge} \\ &= 100,000 + 5,473 + 0 \\ &= 105,473\end{aligned}$$

Smallest amount

The problem asks for “the smallest amount that satisfies the minimum funding standard”, as of 09/15/2015. The first step is to calculate this amount at the valuation date:

$$\begin{aligned}12/31/14 \\ \text{Smallest contr} &= \text{MRC} - \text{CB} - \text{PB} \\ &= 105,473 - 0 - 40,000(1.06) \\ &= 63,073\end{aligned}$$

The plan sponsor makes a contribution of X at 09/15/2015. The discounted value of the contributions paid (using the 2014 effective interest rate of 6.0%) is equal to the “smallest amount” at 12/31/2014:

$$\begin{aligned}63,073 &= X \cdot (1.06)^{-8.5/12} && \text{(using compound interest)} \\ X &= 63,073 \cdot (1.06)^{8.5/12} \\ &= 65,731\end{aligned}$$

Answer is B

(see note on next page)

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Problem 6 – Page 3

Revised 10/15/15

NOTE

You will get the same answer range if you use simple interest:

$$\text{PV of contrib} = X / [(1 + .06*(8.5/12))] \quad (\text{using simple interest})$$

$$\begin{aligned} X &= 63,073 * [1 + .06*(8.5/12)] \\ &= 65,754 \end{aligned}$$

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Problem 7

This problem is a simple one on changing interest assumptions.

I. TRUE

You can change from using segment rates to the full yield curve without getting approval from the IRS. See IRC 430(h)(2)(D)(ii).

II. FALSE

In general, you must get approval from the IRS to revoke the election to use the full yield curve. See IRC 430(h)(2)(D)(ii). The trick to this question is that there was a temporary exception under MAP-21, but only if the actuary notified the plan by 07/05/2013.

III. FALSE

In general, the valuation is based on using segment rates based on the month containing the valuation date. You can elect up to a 4 month lookback period without getting approval from the IRS.

If currently using a lookback period, you must get approval from the IRS to revoke the election (and use no lookback period). See IRC 430(h)(2).

Only item I is true.

Answer is B

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Problem 8

TRUE

This is what the actuary certifies when they sign the Schedule SB:

"Each prescribed assumption was applied in accordance with applicable law and regulations. In my opinion, each other assumption is reasonable (taking into account the experience of the plan and reasonable expectations) and such other assumptions, in combination, offer my best estimate of anticipated experience under the plan."

Answer is A

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Problem 9

Similar to 2010 #29

TRUE

In IRC 430(h), it states that all plans must use pre-retirement mortality. This requirement goes against common practice for small plans, which often use no pre-retirement mortality.

The final regulations allow use of no pre-retirement mortality for certain small plans. This option is only allowed for plans with less than 100 participants who are not in pay status. Since this plan has less than 100 participants in total, there must be less than 100 participants who are not in pay status.

Answer is A

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Problem 10

This problem is a very detailed one on the "annuity substitution rule" for valuing lump sums. This is in the regulation at 1.430(d)-1(f)(4)(iii)(B):

(B) Substitution of annuity form.

*Except as otherwise provided in this paragraph (f)(4)(iii), the present value of a distribution is determined in accordance with this paragraph (f)(4)(iii) if that present value is determined as the present value, using special actuarial assumptions, of the annuity (either the deferred or immediate annuity) which is used under the plan to determine the amount of the distribution. Under these special assumptions, for the period beginning with the expected annuity starting date for the distribution, **the current applicable mortality table under section 417(e)(3) that would apply to a distribution with an annuity starting date occurring on the valuation date is substituted for the mortality table under section 430(h)(3) that would otherwise be used.** In addition, under these special assumptions, the valuation interest rates under section 430(h)(2) are used for purposes of discounting the projected annuity payments from their expected payment dates to the valuation date (as opposed to the interest rates under section 417(e)(3) which the plan uses to determine the amount of the benefit).*

I. TRUE

This is the key requirement, which is shown in the bolded text above.

II. FALSE

In the sentence following the bolded text, it allows use of the valuation interest rates.

III. FALSE

When optional form benefits can produce gains or losses, you must make an assumption of how many participants will elect that optional form (see IRC 430(h)(4)). For a single employer plan, the use of the regular valuation segment rates to value the lump sums will always produce gains or losses.

Only item I is true.

Answer is E

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Problem 11

This problem is a simple one on selection of retirement age assumptions.

ASSERTION

This is true. The sole participant can actually tell you what age they expect to retire, and that would be your best estimate.

REASON

This is a true statement, but not a good explanation. As described earlier, you should use the age when the sole participant actually expects to retire.

Answer is B

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Problem 12 – Page 1

Similar to 2011 #39

Revised 07/16/15

This is a confusing question on the quarterly contribution requirement. The key point of this question is knowing how you discount the “payments made” back to the valuation date. The reason I put that in quotation marks is that there are no payments made until 09/15/2015.

In this problem, you are given all the information you require. The key idea of the problem is that the 2014 plan year contributions are normally discounted back to the valuation date using the 2014 effective interest rate (EIR). During any time period for which there is an underpayment of the required quarterly installments, the interest rate used for discounting is increased by 5%.

The problem gives the 2014 minimum required contribution (MRC) as 105,000. The prefunding balance at 01/01/2014 is 90,000. At 08/15/2015, the plan sponsor elects to use the entire prefunding balance (PB) to satisfy the quarterly contribution requirements. The discounting rules work the same way for using the PB as they do for actual contributions.

This problem does not give you the number of days, which simplifies the calculations. You can count the periods for discounting based on half-months.

<u>Due date</u>	<u>Required Installment</u>	<u>Amount Available</u>	<u>OVER (UNDER)</u>	<u>Months</u>
04/15/2014	20,000	0	(20,000)	3.5
07/15/2014	20,000	0	(20,000)	6.5
10/15/2014	20,000	0	(20,000)	9.5
01/15/2015	20,000	0	(20,000)	12.5
08/15/2015		80,000	Zero	19.5
09/15/2015		X	X	20.5

Each underpayment is eliminated by the election at 08/15/15. The period of underpayment is measured from each due date to 08/15/2015. Each payment shown above will be discounted for a total of 19.5 months.

Payments will be discounted at the effective interest rate of 7.0% from the valuation date up to the due date. Payments will be discounted at the penalty rate (12.0% = 5.0% + 7.0%) between the due date and 08/15/2015.

You need to calculate the present value of the two “contributions” - the 80,000 PB at 08/15/2015 and the final payment of X at 09/15/2015.

$$\begin{aligned} PV &= 20,000 * [(1.07)^{-3.5/12} (1.12)^{-16/12} + (1.07)^{-6.5/12} (1.12)^{-13/12} + (1.07)^{-9.5/12} (1.12)^{-10/12} \\ &\quad + (1.07)^{-12.5/12} (1.12)^{-7/12}] + X (1.07)^{-20.5/12} \\ &= 20,000 * [.8430 + .8526 + .8624 + .8723] + X * (.8908) \\ &= 68,607 + .8908X \end{aligned}$$

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Problem 12 – Page 2

Prefunding balance

The complication in this problem is the handling of the PB, and determining the value of the final contribution at 09/15/15. 80,000 of the PB is used to satisfy the quarterly contribution requirements.

The remaining PB at 01/01/14 that can be used to satisfy the MRC is determined by discounting the 80,000 from the 08/15/15 election date back to 01/01/14 using the 2014 EIR. This rule in the final regulation (at 1.430(f)-1(d)(1)(i)(B)) only uses the 2014 effective interest rate and ignores the penalty rate, which seems strange. But there is some logic to it, since it results in the smallest remaining amount of PB to apply towards the MRC. This produces a larger value for the final contribution of X.

$$\begin{aligned} &01/2014 \\ &\text{remaining} \\ \text{PB} &= 90,000 - 80,000(1.07)^{-19.5/12} \\ &= 90,000 - 71,671 \\ &= 18,329 \end{aligned}$$

Smallest amount

The problem asks for “the smallest amount that satisfies the minimum funding standard”, as of 09/15/2015. The first step is to calculate this amount at the valuation date:

$$\begin{aligned} &01/01/14 \qquad \qquad \text{remaining} \\ \text{Smallest contr} &= \text{MRC} - \text{CB} - \text{PB} \\ &= 105,000 - 0 - 18,329 \\ &= 86,671 \end{aligned}$$

The plan sponsor makes a final contribution of X at 09/15/2015. The discounted value of the contributions paid (from the prior page) is equal to the “smallest amount” at 01/01/2014:

$$\begin{aligned} \text{PV of contrib} &= 68,607 + .8908X && \text{(using compound interest)} \\ &= 86,671 \\ \\ .8908X &= 86,671 - 68,607 \\ X &= 18,064 / .8908 \\ &= 20,276 \end{aligned}$$

Answer is D

NOTE

I am sure you will get the same answer range if you use simple interest. I will leave that as an exercise for the student.

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Problem 13 – Page 1

Revised 09/08/15

The key point of this question is how you handle the change in benefits due to the amendment at 01/01/2014. In general, the funding target and target normal cost are determined based on the plan benefits in effect during the plan year.

To calculate the effect of the amendment, you must do two sets of calculations. Prior to the plan amendment, benefits are defined based on 5 year average compensation. After the plan amendment, benefits are defined based on 3 year average compensation.

The Funding Target is defined as the present value of the accrued benefit. It is similar to the traditional Unit Credit accrued liability. The Target normal cost is defined as the present value of the increase in the accrued benefit during the year.

At 01/01/2014

Age	39
Service	6 years

Based on the default exam conditions, normal retirement age is 65, and the benefit is assumed payable monthly, starting at normal retirement age. The participant is currently 26 years from retirement, so their benefit payments will be valued using only the third segment rate.

POST-Amendment - "FAE3" calculations

The calculation of the Funding target uses the accrued benefit at 01/2014. Here is the formula for the Funding target using monthly annuity rates:

$$FT = AB * [{}_{26|} \ddot{a}_{39 \text{ seg}_3}^{(12)}]$$

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

$$NC = (\Delta AB) * [{}_{26|} \ddot{a}_{39 \text{ seg}_3}^{(12)}]$$

You need to determine the accrued benefit at the valuation date, and the benefit accrual during 2014. One minor trick to the problem is that the pay decreased from 2010 to 2011. You need to be careful that you look at those earlier years, since the benefit is defined based on the average of the highest consecutive years.

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Problem 13 – Page 2

Revised 09/08/15

POST-Amendment - "FAE3" calculations - continued

The problem gives you the 2013 compensation, and the salary scale assumption. The 2014 compensation reflects that salary assumption:

Valuation date	01/01/2014	01/01/2015
Age	39	40
Past service	6	7
Prior year comp	54,000	54,000*1.04 = 56,160
Highest consecutive FAE3	(50,000 + 55,000 + 57,500)/3 = 54,167	(52,000 + 54,000 + 56,160)/3 = 54,053 54,167
Accrued benefit	54,167*6*10% = 32,500	54,167*7*10% = 37,917

As noted on the prior page, the FAE3 can't decrease.

$$\Delta AB = 5,416.67$$

$$\begin{aligned} FT &= AB * [{}_{26|} \ddot{a}_{39 \text{ seg } 3}^{(12)}] \\ &= 32,500(1.075)^{-26} \ddot{a}_{65}^{(12)} \text{ at } 7.5\% \\ &= 32,500(.1525)(10.0) \\ &= 49,575 \end{aligned}$$

$$\begin{aligned} NC &= 5,416.67(1.075)^{-26} \ddot{a}_{65}^{(12)} \text{ at } 7.5\% \\ &= 8,263 \end{aligned}$$

Minimum required contribution

The problem asks for the change in the minimum required contribution (MRC). Based on 2013 exam condition 34, this amount does not reflect a reduction for the funding standard carryover balance (CB) or for the prefunding balance (PB).

Funding Shortfall

The first step is calculation of the funding shortfall. If this amount is zero, then the definition of the minimum required contribution (MRC) will be different.

$$\begin{aligned} \text{Funding S/F} &= \text{Funding target} - (\text{AAV} - \text{CB} - \text{PB}) \\ &= 49,475 - (50,000 - 0 - 1,000) \\ &= 575 \end{aligned}$$

POST-Amendment - "FAE3" calculations - continued

The small magnitude of the shortfall should set off warning bells. As indicated by the answer ranges, the effect of the plan amendment is quite small.

Shortfall Base Exemption

The transition rule for the applicable percentage expired at the end of the 2010 plan year. The modified funding shortfall is not the same as the previously calculated Funding shortfall. This is pretty tricky - you have to read the problem data very carefully. The plan sponsor elects not to use the prefunding balance.

$$\begin{aligned}\text{Modified S/F} &= 100\% * (\text{Funding target}) - (\text{AAV} - 0) \\ &= 49,475 - (50,000 - 0) \\ &= \text{zero}\end{aligned}$$

Shortfall amortization installment

The plan is eligible for the shortfall base exemption. The 2014 shortfall amortization charge is equal to zero.

Minimum Required Contribution

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

$$\begin{aligned}\text{MRC} &= \text{TNC} + \text{Shortfall amort charge} + \text{Waiver amort charge} \\ &= 8,263 + 0 + 0 \\ &= 8,263\end{aligned}$$

PRE-Amendment - "FAE5" calculations

Now you need to re-do all the prior steps using the plan provisions before the amendment.

Valuation date	01/01/2014	01/01/2015
Age	39	40
Past service	6	7
Prior year comp	54,000	$54,000 * 1.04$ $= 56,160$
Highest consecutive FAE5	$(55,000 + 57,500 + 49,000 + 52,000 + 54,000) / 5$ $= 53,500$	$(57,500 + 49,000 + 52,000 + 54,000 + 56,160) / 5$ $= 53,732$
Accrued benefit	$53,500 * 6 * 10\%$ $= 32,100$	$53,732 * 7 * 10\%$ $= 37,612$

PRE-Amendment - "FAE5" calculations - continued

$$\Delta AB = 5,512.40$$

$$\begin{aligned} FT &= AB * [{}_{26|} \ddot{a}_{39 seg_3}^{(12)}] \\ &= 32,100(1.075)^{-26} \ddot{a}_{65}^{(12)} \text{ at } 7.5\% \\ &= (32,100/32,500) * 49,575 \\ &= 48,965 \end{aligned}$$

$$\begin{aligned} NC &= 5,512.40(1.075)^{-26} \ddot{a}_{65}^{(12)} \text{ at } 7.5\% \\ &= (5,512.40/5,416.67) * 8,263 \\ &= 8,409 \end{aligned}$$

This is an interesting result. The plan amendment increased the benefit, so the funding target was lower prior to the plan amendment. But the amendment changed the pattern of benefit accruals, so the target normal cost was higher prior to the plan amendment.

Funding Shortfall

The first step is calculation of the funding shortfall. If this amount is zero, then the definition of the minimum required contribution (MRC) will be different.

$$\begin{aligned} \text{Funding S/F} &= \text{Funding target} - (\text{AAV} - \text{CB} - \text{PB}) \\ &= 48,965 - (50,000 - 0 - 1,000) \\ &= \text{zero} \end{aligned}$$

Shortfall Base Exemption

Since the funding shortfall is zero, all shortfall bases are eliminated. The shortfall amortization installment is also 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.

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

Since the Funding shortfall is limited to zero, the Minimum required contribution is equal to the Target normal cost, plus the Funding target less the AAV (after reduction for both the CB and the PB).

PRE-Amendment - "FAE5" calculations - continued

$$\begin{aligned}\text{MRC} &= \text{TNC} + \text{Funding target} - (\text{AAV} - \text{CB} - \text{PB}) \\ &= 8,409 + 48,965 - (50,000 - 0 - 1,000) \\ &= 8,373\end{aligned}$$

Change in MRC due to amendment

Now you can calculate the value of X, which is the change in the MRC due to amendment:

$$\begin{aligned}X &= (\text{post-amendment MRC}) \text{ minus } (\text{pre-amendment MRC}) \\ X &= 8,263 - 8,373 \\ &= -110\end{aligned}$$

Answer is A

NOTES

1. The answer ranges are not based on absolute values in this problem. You have to be careful to get the sign correct in the final calculation.
2. If you try to shortcut the final steps of the solution, then you could get lucky. For example, you could incorrectly assume the pre-amendment MRC will be the target normal cost of 8,409. The resulting value of X is -146, which falls in the same answer range.

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Problem 14 – Page 1

Similar to EA-2L 2011 #21

To work this problem, you must know various rules in the 436 regulation regarding deemed reduction in funding balances, computation of the presumed adjusted funding target, presumed adjusted funding target attainment percentage (AFTAP) and the interim adjusted value of assets.

Presumed adjusted funding target

In this problem, the 2014 valuation is not completed until 05/02/2014. The 2013 AFTAP was certified as 89%. Prior to April 1, the presumed 2014 AFTAP has the same value as the 2013 AFTAP, or 89%.

Since the 2014 AFTAP is not certified by April 1, the presumed AFTAP becomes 79% at 04/01/2014. This is due to the “10% haircut” in the regulations. This is only done if the presumed AFTAP crosses the boundary values of 60% or 80%.

The problem states that the plan pays benefits under a Level Income option. Since this provides a benefit that exceeds the amount under a straight life annuity, the plan is subject to the IRC 436(d) restrictions.

Under the regulation, you must derive a value for the funding target that corresponds to the value of the presumed AFTAP at 04/01/2014:

Presumed adjusted FT = (Interim value of adjusted assets) / (presumed AFTAP)

Interim value of adjusted assets

The interim value of adjusted assets is defined as the valuation assets minus three items:

- Carryover balance (CB)
- Prefunding balance (PB)
- Value of any receivable contribution for the prior plan year

At 01/01/2014, there is a receivable contribution of X for 2013, which is paid at 05/01/2014. You are given the “actuarial value of assets” as 550,000, which excludes the receivable contribution. This asset value is not the true AAV, which is defined in 430(g) to include the present value of any receivable contributions.

Interim value of

Adj assets = AAV - CB - PB - (PV of 2013 receivable)
 = 550,000 + (PV of 2013 receivable) - 10,000 - 5,000 - (PV of 2013 receivable)
 = 535,000

Since the presumed AFTAP is 89% at 01/01/2014, the plan is not subject to any restrictions under 436(d). There are no “deemed reductions” in the CB or PB at 01/01/2014.

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The presumed adjusted funding target is a totally fictitious amount that corresponds to the presumed AFTAP. The regulation at 1.436-1(g)(2)(ii) says the rules in 1.436-1(a)(5) (deemed elections to reduce the CB and PB) must be applied based on the presumed AFTAP (and the presumed adjusted funding target).

As described earlier, the presumed AFTAP reduces to 79% at 04/01/2014. You must determine the presumed adjusted funding target that corresponds to the presumed AFTAP of 79%:

04/01/2014

$$\begin{aligned}\text{Presumed adj FT} &= 535,000 / 79.0\% \\ &= 677,215\end{aligned}$$

Presumed AFTAP - deemed reduction in CB / PB

In order to pay benefits under the Level Income option, the presumed AFTAP must be at least 80%. You need to calculate the deemed reductions in the CB and PB at 04/01/2014 so the presumed AFTAP satisfies IRC 436(d) at that date.

Presumed adjusted

$$\text{AFTAP} = \frac{\text{NHAP} + (\text{interim adj AAV})}{\text{NHAP} + \text{presumed adjusted funding Target (non At-Risk)}}$$

04/01/2014

Presumed adjusted

$$\begin{aligned}\text{AFTAP} &= \frac{0 + 550,000 - (10,000 + 5,000 - Y)}{0 + 677,215} \\ &= 80.0\%\end{aligned}$$

$$\begin{aligned}Y &= 80.0\%(677,215) - 535,000 \\ &= 6,772\end{aligned}$$

Note that this calculation does not include the 2013 contribution of X, since it is not paid until 05/01/2014. The final AFTAP calculation at 05/02/2014 will include that contribution.

The CB must be reduced by 6,772, which produces a presumed AFTAP of 80% at 04/01/2014.

Certified 2014 AFTAP

The 01/01/2014 valuation is completed at 05/02/2014, and the final AFTAP is certified at 92%. The contribution of X must be adjusted to reflect the payment date of 05/01/2014.

$$\begin{aligned}\text{AFTAP} &= \frac{\text{NHAP} + \text{AAV} - (\text{CB} + \text{PB} - 6,772) + X(1.07)^{-4/12}}{\text{NHAP} + \text{Funding Target (non At-Risk)}} \\ &= 92\%\end{aligned}$$

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$$\begin{aligned}\text{AFTAP} &= \frac{0 + 550,000 - (10,000 + 5,000 - 6,772) + X(1.07)^{-4/12}}{0 + 640,000} \\ &= 92.0\%\end{aligned}$$

$$X(1.07)^{-4/12} = 92.0\%(640,000) - (550,000 - 8,228)$$

$$\begin{aligned}X &= (1.07)^{4/12}(47,028) \\ &= 48,101\end{aligned}$$

Answer is B

NOTE

You get the same answer range if you decide to use simple interest to adjust the contribution:

$$\begin{aligned}X &= [1 + .07(4/12)](47,028) \\ &= 48,125\end{aligned}$$

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Problem 15

Similar to 2012 #14

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

The main point of this problem is determination of the Funding target and the Target normal cost. The Target normal cost is the present value of the change in the accrued benefit during the year. Under a cash balance plan, the accrued benefit increases due to the pay credit for the year.

The problem asks for the sum of the Target normal cost and the Funding target. The Target normal cost is the present value at 12/31/14 of the projected value at normal retirement age (NRA) of this year's pay credit. The Funding target is the present value at 12/31/14 of the projected value at NRA of the hypothetical balance at 12/31/14.

The problem gives you the hypothetical balance at 01/01/2014 and 12/31/2014, and states that the pay credit occurs at the end of the year. You can save some time by not calculating the value of the pay credit for 2014.

The hypothetical account at 12/31/14 is equal to the sum of the 2014 pay credit plus the 12/31/14 value of the "accrued benefit", which is the hypothetical balance at 01/01/14. To project both items to NRA, you use the interest crediting rate of 4.50%.

Valuation date	12/31/2014
Age	46
Account balance plus Pay credit at 12/31/14	155,000
Normal Retirement age	65
Projected balance at NRA	$357,718 = 155,000(1.045)^{19}$

The present value calculation is based on the segment rates. The problem states that benefits are assumed to be paid at NRA in a lump sum. Since there is a single benefit payment at NRA, you discount the lump sum value of the pay credit using a single segment rate. The present value of the lump sum payment at 65 is calculated using the second segment rate of 6.5%:

$$\begin{aligned} \text{FT} + \text{TNC} &= 357,718(D_{65} / D_{46}) \\ &= 357,718(1+i)^{-19}({}_{19}p_{46}) \\ &= 357,718(1.065)^{-19} \\ &= 108,118 \end{aligned}$$

Answer is D

NOTE

Based on the default exam conditions, there is no pre-retirement mortality.

FALSE

This problem is a simple one on funding status definitions for multiemployer plans. A plan is in "endangered" status if it is not in critical status for plan year, and it satisfies either (1) or (2) below.

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

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

This plan is in critical status, since it satisfies the definition in 432(b)(2)(D). That definition can be summarized as follows:

"For the current and the 4 succeeding plan years, the market value of assets plus present value of contributions is less than the present value of all benefit payments and expenses"

The 350,000 market value of assets plus the 450,000 present value of contributions is less than the 890,000 present value of benefit payments.

Answer is B

NOTE

A plan is in critical status if it satisfies one (or more) of the definitions in 432(b)(2)(A) through 432(b)(2)(D) at the start of the plan year.

These definitions range from fairly simple to ridiculously complicated:

- 432(b)(2)(A)
Funded percentage < 65%, and for the current and the 6 succeeding plan years, the market value of assets plus PV of contributions < PV of nonforfeitable benefit payments and expenses
- 432(b)(2)(B)(i)
Plan has accumulated funding deficiency for the current year, ignoring extension of amortization periods

Problem 16 – Page 2

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

For the current and the 4 succeeding plan years, the market value of assets plus PV of contributions $<$ PV of all benefit payments and expenses

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Problem 17 – Page 1

Similar to 2007 #17

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. This is a simplified problem, since you are given all the necessary values to determine the deductible limit.

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 2013 exam condition #27, the §431 asset values are given in exam problems.

$$\begin{aligned}\text{Deductible limit} &= (321,000 + 139,000) * [1.08] \\ &= 496,800\end{aligned}$$

The second step is to check the Full Funding Limitation (FFL) under 404. You are given the ERISA FFL as 4,659,000. You don't need to check the RPA FFL, since that can only make the final FFL even larger.

The final 404 FFL is the greater of the two FFL values. The 404 FFL does not apply, and the deductible limit remains 496,800.

The third step would be to calculate "the smallest amount that satisfies the minimum funding standard" under IRC 431. You are given this amount as 250,000, which is less than the 404 deductible limit. At this point, the 404 deductible limit is the greater of 250,000 and 496,800.

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 that is used to calculate the 404 FFL. One key to the solution is that multiemployer plans use 140% of the current liability in the calculation:

$$\begin{aligned}\text{\$404 "RPA 94" UCL} &= 140\% * (12/31 \text{ CL}) - (1+i) * (\text{AAV}) && \text{(if no benefit payments)} \\ &= 1.40 * 12,201,000 - 9,021,000 \\ &= 8,060,400\end{aligned}$$

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Problem 17 – Page 2

The 404 UCL produces the final result for the deductible limit, since it exceeds the previously calculated value of 496,800. The final deductible limit is 8,060,400.

Answer is D

NOTE

The answer ranges in this problem are VERY large. Even if you did not think about the 404 UCL, it should be clear that the correct answer could not be 496,400. That value is too small, and falls outside the “implied answer range” for answer A.

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Problem 18 – Page 1

This problem is a confusing one on gains and losses and cash balance plans.

I. FALSE

The termination benefit is defined as a lump sum distribution. But it is not equal to the cash balance account, since it is actuarially equivalent to the single life annuity benefit. You don't need to do any analysis here. Regardless of how many people terminate, there should be no gain / loss (since it is actuarially equivalent).

II. FALSE

Note that the death benefit is equal to the cash balance account. As a result, there will be a G/L on death. The non-investment G/L is defined as the difference between the actual liability and the expected accrued liability (the expected funding target).

Assume you have a participant whose current age is x , and their current cash balance account is CB_x . Their accrued benefit under the plan is based on the cash balance account projected to age 65, using the interest crediting rate of 5%:

$$\begin{aligned}\text{Accrued ben} &= (1.05)^{65-x}(CB_x) / \ddot{a}_{65}^{(12)} && \text{(annuity at segment rate } j) \\ \text{LS at 65} &= (1.05)^{65-x}(CB_x)\end{aligned}$$

Their funding target consists of the present value of this amount, discounted at one of the three segment rates (which depends on their current age x).

$$\text{FT at } x = (1.05)^{65-x}(CB_x) / (1+j)^{65-x}$$

Note that all three of the segment rates are greater than 5%. No matter what their current age is, the funding target will be less than the death benefit. Any death under the plan results in an actuarial loss - not an actuarial gain.

III. FALSE

The assumed retirement benefit is defined as either a single life annuity or a lump sum distribution (actuarially equivalent to the life annuity). You don't need to do any analysis here. Regardless of how many people retire, there should be no gain / loss (since both benefits are actuarially equivalent).

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Problem 18 – Page 2

None of the items are true.

Answer is A

NOTE

This question generated quite a bit of discussion on the Actuarial Outpost after the exam. I think it was too easy to overthink the third item. For example, some students started thinking about the difference between valuation assumptions and actual lump sum payments to participants. But that is not the same as the definition of the non-investment G/L for valuation purposes.

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Problem 19 – Page 1

Similar to 2012 #41

The key to this problem is knowing the gain / loss formulas. The problem asks for the mortality G/L for one retiree who survives during 2014.

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

Smith apparently retired at 01/01/2014 at age 65 with a life annuity payment form. Since the participant is retired, the normal cost is zero.

At 01/01/2015, Smith is still alive. One complicating factor in the solution is that benefits are payable monthly (not annually).

$$\begin{aligned}AL_0 &= 12(8,000) \ddot{a}_{65}^{(12)} \\ &= 96,000(10.28) \\ &= 986,880\end{aligned}$$

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

One key point of the problem is handling the monthly interest on the benefit payments.

12/31/2014

$$\begin{aligned}\text{BP} + \text{int} &= 8,000[12 + .07(12/12 + 11/12 + \dots + 1/12)] \\ &= 8,000[12 + (.07/12)(12 + 11 + \dots + 1)] \\ &= 8,000[12 + \frac{(.07)(12)(13)}{2}] \\ &= 8,000(12)[1 + (.07)(13/24)] \\ &= 99,640\end{aligned}$$

$$\begin{aligned}{}_eAL_1 &= (1+i)(AL_0 + \text{zero}) - (\text{actual benefit payments} + i) \\ &= 1.07 \cdot 986,880 - 99,640 \\ &= 956,322\end{aligned}$$

$$\begin{aligned}AL_1 &= 12(8,000) \ddot{a}_{66}^{(12)} \\ &= 96,000(10.06) \\ &= 965,760\end{aligned}$$

$$\begin{aligned}\text{Non-inv G/L} &= {}_eAL_1 - AL_1 \\ &= 956,322 - 965,760 \\ &= 9,438 \text{ Loss}\end{aligned}$$

Answer is E

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Problem 19 – Page 2

There is another method of solution, which assumes you know the G/L resulting from various cases of death or survival for a straight life annuity benefit. Assume you have a monthly life annuity of \$1, payable at age x :

Survival case: produces loss $q_x * \ddot{a}_{x+1}^{(12)} + 11/24 * q_x$

Death case: produces gain ${}_eAL_1$
 $= (1+i)(\ddot{a}_x^{(12)} + \text{zero}) - (\text{actual benefit payments} + i)$

Since Smith survived, there is a loss. To calculate the amount, you must solve for the value of q_{65} . This is done using the relationship between annual life annuity values at ages 65 and 66:

$$q_{65} = 1 - p_{65}$$

$$\ddot{a}_x = 1 + v(p_x) \ddot{a}_{x+1}$$

$$\ddot{a}_x - 1.0 = v(p_x) \ddot{a}_{x+1}$$

$$p_x = (1+i)(\ddot{a}_x - 1.0) / \ddot{a}_{x+1}$$

$$p_{65} = (1+i)(\ddot{a}_{65} - 1.0) / \ddot{a}_{66}$$

$$\ddot{a}_x^{(12)} = \ddot{a}_x - 11/24$$

$$\begin{aligned}\ddot{a}_{65} &= \ddot{a}_{65}^{(12)} + 11/24 \\ &= 10.28 + .4583 \\ &= 10.7383\end{aligned}$$

$$\begin{aligned}\ddot{a}_{66} &= \ddot{a}_{66}^{(12)} + 11/24 \\ &= 10.06 + .4583 \\ &= 10.5183\end{aligned}$$

$$\begin{aligned}p_{65} &= (1.07)(10.7383 - 1.0) / 10.5183 \\ &= .9907\end{aligned}$$

$$\begin{aligned}q_{65} &= 1 - p_{65} \\ &= .0093\end{aligned}$$

$$\begin{aligned}\text{Loss} &= q_x * \{ \ddot{a}_{x+1}^{(12)} + 11/24 \} \\ &= 12(8,000)[.0093 \{ 10.06 + .4583 \}] \\ &= 9,438\end{aligned}$$

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Problem 20 – Page 1

Similar to 2012 #28

The key to this problem is knowing the WRERA changes to the definition of the Target normal cost in IRC 430(b)(1). Those changes allow for the addition of expected plan-related expenses and the subtraction of expected mandatory employee contributions.

The problem asks for the "smallest amount" at 01/01/14. Based on 2013 exam conditions 31 and 32, the plan sponsor elects to offset both the CB and the PB against the minimum contribution under IRC 430. Based on 2013 exam condition 35, the "smallest amount" reflects offsetting both the CB and the PB against the minimum required contribution (MRC).

Funding Shortfall

The first step is calculation of the funding shortfall. If this amount is zero, then the definition of the minimum required contribution (MRC) will be different:

$$\begin{aligned}\text{Funding S/F} &= \text{Funding target} - (\text{AAV} - \text{CB} - \text{PB}) \\ &= 3,100,000 - (2,900,000 - 200,000 - 0) \\ &= 400,000\end{aligned}$$

Shortfall Base Exemption

The transition rule for the applicable percentage expired at the end of the 2010 plan year. The modified funding shortfall is different from the previously calculated Funding shortfall:

$$\begin{aligned}\text{Modified S/F} &= 100\% * (\text{Funding target}) - (\text{AAV} - \text{PB}) \\ &= 3,100,000 - (2,900,000 - 0) \\ &= 200,000\end{aligned}$$

Shortfall amortization installment

The plan is not eligible for the shortfall base exemption. You have to set up the 2014 shortfall amortization base, which is equal to

1. 100% times the Funding target
2. Minus the Actuarial asset value reduced by both CB and PB
3. Minus the present value of prior years' shortfall and waiver amortization installments:

This problem states that the PV of prior shortfall amortization installments is zero. The 2013 shortfall base is the same as the Funding shortfall, or 400,000.

You must calculate the shortfall amortization installment for 2014. The problem gives the 7 year annuity factor:

$$\begin{aligned}\text{S/F amort} &= 400,000 / 5.9200 \\ &= 67,568\end{aligned}$$

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Problem 20 – Page 2

$$\text{S/F charge} = 67,568$$

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.

Target normal cost

The problem states that the PV of mandatory employee contributions expected for the year is 16,000:

$$\begin{aligned} 01/2014 \text{ TNC} &= 200,000 - 16,000 \text{ employee contributions} \\ &= 184,000 \end{aligned}$$

Minimum Required Contribution

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

$$\begin{aligned} \text{MRC} &= \text{TNC} + \text{Shortfall amort charge} + \text{Waiver amort charge} \\ &= 184,000 + 67,568 + 0 \\ &= 251,568 \end{aligned}$$

Smallest amount

The problem asks for “the smallest amount that satisfies the minimum funding standard” as of 01/01/2014.

$$\text{Smallest contr} = \text{MRC} - \text{CB} - \text{PB}$$

$$\begin{aligned} X &= 251,568 - 200,000 - 0 \\ &= 51,568 \end{aligned}$$

Answer is D

Problem 21

Revised 10/19/16

This problem is a simple one on the multiemployer funding improvement plan under IRC 432.

I. FALSE

IRC 432(c)(3)(A)(i) defines the change in the funded percentage during the funding improvement period for endangered plans (or seriously endangered plans). In neither case does the funded percentage increase by 20%. For endangered plans it increases by 33% of the difference between 100% and the plan's funded percentage over a 10 year period. For seriously endangered plans, it increases by 20% of the difference between 100% and the plan's funded percentage over a 15 year period.

II. TRUE

IRC 432(c)(3)(A)(ii) states that the plan must avoid funding deficiencies during the funding improvement period.

III. FALSE

The definitions for a funding improvement plan do not allow for reduction in any early retirement benefits or retirement-type subsidies. But this is possible for plans in critical status (see below).

Only item II is true.

Answer is C

NOTES

1. IRC 432(e) describes the requirement that a multiemployer plan in critical status must adopt a rehabilitation plan.

IRC 432(e)(8) describes which plan benefits may be reduced to meet the requirements of IRC 432. There is a definition of "adjustable benefits" in IRC 432(e)(8)(A)(iv). The definition includes early retirement benefits or retirement-type subsidies. Based on the exception in IRC 432(e)(8)(A)(ii), the plan is not allowed to reduce benefits that are already in pay status.

2. Item II above is no longer a true statement. Based on MEPRA 2014, a plan only has to avoid a funding deficiency for the final year of the funding improvement period.

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Problem 22

Similar to 2012 #33

FALSE

In a typical valuation, you use the IRC 430(h)(2)(c) segment rates to value the funding target and target normal cost. As described in Notice 2009-22, you must limit the assumed return on assets so it does not exceed the third segment rate at each valuation date.

In this problem, the valuation is based on the full yield curve, so the segment rates are not used for the valuation. In that case, the assumption for expected earnings can not exceed the average of the third segment rates for the 24-month period ending with the month preceding the month that contains the valuation date for the plan year.

Answer is B

Problem 23 – Page 1

Similar to 2012 #04

Revised 09/08/15

The key point of this question is knowing how to handle post-PPA 2006 waivers. This is a relatively “forgiving” question, since you might get into the correct answer range if you determine the waiver amortization factor incorrectly.

This problem asks for “the minimum required contribution”. Based on 2013 exam condition 34, this amount does not reflect a reduction for the funding standard carryover balance (CB) or for the prefunding balance (PB).

Funding Shortfall

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

$$\begin{aligned}\text{Funding S/F} &= \text{Funding target} - (\text{AAV} - \text{CB} - \text{PB}) \\ &= 7,700,000 - (5,200,000 - 20,000 - 80,000) \\ &= 2,600,000\end{aligned}$$

Shortfall Base Exemption

You do not need to think too much about whether this plan satisfies the shortfall base exemption. The transition rule for the applicable percentage expired at the end of the 2010 plan year. The modified funding shortfall is similar to the previously calculated Funding shortfall.

$$\begin{aligned}\text{Modified S/F} &= 100\% * (\text{Funding target}) - (\text{AAV} - \text{PB}) \\ &= \text{NOT zero}\end{aligned}$$

Waiver amortization

The rules in the proposed regulation for calculating the waiver amortization are a bit unusual. At 1.430(a)-1(d)(1), it states that the waiver amortization installment is calculated using the segment rates for the year that the waiver is granted - NOT for the year the first amortization payment is paid.

The 2013 waiver is amortized starting in 2014. Based on the regulations, the amount of the waiver amortization payment is determined using the 2013 segment rates. The amortization factor assumes waiver payments starting in 2014, so the segment rates used are 5.5% for 4 years, and 6.5% for the fifth year. The amortization factor is calculated using an end of year annuity based on the 1st segment rate for 2013 for four years, and the 2nd segment rate for 2013 for one year:

$$\begin{aligned}\text{Amort factor} &= a_{\overline{4}|.055} + (1.065)^{-5} \\ &= 4.2350\end{aligned}$$

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Problem 23 – Page 2

$$\begin{aligned}\text{Waiver amort} &= 410,000 / 4.2350 \\ &= 96,812\end{aligned}$$

Shortfall amortization installment

The plan is not eligible for the shortfall base exemption. You have to set up the 2014 shortfall amortization base, which is equal to

1. 100% times the Funding target
2. Minus the Actuarial asset value reduced by both CB and PB
3. Minus the present value of prior years' shortfall and waiver amortization installments.

There are five years left in the amortization of the 2013 waiver. You can directly calculate the five year amortization factor for the 2013 waiver, which is $\ddot{a}_{\overline{5}|.05}$, or 4.5460. The problem states that the 2013 shortfall amortization installment is 330,000. You are given the six year amortization factor for the shortfall as 5.29.

$$\begin{aligned}\text{S/F Amort base} &= 100\% * (\text{Funding target}) - (\text{AAV-CB-PB}) - (\text{PV of PY Amortizations}) \\ &= 1.0 * 7,700,000 - (5,200,000 - 20,000 - 80,000) - (96,812 * 4.5460) \\ &\quad - (330,000 * 5.29) \\ &= 2,600,000 - 440,101 - 1,745,700 \\ &= 414,199\end{aligned}$$

You must calculate the shortfall amortization installment for 2014. You are given the 7 year annuity factor:

$$\begin{aligned}\text{S/F amort} &= 414,199 / 6.00 \\ &= 69,033\end{aligned}$$

$$\begin{aligned}\text{S/F charge} &= 69,033 + 330,000 \\ &= 399,033\end{aligned}$$

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

Minimum Required Contribution

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

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Problem 23 – Page 3

$$\begin{aligned}\text{MRC} &= \text{TNC} + \text{Shortfall amort charge} + \text{Waiver amort charge} \\ &= 85,000 + 399,033 + 96,812 \\ &= 580,845\end{aligned}$$

Answer is D

NOTE

You can get the same answer range, even though you calculate the waiver amortization incorrectly. If you incorrectly use only the first 2013 segment rate of 5.5%, the amortization factor is 4.2703. The resulting waiver amortization payment is 96,012, which eventually gives a shortfall amortization charge of 399,639. The resulting value of the 2014 minimum required contribution is 580,651, which is in the correct answer range.

If you make a different error, you will not get the same answer range. For example, if you calculate the waiver amortization using an annuity due at 5.5%, the waiver amortization payment is 91,007. The resulting value of the 2014 minimum required contribution is 579,438, which is in the wrong answer range.

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Problem 24

Similar to 2012 #48

This is the second question asked on calculations related to extension of amortization periods under IRC 431. The problem gives information for three bases that were established prior to 2014. The problem states that the five year extension applies to the amortization periods for the “eligible” bases established on or before 01/01/2013.

The “eligible” bases are the charge bases. It doesn’t make sense to extend amortization periods for any credit bases, since that would increase the minimum contribution.

The problem asks for the change in the minimum required contribution at 12/31/2014 due to the extension of amortization periods. You should ignore the 01/2012 gain base and the 01/2014 loss base, since those amortization periods do not change.

Description	Combined base	Loss base
01/2013 outstanding base	9,700,000	710,000
01/2013 remaining years	8	15
01/2013 amortization payment	$9,700,000 / \ddot{a}_{8 .075}$ = 1,540,514	$710,000 / \ddot{a}_{15 .075}$ = 74,822
01/2014 outstanding base	$1,540,514 * \ddot{a}_{7 .075}$ = 8,771,448	$74,822 * \ddot{a}_{14 .075}$ = 682,816
01/2014 remaining years	$7 + 5 = 12$	$14 + 5 = 19$
01/2014 amortization payment	$8,771,448 / \ddot{a}_{12 .075}$ = 1,054,841	$682,816 / \ddot{a}_{19 .075}$ = 63,779
Decrease in amortization	$1,540,514 - 1,054,841$ = 485,673	$74,822 - 63,779$ = 11,044

The total decrease in the amortization payment at 01/2014 is $496,716 = 485,673 + 11,044$. The change in the “minimum required contribution” at 12/31/2014 is $1.075 * 496,716 = 533,970$.

Answer is C

Problem 25

Similar to 2012 #49

Revised 10/15/15

FALSE

This is the first detailed exam question asked on details of the definition of the rehabilitation period. IRC 432(e)(4)(A) defines the beginning date of the rehabilitation period:

*“(4) Rehabilitation period
For purposes of this section--*

(A) In general

The rehabilitation period for a plan in critical status is the 10-year period beginning on the first day of the first plan year of the multiemployer plan following the earlier of--

(i) the second anniversary of the date of the adoption of the rehabilitation plan, or

(ii) the expiration of the collective bargaining agreements in effect on the due date for the actuarial certification of critical status for the initial critical year under subsection (a)(1) and covering, as of such date at least 75 percent of the active participants in such multiemployer plan.”

2014 is the first year the plan is certified in critical status. For the 2014 valuation year, the due date of the actuarial certification is 03/31/2014. You are given the expiration dates for the four collective bargaining agreements in effect on that date, in order of expiration date.

The total number of actives covered by the four collective bargaining agreements is $150 + 400 + 300 + 275 = 1,125$. 75% of that total is 843.75, or 844 participants. The first three collective bargaining agreements cover 850 participants, which meets the 75% threshold.

The problem gives the date of adoption of the rehabilitation plan as 10/01/2014. The date for item (i) is 10/01/2016, which is the second anniversary of the date of adoption. The date for item (ii) is 12/31/2015.

The earlier of the two dates is 12/31/2015. The first day of the plan year following that date is 01/01/2016. The ten year rehabilitation period begins on 01/01/2016 and ends 12/31/2025.

Answer is B

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Problem 26 – Page 1

Similar to 2010 #11

The key to this problem is the calculation of the Funding target, Target normal cost and the Shortfall amortization base at 01/01/2014 under IRC Section 430. This plan has a funding standard carryover balance (CB) of zero and a prefunding balance (PB) of 50,000 at 01/01/2014.

The problem asks for the "smallest amount" at 01/01/2014. Based on 2013 exam conditions 31 and 32, the plan sponsor elects to offset both the CB and the PB against the minimum contribution under IRC 430. Based on exam condition 35, the "smallest amount" reflects offsetting both the CB and the PB against the minimum contribution.

Valuation calculations

You need to determine values for the Funding target and the Target normal cost at 01/01/2014. The first step is to determine the accrued benefit at the 01/01/2011 valuation date:

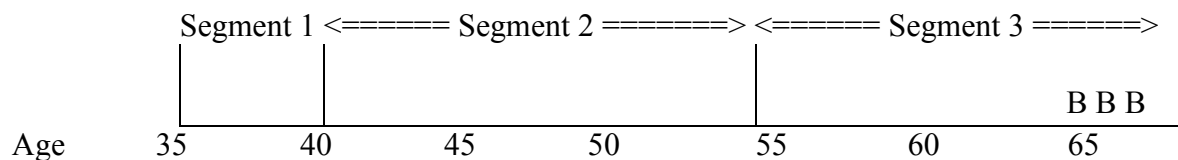
	Average participant
Age	35.0
Past service	10.0
Accrued benefit	$10.0(50)(12) = 6,000$

$$\Delta \text{ Accrued benefit} = 12(50) = 600$$

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.

Based on the default exam conditions, normal retirement age is 65, and the benefit is assumed payable monthly, starting at normal retirement age. Each participant is currently 30 years from retirement, so their benefit payments will be valued using the third segment rate:



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

$$\begin{aligned}
 \text{Age 35 FT} &= 6,000 * {}_{30|}\ddot{a}_{35 \text{ seg}_3}^{(12)} \\
 &= 6,000(v^{30} {}_{30}p_{35}) \ddot{a}_{65 \text{ seg}_3}^{(12)} \quad \text{all at segment 3 rate}
 \end{aligned}$$

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Problem 26 – Page 2

$$\begin{aligned}\text{Age 35 FT} &= 6,000(1.075)^{-30}(1.0)(10.05) \\ &= 6,887.53\end{aligned}$$

The prior calculation is for a single participant. You need to increase the value to reflect all 50 active plan participants, and add in the funding target for the inactive plan participants:

$$\begin{aligned}\text{Total FT} &= 6,887.53 * 50 + 4,500,000 \\ &= 4,844,376\end{aligned}$$

Target Normal Cost

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

$$\begin{aligned}\text{Age 35 TNC} &= 600(1.075)^{-30}(1.0)(10.05) \\ &= 6,888 * (600/6,000) \\ &= 689\end{aligned}$$

$$\begin{aligned}\text{Total TNC} &= 689 * 50 \\ &= 34,438\end{aligned}$$

The main trick to this problem is that the plan pays administrative expenses from the trust fund. The final Target normal cost includes 35,000 in expenses:

$$\begin{aligned}\text{Final TNC} &= 34,438 + 35,000 \\ &= 69,438\end{aligned}$$

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 PB and the CB.

$$\begin{aligned}\text{Funding S/F} &= \text{Funding target} - (\text{AAV} - \text{CB} - \text{PB}) \\ &= 4,844,376 - (4,500,000 - 0 - 50,000) \\ &= 394,376\end{aligned}$$

Shortfall Base Exemption

You do not need to think too much about whether this plan satisfies the shortfall base exemption. The transition rule for the applicable percentage expired at the end of the 2010 plan year. The modified funding shortfall is identical to the previously calculated Funding shortfall:

$$\begin{aligned}\text{Modified S/F} &= 100\% * (\text{Funding target}) - (\text{AAV} - \text{PB}) \\ &= \text{NOT zero}\end{aligned}$$

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Problem 26 – Page 3

Based on 2013 exam conditions 31 and 32, the plan sponsor elects to offset both the CB and the PB against the minimum contribution under IRC 430. As a result, the calculation above offsets the entire PB against the AAV. In general, the only time you should not do this is when the problem states that the plan sponsor does not elect to apply the CB and the PB against the MRC.

Shortfall amortization installment

The plan is not eligible for the shortfall base exemption. You have to set up the 2014 shortfall amortization base, which is equal to

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

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

This problem gives you the 6-year amortization factor, as well as the 2013 shortfall installment. Now you can calculate the new shortfall base:

$$\begin{aligned}\text{S/F Amort base} &= 1.0 * 4,844,376 - (4,500,000 - 0 - 50,000) - (\text{PV of PY Amortizations}) \\ &= 394,376 - 25,000(5.24) \\ &= 263,376\end{aligned}$$

You must calculate the shortfall amortization installment for 2014. You are given the 7 year annuity factor:

$$\begin{aligned}\text{S/F amort} &= 263,376 / 5.92 \\ &= 44,489\end{aligned}$$

$$\begin{aligned}\text{S/F charge} &= 44,489 + 25,000 \\ &= 69,489\end{aligned}$$

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

Minimum required contribution

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

$$\begin{aligned}\text{MRC} &= \text{TNC} + \text{Shortfall amort charge} + \text{Waiver amort charge} \\ &= 69,438 + 69,489 + 0 \\ &= 138,927\end{aligned}$$

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Problem 26 – Page 4

Smallest amount

The problem asks for “the smallest amount that satisfies the minimum funding standard”. You should offset both the CB and the PB against the MRC:

$$\begin{aligned}\text{Smallest contr} &= \text{MRC} - \text{CB} - \text{PB} \\ &= 138,927 - 0 - 50,000 \\ &= 88,927\end{aligned}$$

Answer is D

Fall 2013 EA-2F Exam Solutions

Problem 27 – Page 1

Similar to 2002 #29

The key point to this problem is the calculation of the liquidity shortfall. You have to construct 12 months of disbursements from the quarterly payments you are given.

The liquidity shortfall for a quarter equals the base amount minus the liquid assets, both at the end of the quarter. It can't exceed the amount which, when added to prior installments for the plan year, increases the funding target attainment percentage (FTAP) to 100% (including the expected increase due to benefits accruing during the year).

Liquid assets are items for which there is a liquid financial market, such as cash, stocks, and bonds. The base amount equals 3 times adjusted disbursements from the plan for the 12 months ending on the last day of the quarter.

Adjusted disbursements equal all disbursements from the plan less the FTAP times the sum of annuity purchases, lump sums, and other accelerated payments. Based on the Schedule SB instructions, the FTAP is calculated by truncating to .01%.

You are given five quarters of data, but your calculation of the adjusted disbursements should only use the four quarters ending 03/31/2014.

$$\begin{aligned}\text{All Disbursements} &= (205,000 + 5,000) + (250,000 + 5,000) + (270,000 + 5,000) \\ &\quad + (280,000 + 5,000 + 50,000 + 100,000) \\ &= 210,000 + 255,000 + 275,000 + 435,000 \\ &= 1,175,000\end{aligned}$$

$$\begin{aligned}\text{Accelerated payments} &= 50,000 \text{ lump sums} + 100,000 \text{ annuity purchases at 03/31/14} \\ &= 150,000\end{aligned}$$

$$\text{FTAP} = \frac{(\text{AAV} - \text{CB} - \text{PB})}{\text{Non At-Risk FT}}$$

$$\begin{aligned}\text{01/2014 AAV} &= 2,250,000 \text{ liquid asset} + 250,000 \text{ illiquid asset} \\ &= 2,500,000\end{aligned}$$

$$\begin{aligned}\text{FTAP} &= (2,500,000 - 0 - 0) / 3,050,000 \\ &= 81.96\%\end{aligned}$$

$$\begin{aligned}\text{Adjusted disburse.} &= 1,175,000 - .8196(150,000) \\ &= 1,052,060\end{aligned}$$

$$\begin{aligned}\text{Base amount} &= 3 * 1,052,060 \\ &= 3,156,180\end{aligned}$$

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Problem 27 – Page 2

Revised 10/29/14

$$\begin{aligned}\text{Liquidity Shortfall} &= 3,156,180 - 2,300,000 \text{ liquid asset at 03/31/2014} \\ &= 856,180\end{aligned}$$

The trick to this calculation is using the correct asset amount. It is incorrect to use the same 2,250,000 value that is part of the AAV at 01/01/2014.

The cap on the liquidity shortfall is the amount to increase the FTAP to 100%. I'll identify this amount as "CAP":

$$\begin{aligned}100\% \text{ FTAP} &= \{\text{CAP} + (2,300,000 \text{ liquid asset} - 0 - 0)\} / \{3,050,000 + 350,000 \text{ TNC}\} \\ \text{CAP} &= 100\% * 3,400,000 - 2,300,000 \\ &= 1,100,000\end{aligned}$$

The final liquidity shortfall is 856,180, since that is less than the cap amount.

Answer is D

NOTES

The calculation of the cap on the liquidity shortfall is not 100% clear in the proposed regulation. If you include the non-liquid assets in the calculation, then the cap amount is much smaller. Intuitively, this is an illogical result - so I only used the liquid asset.

Problem 28 – Page 1

Revised 09/08/15

The key point of this question is recognizing that this is an ancillary benefit problem for a single employer plan. The problem is simplified a bit, since you have annual benefit payments. Due to the age of the participant, you only need to calculate the value of the death benefit for exit at one age.

The Funding Target is defined as the present value of the accrued benefit. It is similar to the traditional Unit Credit accrued liability. Most of the work in the problem is calculating the present value factor for the Funding target. You should do calculations for the retirement benefit first, then deal with the death benefit.

Funding target - Retirement benefit

At 01/01/2014

Age	64
Accrued benefit	18,500

Based on the default exam conditions, normal retirement age is 65, and the benefit is assumed payable monthly, starting at normal retirement age. The participant is currently 1 year from retirement, so their benefit payments will be valued using all three segment rates.

	Segment 1 <=====			Segment 2 =====>			<===== Segment 3 =====>		
	B ... B			B B ... B B ... B			B B ... B B B ... B		
Age	64	65	68	69		83	84	...	

One simplifying aspect of the problem is that the pre-retirement mortality and post-retirement mortality are the same. This means you can use the same commutation functions both before and after benefits commence.

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

$$FT-RET = 18,500 * [{}_1| \ddot{a}_{64:4|seg_1} + {}_5| \ddot{a}_{64:15|seg_2} + {}_{20|} \ddot{a}_{64|seg_3}]$$

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

$$\begin{aligned} {}_1| \ddot{a}_{64:4|seg_2} &= (v^1 p_{64}) \ddot{a}_{65:4|seg_1} && \text{all at segment 1 rate} \\ &= (N_{65} - N_{69}) / D_{64} && \text{all at segment 1 rate} \end{aligned}$$

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Problem 28 – Page 2

Funding target - Retirement benefit - continued

$$\begin{aligned} {}_5|\ddot{a}_{64:\overline{15}|seg_2} &= (v^5 {}_5p_{64}) \ddot{a}_{69:\overline{15}|seg_2} && \text{all at segment 2 rate} \\ &= (N_{69} - N_{84}) / D_{64} && \text{all at segment 2 rate} \end{aligned}$$

$$\begin{aligned} {}_{20}|\ddot{a}_{64 seg_3} &= (v^{20} {}_{20}p_{64}) \ddot{a}_{84 seg_3} && \text{all at segment 3 rate} \\ &= (N_{84} / D_{64}) && \text{all at segment 3 rate} \end{aligned}$$

$$\begin{aligned} \text{FT-RET} &= 18,500 \left[\underset{\text{Segment 1}}{(N_{65} - N_{69}) / D_{64}} + \underset{\text{Segment 2}}{(N_{69} - N_{84}) / D_{64}} + \underset{\text{Segment 3}}{N_{84} / D_{64}} \right] \\ &= 18,500 \left[\frac{(3,527 - 2,478)}{306} + \frac{(1,203 - 175)}{167} + \frac{77}{92} \right] \\ &= 18,500 [3.4281 + 6.1557 + .8370] \\ &= 192,784 \end{aligned}$$

Funding target - Death benefit

The pre-retirement death benefit is equal to the accrued benefit. There is only one exit age for the death benefit, since the participant is assumed to retire at the beginning of the year they reach age 65.

You need to calculate the present value of the death benefit payable based on death at age 64. Compared to the funding target calculation, there is one additional payment of 18,500, which occurs at age 64 (at the beginning of the year). You have almost exactly the same factors as were used above for the retirement benefit funding target:

$$\begin{aligned} \text{FT-DTH} &= 18,500 * (q_{64}) * \left[\underset{\text{Segment 1}}{(N_{64} - N_{69}) / D_{64}} + \underset{\text{Segment 2}}{(N_{69} - N_{84}) / D_{64}} + \underset{\text{Segment 3}}{N_{84} / D_{64}} \right] \\ &= 18,500 * (q_{64}) * [1.0 + 3.4281 + 6.1557 + .8370] \\ &= .0105 * (192,784 + 18,500) \\ &= 2,218 \end{aligned}$$

The total funding target is $195,002 = 2,218 + 192,784$.

Answer is B

Fall 2013 EA-2F Exam Solutions

Problem 29 – Page 1

Similar to 2002 #20

Revised 10/19/16

The key to this problem is handling mandatory employee contributions, and understanding the definition of employer normal cost. The employer normal cost simply means the normal cost, reduced to reflect the effect of the mandatory employee contributions. The remainder of the problem is determining the normal cost under the Aggregate method.

With no mandatory employee contributions the Aggregate cost method definitions are:

$$\begin{aligned}\$431 \text{ PVNC} &= \text{PVB} - \text{AAV} - (\text{O/S } \$431 \text{ bases} - \text{CB}) && \text{NOTE: no ARA under Aggregate} \\ \text{AGG NC} &= \text{PVNC} / \left(\text{average } \ddot{s}_{\overline{X:RA-X}|} \right)\end{aligned}$$

With mandatory employee contributions, you increase both the PVB and the AAV. You increase the PVB by the amount of expected future refunds of contributions. The AAV should include the accumulated past mandatory employee contributions (EECWI). The AAV is also increased by the present value of future expected mandatory employee contributions (PVEEC):

$$\$431 \text{ PVNC} = (\text{PVB} + \text{refunds}) - (\text{AAV} + \text{PVEEC}) - (\text{O/S } \$431 \text{ bases} - \text{CB})$$

The mandatory employee contributions are 2.5% of pay, so the present value of future contributions can be approximated as $2.5\%(35,000,000) = 875,000$. This is an approximation, because it assumes that the current year's employee contribution is paid in full at the beginning of the year. In reality, employee contributions are withheld from each paycheck, or are simply paid at the end of each year.

$$\begin{aligned}\$431 \text{ PVNC} &= 7,200,000 - (4,500,000 + 875,000) - (0 - 0) \\ &= 1,825,000\end{aligned}$$

$$\begin{aligned}\text{PVE} / \text{E} &= 35,000,000 / 3,500,000 \\ &= 10.0\end{aligned}$$

$$\begin{aligned}\text{AGG NC} &= 1,825,000 / 10.0 \\ &= 182,500\end{aligned}$$

Answer is A

NOTES

1. Based on the default exam conditions, there are no pre-retirement decrements. As a result, the present value of future refunds is zero.
2. There is another solution technique that some students prefer, which does not reduce the PVNC by the present value of future expected mandatory employee contributions (PVEEC). As a result, the "total NC" is calculated. You then have to calculate the "employer NC" by reducing the total NC by the mandatory employee contributions for the current year. These calculations are shown on the next page.

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Problem 29 – Page 2

(Alternate solution method)

$$\begin{aligned}\text{Total PVNC} &= (\text{PVB} + \text{refunds}) - \text{AAV} - (\text{O/S } \$412 \text{ bases} - \text{CB}) \\ &= 7,200,000 - 4,500,000 - (0 - 0) \\ &= 2,700,000\end{aligned}$$

$$\begin{aligned}\text{Total NC} &= 2,700,000 / 10.0 \\ &= 270,000\end{aligned}$$

$$\begin{aligned}\text{Employer NC} &= 270,000 - 2.5\%(3,500,000) \\ &= 182,500\end{aligned}$$

In this problem (as well as prior exam problems), this alternate solution method gives the identical answer. This is not always the case - consider a plan where the mandatory employee contributions are 1% up to 50,000 and 3% above 50,000. If the valuation assumptions include a salary scale, then the two solution methods will produce a different result.

Fall 2013 EA-2F Exam Solutions

Problem 30 – Page 1

Similar to 2012 #19

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

You need to calculate the Unit Credit accrued liability at 01/01/2014. The accrued liability is defined as the present value of the accrued benefit.

Retired AL = PV of Early retirement benefit

Active AL = PV of Accrued benefit

Retired PVB calculations

01-01-14 Age 50

Accrued benefit 25,000

Early retirement reduction factor 1.00

Early retirement benefit 25,000

Retirement annuity $\ddot{a}_{50}^{(12)} = 12.84$

PVB as retiree $25,000 * 12.84 = 321,000$

Active AL calculations

One minor wrinkle in this calculation is that the assumptions include a probability of retirement at age 55. This problem is less complicated than other similar exam questions. One reason is that the early retirement benefits are unreduced, since the participant has 31 years of service. Another reason is that there is no pre-retirement mortality.

01-01-14 Age 50

Accrued benefit 25,000

Early retirement benefit 25,000

Accrued liability - ER at 55
$$\begin{aligned} & 25,000(1.07)^{-5} \ddot{a}_{55}^{(12)} \\ & = 25,000(.7130)(12.15) \\ & = 216,570 \end{aligned}$$

Accrued liability - ER at 65
$$\begin{aligned} & 25,000(1.07)^{-15} \ddot{a}_{65}^{(12)} \\ & = 25,000(.3624)(10.26) \\ & = 92,967 \end{aligned}$$

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Problem 30 – Page 2

$$\begin{aligned}\text{Active AL} &= 50\%(216,570) + (1-50\%)(92,967) \\ &= 154,768\end{aligned}$$

Since the PVB as a retiree is greater, there is a loss at Smith's retirement of $166,232 = 321,000 - 154,768$.

Answer is C

This question has not been asked for a multiemployer plan since PPA was passed. This is such an old topic that this is essentially a trick question! These calculations are almost identical to those for some recent questions on single employer plans.

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.

For all of these methods, a corridor must be applied for the final actuarial value of assets. The final actuarial value of assets can't be lower than 80% of market value. The final actuarial value of assets can't be greater than 120% of market value. The resulting AAV must fall between 80% and 120% of the market value.

(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 years' gain or loss. With a five year average, the fractions are $\frac{4}{5}$, $\frac{3}{5}$, $\frac{2}{5}$, and $\frac{1}{5}$. With a four year average, the fractions are $\frac{3}{4}$, $\frac{2}{4}$, and $\frac{1}{4}$. With a three year average, the fractions are $\frac{2}{3}$ and $\frac{1}{3}$.

You need to calculate the 2013 G/L item. To do this, you need to calculate the expected market value of assets at 01/01/14.

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Problem 31 – Page 2

Revised 08/05/15

01/01/14 Asset calculations - simple interest

$$\begin{aligned} 01/14 \text{ } _e\text{MVA} &= (1.075) * 186,000 + [1 + .075(3/12)] * 20,000 - [1 + .075(6/12)] * 21,500 \\ &= 198,019 \end{aligned}$$

$$\begin{aligned} \text{MVA G/L} &= 01/14 \text{ MVA} - 01/14 \text{ } _e\text{MVA} \\ &= 205,000 - 198,019 \\ &= 6,981 \quad \text{Gain} \end{aligned}$$

Preliminary

$$\begin{aligned} 01/14 \text{ AAV} &= 01/14 \text{ MVA} - 4/5(2013 \text{ G/L}) - 3/5(2012 \text{ G/L}) - 2/5(2011 \text{ G/L}) - 1/5(2010 \text{ G/L}) \\ &= 205,000 - .80(6,981) - .60(-30,000) - .40(-25,000) - .20(-7,000) \\ &= 228,815 \end{aligned}$$

You need to make sure that the preliminary AAV does not fall outside the allowable corridor. As described earlier, it must be limited to be between 80%(MVA) and 120%(MVA):

$$\begin{aligned} 01/14 \text{ AAV} &= \text{Lesser of } [1.20(205,000) \text{ and greater of } (228,815 \text{ or } .80(205,000))] \\ &= 228,815 \end{aligned}$$

The corridor does not apply.

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. Of course this does not match the signs for the asset gains and losses given in the problem.
2. If you used compound interest to calculate the expected market values, the expected market value at 01/2014 and the G/L value for 2013 are slightly different:

$$\begin{aligned} 01/14 \text{ } _e\text{MVA} &= 198,023 \\ 2013 \text{ G/L} &= 6,977 \\ 01/14 \text{ AAV} &= 228,819 \quad (\text{corridor does not apply}) \end{aligned}$$

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Problem 32

The key to this problem is knowing the deemed reduction rules under IRC 436. The problem clearly states that there is a reduction in the funding balances due to the AFTAP certification.

The problem states that the plan has a lump sum option. This means that the plan is subject to the IRC 436(d) restrictions. The 2013 AFTAP was certified as 92.0% on 03/31/2013. The presumed AFTAP at 01/01/2014 is also 92.0%.

In order to pay lump sums, the AFTAP must be at least 80%. You need to calculate the AFTAP at 08/01/2014 to see if it satisfies IRC 436(d):

$$\begin{aligned}\text{AFTAP} &= \frac{\text{NHAP} + \text{AAV} - \text{CB} - \text{PB}}{\text{NHAP} + \text{Funding Target (non At-Risk)}} \\ &= \frac{0 + 6,900,000 - 55,120 - 30,000}{0 + 8,600,000} \\ &= 79.24\%\end{aligned}$$

Since the AFTAP is less than 80%, there may be a deemed reduction under IRC 436(f)(3). If it is possible to reduce the CB (and PB) enough to increase the AFTAP to 80%, then this reduction must occur as if the employer had elected to do so under IRC 430(f).

$$\begin{aligned}\text{Desired AFTAP} &= \frac{0 + 6,900,000 - (55,120 + 30,000 - X)}{0 + 8,600,000} \\ &= 80.0\%\end{aligned}$$

$$.80(8,600,000) = 6,900,000 - (55,120 + 30,000 - X)$$

$$\begin{aligned}X &= .80(8,600,000) - [6,900,000 - (55,120 + 30,000)] \\ &= 65,120\end{aligned}$$

Answer is D

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Problem 33

FALSE

In general, the cushion amount is the sum of

- 50% of the Funding target, and
- the increase in the funding target if the plan allowed for future compensation increases.

Under 404(o)(3), there is a special rule which allows an alternate definition of the cushion amount for plans where benefits are not based on compensation. You can instead allow for expected future benefit increases, based on the average annual increase in benefits over the prior six years.

Answer is B

Fall 2013 EA-2F Exam Solutions

Problem 34 – Page 1

Similar to 2012 #06

The key to this problem is knowing how to do calculations under the Aggregate (AGG) cost method. Unlike most problems on the Aggregate method, you have no credit balance or amortization bases. This time you are doing calculations that are more typical for a problem on individual cost methods.

The normal cost is equal to the present value of future normal costs (PVNC) divided by the average temporary annuity for active participants. In this problem, you are not given the present value of future compensation. You must calculate the average temporary annuity including a salary scale.

You have a population of 100 clones. You need to determine the projected benefit, and the present value of benefits (PVB) for an individual. Then you can calculate the PVB for the entire plan.

01/01/2014 data

Birth date	01/01/63
Age	51
Past service	6
Total service	20
2013 pay	30,000 at age 50

$$\begin{aligned}\text{Age 64 pay} &= 30,000(1.04)^{14} \\ &= 51,950\end{aligned}$$

$$\begin{aligned}\text{FAE3@65} &= 51,950 * [\ddot{a}_{3|.04} / 3] \\ &= 49,978\end{aligned}$$

$$\begin{aligned}\text{Proj ben}_{65} &= 49,978(2\%)(20) \\ &= 19,991\end{aligned}$$

$$\begin{aligned}\text{PVB}_{51} &= 19,991(D_{65}/D_{51})\ddot{a}_{65}^{(12)} \\ &= 19,991(v^{14})({}_{14}p_{51})\ddot{a}_{65}^{(12)}\end{aligned}$$

Based on the default exam conditions, there are no pre-retirement decrements. The present value calculation uses interest-only discounting prior to normal retirement age (which is 65 by default).

$$\begin{aligned}\text{PVB}_{51} &= 19,991(1.075)^{-14}(9.90) \\ &= 71,904\end{aligned}$$

$$\begin{aligned}\text{Total PVB} &= 100(71,904) \\ &= 7,190,416\end{aligned}$$

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Problem 34 – Page 2

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

$$\begin{aligned}\text{AGG PVNC} &= \text{PVB} - \text{AAV} - (\text{O/S 431 bases} - \text{CB}) \\ &= 7,190,416 - 2,000,000 - (0 - 75,000) \\ &= 5,265,416\end{aligned}$$

The plan benefit is pay related, so the normal cost is determined as a level percentage of pay:

$$\begin{aligned}\text{AGG NC} &= \text{PVNC} / (\text{average temporary annuity}) \\ &= \text{PVNC} / (\text{PVE}/E)\end{aligned}$$

You are not given the value of PVE (present value of future earnings) in this problem. Since you have a population of clones, the average temporary annuity for the plan is the same as the value for a single participant. You need to calculate an increasing temporary annuity, based on the 4% salary scale:

$$\begin{aligned}s\ddot{a}_{51:14} &= [1 + (1.04/1.075)^1 + (1.04/1.075)^2 + \dots + (1.04/1.075)^{13}] \\ &= \ddot{a}_{14|j} \quad \text{where } 1+j = 1.075/1.04 \rightarrow j = 3.3654\% \\ &= 11.3907\end{aligned}$$

$$\begin{aligned}\text{AGG NC} &= 5,265,416 / 11.3907 \\ &= 462,257\end{aligned}$$

Answer is C

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Problem 35

Similar to 2012 #31

TRUE

This is very clear - see IRC 432(b)(3)(A):

“(3) Annual certification by plan actuary

(A) In general

Not later than the 90th day of each plan year of a multiemployer plan, the plan actuary shall certify to the Secretary and to the plan sponsor--

(i) whether or not the plan is in endangered status for such plan year and whether or not the plan is or will be in critical status for such plan year, and

(ii) in the case of a plan which is in a funding improvement or rehabilitation period, whether or not the plan is making the scheduled progress in meeting the requirements of its funding improvement or rehabilitation plan.”

Answer is A

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Problem 36 – Page 1

Similar to 2012 #22

This is a straightforward question on IRC 430 minimum funding calculations. You need to do calculations for both 2013 and 2014. This plan has a funding standard carryover balance (CB) of zero and a prefunding balance (PB) of 225,000 at 01/01/2013.

This problem asks for “the minimum required contribution”. Based on 2013 exam condition 34, this amount does not reflect a reduction for the funding standard carryover balance (CB) or for the prefunding balance (PB).

2013 Funding Shortfall

The first step is calculation of the funding shortfall. If this amount is zero, then the definition of the minimum required contribution (MRC) will be different:

$$\begin{aligned}\text{Funding S/F} &= \text{Funding target} - (\text{AAV} - \text{CB} - \text{PB}) \\ &= 2,300,000 - (2,400,000 - 0 - 225,000) \\ &= 125,000\end{aligned}$$

2013 Shortfall Base Exemption

You do not need to think too much about whether this plan satisfies the shortfall base exemption. The transition rule for the applicable percentage expired at the end of the 2010 plan year. The modified funding shortfall is identical to the previously calculated Funding shortfall:

$$\begin{aligned}\text{Modified S/F} &= 100\% * (\text{Funding target}) - (\text{AAV} - \text{PB}) \\ &= \text{NOT zero}\end{aligned}$$

2013 Shortfall amortization installment

The plan is not eligible for the shortfall base exemption. You have to set up the 2013 shortfall amortization base, which is equal to

1. 100% times the Funding target
2. Minus the Actuarial asset value reduced by both CB and PB
3. Minus the present value of prior years' shortfall and waiver amortization installments:

There was no funding shortfall at 01/01/2012, so the shortfall bases and amortizations were eliminated at that date. The 2013 shortfall base is the same as the Funding shortfall, or 125,000.

You must calculate the shortfall amortization installment for 2013. You are given the 7-year annuity factor:

$$\begin{aligned}\text{S/F amort} &= 125,000 / 5.92 \\ &= 21,115\end{aligned}$$

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Problem 36 – Page 2

You don't need to do any additional calculations for 2013. The problem states that the 01/01/2014 PB is 300,000.

2014 Funding Shortfall

The first step is calculation of the funding shortfall. If this amount is zero, then the definition of the minimum required contribution (MRC) will be different:

$$\begin{aligned}\text{Funding S/F} &= \text{Funding target} - (\text{AAV} - \text{CB} - \text{PB}) \\ &= 2,350,000 - (2,600,000 - 0 - 300,000) \\ &= 50,000\end{aligned}$$

2014 Shortfall Base Exemption

You do not need to think too much about whether this plan satisfies the shortfall base exemption. The transition rule for the applicable percentage expired at the end of the 2010 plan year. The modified funding shortfall is identical to the previously calculated Funding shortfall:

$$\begin{aligned}\text{Modified S/F} &= 100\% * (\text{Funding target}) - (\text{AAV} - \text{PB}) \\ &= \text{NOT zero}\end{aligned}$$

2014 Shortfall amortization installment

The plan is not eligible for the shortfall base exemption. You have to set up the 2014 shortfall amortization base, which is equal to

1. 100% times the Funding target
2. Minus the Actuarial asset value reduced by both CB and PB
3. Minus the present value of prior years' shortfall and waiver amortization installments:

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

This problem gives you the 6-year amortization factor, so you can calculate the new shortfall base:

$$\begin{aligned}\text{S/F Amort base} &= 1.0 * 2,350,000 - (2,600,000 - 0 - 300,000) - (\text{PV of PY Amortizations}) \\ &= 50,000 - 21,115(5.24) \\ &= -60,642\end{aligned}$$

You must calculate the shortfall amortization installment for 2014. You are given the 7 year annuity factor:

$$\begin{aligned}\text{S/F amort} &= -60,642 / 5.92 \\ &= -10,244\end{aligned}$$

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Problem 36 – Page 3

$$\begin{aligned}\text{S/F charge} &= 21,115 - 10,244 \\ &= 10,871\end{aligned}$$

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

2014 Minimum Required Contribution

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

$$\begin{aligned}\text{MRC} &= \text{TNC} + \text{Shortfall amort charge} + \text{Waiver amort charge} \\ &= 100,000 + 10,871 + 0 \\ &= 110,871\end{aligned}$$

Answer is C

Fall 2013 EA-2F Exam Solutions

Problem 37 – Page 1

The key point of this question is knowing how to handle post-PPA 2006 waivers. This is a much shorter question than problem 23 from this exam.

This problem asks for “the minimum required contribution”. Based on 2013 exam condition 34, this amount does not reflect a reduction for the funding standard carryover balance (CB) or for the prefunding balance (PB).

Waiver amortization

The rules in the proposed regulation for calculating the waiver amortization are a bit unusual. At 1.430(a)-1(d)(1), it states that the waiver amortization installment is calculated using the segment rates for the year that the waiver is granted - NOT for the year the first amortization payment is paid.

The 2013 waiver is amortized starting in 2014. Based on the regulations, the amount of the waiver amortization payment is determined using the 2013 segment rates. The amortization factor assumes waiver payments starting in 2014, so the segment rates used are 2% for 4 years, and 4% for the fifth year. The amortization factor is calculated using an end of year annuity based on the 1st segment rate for 2013 for four years, and the 2nd segment rate for 2013 for one year:

$$\begin{aligned}\text{Amort factor} &= a_{\overline{4}|.055} + (1.065)^{-5} \\ &= 4.2350\end{aligned}$$

2013 Minimum Required Contribution

The question gives you the shortfall amortization charge for both 2013 and 2014. This allows you to calculate the amount of the 2013 waiver, which is the total 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.

$$\begin{aligned}\text{2013 MRC} &= \text{TNC} + \text{Shortfall amort charge} + \text{Waiver amort charge} \\ &= 250,000 + 100,000 + 0 \\ &= 350,000\end{aligned}$$

$$\begin{aligned}\text{Waiver amort} &= 350,000 / 4.2350 \\ &= 82,644\end{aligned}$$

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Problem 37 – Page 2

2014 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.

$$\begin{aligned}\text{MRC} &= \text{TNC} + \text{Shortfall amort charge} + \text{Waiver amort charge} \\ &= 275,000 + 125,000 + 82,644 \\ &= 482,644\end{aligned}$$

Answer is D

NOTE

The answer ranges on this question are very narrow. As a result, you can not get in the same answer range if you calculate the waiver amortization incorrectly. For example, if you incorrectly use only the first 2013 segment rate of 5.5%, the amortization factor is 4.2703. The resulting waiver amortization payment is 81,962. The resulting value of the 2014 minimum required contribution is 481,962, which is in the wrong answer range.

Fall 2013 EA-2F Exam Solutions

Problem 38

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.

This is a simplified problem on determining the minimum funding standard account (MFSA) credit balance. The problem gives you very little information, other than most of the MFSA amortization amounts. You don't have enough information to calculate any G/L or the FFL.

To set up the MFSA, you need to determine the amortizations for the 431 bases. The problem gives you the amortization payments for everything except the plan amendment at 01/01/2014.

$$\begin{aligned}\text{Plan amort} &= 100,000 / \ddot{s}_{\overline{15}|.07} \\ &= 10,261\end{aligned}$$

Now you can set up the MFSA and calculate the 12/31/14 credit balance:

2014 Minimum Funding Standard Account			
Charges		Credits	
Normal Cost	100,000	Credit Balance	80,000
Amortization charges	75,000	Amortization credits	50,000
Plan change	10,261	12/31 contribution	100,000
7% interest	12,968	7% interest	9,100
Total charges	<u>198,229</u>	Total credits	<u>239,100</u>

The credit balance at 12/31/14 is $40,871 = 239,100 - 198,229$.

Answer is B

This question has not been asked for a multiemployer plan since PPA was passed. This is such an old topic that this is essentially a trick question! These calculations are almost identical to those for some recent questions on single employer plans.

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.

For all of these methods, a corridor must be applied for the final actuarial value of assets. The final actuarial value of assets can't be lower than 80% of market value. The final actuarial value of assets can't be greater than 120% of market value. The resulting AAV must fall between 80% and 120% of the market value.

(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 five year average, the fractions are $\frac{4}{5}$, $\frac{3}{5}$, $\frac{2}{5}$, and $\frac{1}{5}$. With a four year average, the fractions are $\frac{3}{4}$, $\frac{2}{4}$, and $\frac{1}{4}$. With a three year average, the fractions are $\frac{2}{3}$ and $\frac{1}{3}$.

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Problem 39 – Page 2

2013 and 2014 asset values

This problem gives you market values at 12/31/2012 and 12/31/2013, but it does not state that the valuation date is 12/31. Based on 2013 exam condition 16, the valuation date is 01/01. I will ignore the one day difference, and treat the 12/31 asset values given as the correct asset values at 01/01/2013 and 01/01/2014.

You are given the necessary G/L items so that you can calculate the preliminary AAV at 01/01/2013 and 01/01/2014:

Preliminary

$$\begin{aligned} 01/13 \text{ AAV} &= 01/13 \text{ MVA} - 4/5(2012 \text{ G/L}) - 3/5(2011 \text{ G/L}) - 2/5(2010 \text{ G/L}) - 1/5(2009 \text{ G/L}) \\ Y &= 1,000,000 - .80(-100,000) - .60(-150,000) - .40(-200,000) - .20(-300,000) \\ &= 1,310,000 \end{aligned}$$

Preliminary

$$\begin{aligned} 01/14 \text{ AAV} &= 01/14 \text{ MVA} - 4/5(2013 \text{ G/L}) - 3/5(2012 \text{ G/L}) - 2/5(2011 \text{ G/L}) - 1/5(2010 \text{ G/L}) \\ X &= 1,250,000 - .80(250,000) - .60(-100,000) - .40(-150,000) - .20(-200,000) \\ &= 1,210,000 \end{aligned}$$

You need to make sure that the preliminary AAV does not fall outside the allowable corridor. As described earlier, it must be limited to be between 80%(MVA) and 120%(MVA):

$$\begin{aligned} 01/13 \text{ AAV} &= \text{Lesser of } [1.20(1,000,000) \text{ and greater of } (1,310,000 \text{ or } .80(1,000,000))] \\ Y &= 1,200,000 \quad (\text{corridor does apply}) \end{aligned}$$

$$\begin{aligned} 01/14 \text{ AAV} &= \text{Lesser of } [1.20(1,250,000) \text{ and greater of } (1,210,000 \text{ or } .80(1,250,000))] \\ X &= 1,210,000 \end{aligned}$$

$$|Y-X| = 10,000$$

Answer is A

NOTES:

1. In the calculation of the AAV above, asset gains are treated as positive numbers, and asset losses are treated as negative numbers. Of course this does not match the signs for the asset gains and losses given in the problem.
2. If you try to shortcut the calculation of the preliminary AAV, you might forget to apply the corridor. For example, you can write a formula directly for X-Y:

$$X-Y = 250,000 - .20(250,000) - .20(-100,000) - .20(-150,000) - .20(-200,000)$$

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Problem 40

FALSE

This seems obviously true - you are not allowed to project increases in the 415(b)(1)(A) dollar limit. But the point of the question is the 415(b)(1)(B) compensation limit. When calculating benefits at future exit ages, you are allowed to take the salary scale into account. The future pay increases can produce an increase in the 415 limit (compared to calculations at the valuation date).

Answer is B

The key to working this problem is knowing the special rule in the final 1.430 regulations regarding bringing forward the prefunding balance (PB) based on two different interest rates. The calculation is based on the rule shown in example 4 of the final regulation. The portion of the prefunding balance that is attributed to the sponsor's use of the prefunding balance at the beginning of the year must be increased with interest based on the plan's rate of return on assets.

2013 Prefunding balance

The problem asks for the prefunding balance at 01/01/14. The problem states that the plan sponsor elects to use 400,000 of the PB to satisfy the quarterly contribution requirement. They also elect to voluntarily reduce the prefunding balance by 1,800,000 at 01/01/2013.

Remaining

$$\begin{aligned} 01/2013 \text{ PB} &= 6,200,000 - (1,800,000 \text{ reduction} + 400,000 \text{ PB applied}) \\ &= 4,000,000 \end{aligned}$$

Excess contribution

You can calculate the amount of the excess contribution at 01/01/2013. You need to compare the present value of the contribution paid at 07/01/2013 to the MRC. The present value is calculated using the effective rate of interest for the 2013 plan year:

$$\begin{aligned} \text{PV of contrib} &= 6,180,000 * (1.06)^{-6/12} \\ &= 6,002,547 \end{aligned}$$

Addition to

$$\begin{aligned} 2013 \text{ PB} &= 6,002,547 - (3,000,000 \text{ MRC} - 400,000 \text{ PB applied}) \\ &= 3,002,547 \text{ excess contribution} + 400,000 \text{ PB applied} \end{aligned}$$

If there was no PB used, then the 01/2014 PB equals the sum of the 01/2013 PB (brought forward using the rate of return on assets for the 2013 plan year) plus the excess contribution (brought forward with the effective rate of interest for the 2013 plan year). But the calculation is not done that way, due to the special rule in the final 1.430 regulations.

The portion of the prefunding balance that is attributed to the sponsor's use of the prefunding balance at the beginning of the year must be increased with interest based on the 2013 rate of return on assets.

$$\begin{aligned} 01/2014 \text{ PB} &= 1.06(3,002,547 \text{ excess contribution}) + 1.12(4,000,000 \text{ PB} + 400,000 \text{ applied}) \\ &= 8,110,699 \end{aligned}$$

Answer is D

NOTES

1. You get a slightly different numerical result if you use simple interest. The resulting PV of the contribution is 6,000,000 and the 01/2014 PB is 8,108,000. As expected, this is in the same answer range.

NOTES - continued

2. There is a way to check your calculation, which is to ignore the statement about applying the PB towards the quarterly contribution requirement. The 01/2013 prefunding balance would be $4,400,000 = 6,200,000 - 1,800,000$. The 2013 excess contribution would be $3,002,547 = 6,002,547 - 3,000,000$.

$$\begin{aligned} 01/2014 \text{ PB} &= 1.06(3,002,547 \text{ excess contribution}) + 1.12(4,400,000 \text{ PB}) \\ &= 8,110,699 \end{aligned}$$

Fall 2013 EA-2F Exam Solutions

Problem 42

Revised 07/16/15

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.

This is a simplified problem on determining the minimum funding standard account (MFSA) credit balance. To set up the MFSA, you need to determine the amortizations for the 431 bases. The problem gives you the amortization payments for everything except the 2013 experience gain at 01/01/2014.

$$\begin{aligned}\text{Gain amort} &= 1,400,000 / \ddot{a}_{15|0.075} \\ &= 147,537\end{aligned}$$

Based on 2013 exam condition 35, the "smallest amount" reflects offsetting the funding standard account credit balance (CB) against the minimum required contribution. The "smallest amount" is the contribution that produces a credit balance of zero.

Now you can set up the MFSA and calculate the "smallest amount" at 01/01/14. Since this value is at 01/01, you don't need to reflect interest in the MFSA:

2014 Minimum Funding Standard Account			
Charges		Credits	
Normal Cost	400,000	Credit Balance	800,000
Amortization charges	1,800,000	Amortization credits	1,300,000
		Gain amortization	147,537
	0	01/01 contribution	X
7.5% interest	N/A	7.5% interest	N/A
Total charges	<u>2,200,000</u>	Total credits	<u>X + 2,247,537</u>

The total credits exceed the total charges. The "smallest amount" is equal to zero - unusual!

The problem asks for the credit balance at 12/31/14, reflecting an additional contribution of 900,000 at 01/01/14. The credit balance at 12/31/14 is $1,018,602 = 1.075 * [2,247,537 + 900,000 - 2,200,000]$.

Answer is D

NOTE

The key point of the question is not to forget about crediting interest to 12/31/14. You don't need to think too hard about the FFL. Since the UAL is huge, the FFL will have no effect on the MFSA.

Fall 2013 EA-2F Exam Solutions

Problem 43 – Page 1

Similar to 2012 #46

The key to this problem is the calculation of the deductible limit under IRC 404(o). You need to know the definition of the cushion amount, and the alternative At-Risk definition of the deductible limit.

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. This problem does not give the IRC 430 minimum contribution, so you should ignore that item.

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

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

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

Cushion Amount

The Cushion amount is defined as the sum of two pieces:

- (1) 50% of the Funding target, and
- (2) the increase in the Funding target due to allowing for future pay increases.

$$\begin{aligned}\text{Cushion amount} &= 50\%(\text{FT}) + \Delta\text{FT due to pay increases} \\ &= .5(6,350,000) + (7,250,000 - 6,350,000) \\ &= 4,075,000\end{aligned}$$

Now you can calculate the deductible limit. This calculation uses the non At-Risk funding target. This plan is not in At-Risk status, based on 2013 exam condition 45.

Target normal cost	275,000
+ Funding target	6,350,000
+ Cushion amount	4,075,000
Sub-total	10,700,000
Less unreduced AAV	6,200,000
Deductible limit	4,500,000

In most cases, this will be the final deductible limit - but you need to check the alternative definition, as shown on the next page.

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Problem 43 – Page 2

Alternative Deductible Limit: At-Risk

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

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

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

At-Risk Target normal cost	385,000
+ At-Risk Funding target	8,800,000
Sub-total	9,185,000
Less unreduced AAV	6,200,000
Deductible limit	2,985,000

The alternative definition has no effect on the deductible limit. The final deductible limit is 4,500,000.

Answer is D

NOTE

Some prior exam problems have not given you the At-Risk values of the target normal cost and funding target. If this plan had some type of subsidized early retirement benefit, or optional forms of payment, then you would need to calculate the At-Risk values of the Funding target and the Target normal cost.

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Problem 44 – Page 1

Similar to 2011 #42

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 reading the question carefully. There is a plan amendment effective 01/01/2014. The problem gives you 2014 valuation results that do not reflect that amendment.

The problem asks for the "smallest amount" at 12/31/2014. Based on 2013 exam condition 35, the "smallest amount" reflects offsetting the funding standard account credit balance (CB) against the minimum contribution.

2014 Balance equation

One trick to the question is that a new G/L base must be set up at 01/01/2014. In addition, you need to determine the amount of the plan change base.

You must use the actuarial balance equation to determine the amount of the G/L base. In general, the G/L base is determined before anything else occurs at the valuation date. There are two prior experience loss bases. The 2011 loss base was established at 01/01/2012. There are 13 amortization years remaining at 01/01/2014. For the 2012 loss base, there are 14 amortization years remaining at 01/01/2014.

$$\begin{aligned}\text{UAL} &= \text{AL} - \text{AAV} \\ &= 14,000,000 - 10,000,000 \\ &= 4,000,000\end{aligned}$$

$$\begin{aligned}\text{O/S 431 bases} &= 300,000 * \ddot{a}_{13|.07} + 250,000 * \ddot{a}_{14|.07} + \text{LOSS} \\ &= 2,682,806 + 2,339,413 + \text{LOSS}\end{aligned}$$

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

$$\begin{aligned}4,000,000 &= 2,682,806 + 2,339,413 + \text{LOSS} - 500,000 \\ \text{LOSS} &= -522,219\end{aligned}$$

The negative result means that there was actually a gain for 2013:

$$\begin{aligned}\text{Gain amort} &= 522,219 / \ddot{a}_{15|.07} \\ &= 53,586\end{aligned}$$

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Problem 44 – Page 2

Revised 10/15/15

2014 Plan amendment

There is a plan amendment at 01/01/14. The problem gives you the benefit rates for service before 2014 and after 2013. You can determine the normal cost and accrued liability before and after the plan amendment. The plan amendment only affects the active participants.

Since the cost method is Unit Credit, both the normal cost and accrued liability will reflect the new benefit level:

	Before Amendment		After amendment
Normal cost	500,000	* (28/26) =	538,462
Active accrued Liability	8,000,000	* (28/26) =	8,615,385

$$\begin{aligned}\text{Plan chg base} &= 8,615,385 - 8,000,000 \\ &= 615,385\end{aligned}$$

$$\begin{aligned}\text{Plan amort} &= 615,385 / \ddot{a}_{15|0.07} \\ &= 63,146\end{aligned}$$

Now you can set up the MFSA and calculate the 12/31/14 “smallest amount”:

2014 Minimum Funding Standard Account

Charges		Credits	
Normal Cost	538,462	Credit Balance	500,000
2011 Loss amort	300,000	2013 Gain amort	53,586
2012 Loss amort	250,000		
Plan chg amortization	63,146	12/31 minimum	x
7% interest	80,613	7% interest	38,751
Total charges	1,232,221	Total credits	x + 592,337

The “smallest amount” at 12/31/14 is $639,883 = 1,232,221 - 592,337$. This includes interest to 12/31, and reflects offsetting the credit balance against the minimum contribution.

Answer is B

NOTE

You don’t need to think too hard about the FFL. Since the UAL is huge, the FFL will have no effect on the MFSA.

Fall 2013 EA-2F Exam Solutions

Problem 45 – Page 1

Similar to 2010 #49

Revised 08/05/15

The key to this problem is that you must know how to do calculations under the Entry Age Normal method. The main point of this question is handling of the salary scale when you calculate the Entry Age Normal accrued liability.

In general, the Entry Age Normal Cost (EANC) is defined as the present value of benefits at entry age, divided by a temporary annuity at entry age. With a salary scale assumption, the EANC is defined so that it is equal to a level percentage of pay at each age.

$$EANC = \frac{PVB_{EA}}{s\ddot{a}_{EA:RA-EA}}$$

Age 50 at 01/01/14

Entry age 34

Past service 16

Based on the exam conditions, normal retirement age is 65 by default. To calculate the present value of future benefits, you need to calculate the projected monthly benefit at age 65.

Retirement age	65
2013 pay - age 49	100,000
Age 64 pay	$180,094 = 100,000(1.04)^{15}$
Projected benefit	$72,038 = 40\%(180,094)$
PVB at entry age	$72,038(D_{65} / D_{34}) \ddot{a}_{65}^{(12)}$

There are no commutation functions given. Based on 2013 exam condition 18, there are no pre-retirement decrements. You need to use an interest-only discount at 7% for periods prior to age 65.

The problem asks for the accrued liability at 01/01/2014. There are three ways to calculate the EAN accrued liability. The prospective and retrospective formulas require you to calculate the Entry Age Normal cost:

Prospective

$$EAN AL = PVB - PV(EANC)$$

Retrospective

$$EAN AL = (EANC) s\ddot{s}_{EA:CA-EA}$$

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Problem 45 – Page 2

The third formula uses the ratio of two annuities (at entry age) times the PVB at the current age:

$$\begin{aligned}\text{EAN AL} &= \text{PVB}_{\text{CA}} * \left(\frac{{}^s\ddot{a}_{\overline{\text{EA:CA}-\text{EA}}}|}}{{}^s\ddot{a}_{\overline{\text{EA:RA}-\text{EA}}}|}} \right) \\ &= \text{PVB}_{\text{CA}} * \left(\frac{{}^s\ddot{a}_{\overline{34:16}}|}}{{}^s\ddot{a}_{\overline{34:31}}|}} \right)\end{aligned}$$

Now you must evaluate these annuities. There are no pre-retirement decrements, but you need to evaluate an increasing temporary annuity:

$$\begin{aligned}{}^s\ddot{a}_{\overline{34:16}}| &= [1 + (1.04/1.07)^1 + (1.04/1.07)^2 + \dots + (1.04/1.07)^{15}] \\ &= \ddot{a}_{\overline{16}|j} \text{ where } 1+j = 1.07/1.04 \rightarrow j = 2.885\% \\ &= 13.0382\end{aligned}$$

$$\begin{aligned}{}^s\ddot{a}_{\overline{34:31}}| &= \ddot{a}_{\overline{31}|2.885\%} \\ &= 20.8960\end{aligned}$$

Now you can calculate the PVB at current age, and then the EAN accrued liability:

$$\begin{aligned}\text{PVB at age 50} &= 72,038(D_{65} / D_{50}) \ddot{a}_{65}^{(12)} \\ &= 72,038(v^{15} {}_{15}p_{50}) \ddot{a}_{65}^{(12)} \\ &= 72,038(1.07)^{-15}(9.58) \\ &= 250,132\end{aligned}$$

$$\begin{aligned}\text{EAN AL} &= 250,132(13.0382 / 20.8960) \\ &= 156,071\end{aligned}$$

Answer is C

NOTE

You can also check your work by calculating the EAN accrued liability using one of the other two formulas. I will leave that as an exercise for the student.

Fall 2013 EA-2F Exam Solutions

Problem 46 – Page 1

This is a straightforward question on IRC 430 minimum funding calculations. You need to calculate the shortfall amortization charge for 2014. This plan has a funding standard carryover balance (CB) of zero and a prefunding balance (PB) of 4,000,000 at 01/01/2014.

The main point of this problem is that it does not give you the shortfall amortization factors. You need to construct them based on the given segment rates.

Funding Shortfall

The first step is calculation of the funding shortfall. If this amount is zero, then the definition of the minimum required contribution (MRC) will be different:

$$\begin{aligned}\text{Funding S/F} &= \text{Funding target} - (\text{AAV} - \text{CB} - \text{PB}) \\ &= 60,000,000 - (61,000,000 - 0 - 4,000,000) \\ &= 3,000,000\end{aligned}$$

Shortfall Base Exemption

You do not need to think too much about whether this plan satisfies the shortfall base exemption. The transition rule for the applicable percentage expired at the end of the 2010 plan year. The modified funding shortfall is identical to the previously calculated Funding shortfall:

$$\begin{aligned}\text{Modified S/F} &= 100\% * (\text{Funding target}) - (\text{AAV} - \text{PB}) \\ &= \text{NOT zero}\end{aligned}$$

Shortfall amortization installment

The plan is not eligible for the shortfall base exemption. You have to set up the 2012 shortfall amortization base, which is equal to

1. 100% times the Funding target
2. Minus the Actuarial asset value reduced by both CB and PB
3. Minus the present value of prior years' shortfall and waiver amortization installments:

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

The problem states there are two shortfall amortization bases prior to 2014. This problem gives you the segment rates, so you can determine the 5-year and 6-year amortization factors. Then you can calculate the new shortfall base:

$$\begin{aligned}\text{PV S/F Amort} &= 500,000 \ddot{a}_{\overline{5}|j} + 350,000 \ddot{a}_{\overline{6}|j \& k} \\ &\quad \text{rate } j \text{ is } 5.0\% \quad \quad \text{rate } k \text{ is } 6.0\%\end{aligned}$$

Problem 46 – Page 2**Revised 10/19/16**

$$\begin{aligned}\ddot{a}_{\overline{5}|.05} &= 4.5460 \\ \ddot{a}_{\overline{6}|j\&k} &= \ddot{a}_{\overline{5}|.05} + (1.06)^{-5} \\ &= 4.5460 + .7473 \\ &= 5.2932\end{aligned}$$

This is a very familiar result. You might recognize this factor, since it appears in many exam questions!

$$\begin{aligned}\text{S/F Amort base} &= 100\% * (\text{Funding target}) - (\text{AAV} - \text{CB} - \text{PB}) - (\text{PV of PY Amortizations}) \\ &= 1.0 * 60,000,000 - (61,000,000 - 0 - 4,000,000) - (\text{PV of PY Amortizations}) \\ &= 3,000,000 - \{500,000(4.5460) + 350,000(5.2932)\} \\ &= -1,125,598\end{aligned}$$

You must calculate the shortfall amortization installment for 2014. You can calculate the 7-year annuity factor:

$$\begin{aligned}\ddot{a}_{\overline{7}|j\&k} &= \ddot{a}_{\overline{5}|.05} + (1.06)^{-5} + (1.06)^{-6} \\ &= 4.5460 + .7473 + .7050 \\ &= 5.9982\end{aligned}$$

$$\begin{aligned}2014 \\ \text{S/F amort} &= -1,125,598 / 5.9982 \\ &= -187,657 \\ \\ \text{S/F charge} &= 500,000 + 350,000 - 187,657 \\ &= 662,343\end{aligned}$$

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

Answer is D**NOTE**

It is no longer necessary to calculate the 6 and 7 year amortization factors. Starting with the 2014 exam, you can look up these factors in the tables given with the exam. You can only do this for two sets of segment rates: 3% / 4% / 5% or 5% / 6% / 7%.

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Problem 47

FALSE

For a plan with a valuation date on the first day of the plan year, the notification of the revocation must occur by the last day of the plan year. For a plan with a valuation date other than the first day of the plan year, the notification of the revocation must occur by deadline for contributions to be paid for the plan year.

Based on 2013 exam condition 16, the valuation date is the first day of the plan year. The date specified in the question is incorrect.

See 1.430(f)-1(f)(3)(iii)

Answer is B

NOTE

This rule allows for the fact that the “deemed reduction” rules under IRC 436 may change the amount of the carryover / prefunding balances on the 1st day of the following plan year.

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Problem 48

This problem is a simple one on quarterly contribution requirements under IRC 430(j).

I. TRUE

The test is based on the prior year so the result is known before the due date of the first quarterly installment.

II. FALSE

If this year's funding shortfall is zero, then the shortfall charge may also be zero. But the required quarterly installment would be based on the Target normal cost.

III. TRUE

This is a very tricky rule which was tested in question 12 on this year's exam.

See 1.430(f)-1(d)(1)(ii)(B)

Both item I and item III are true.

Answer is C

Fall 2013 EA-2F Exam Solutions

Problem 49

Similar to 2011 #39

Revised 10/29/14

This is a simplified question on the quarterly contribution requirement. The key point of this question is knowing how you discount the payments made back to the valuation date. This is the first True / False question that was deemed worthy of 3 points on the enrollment exams.

In this problem, you are given all the information you require. The key idea of the problem is that the 2013 plan year contributions are normally discounted back to the valuation date using the 2013 effective interest rate (EIR). During any time period for which there is an underpayment of the required quarterly installments, the interest rate used for discounting is increased by 5%.

This problem does not give you the number of days, which simplifies the calculations. You can count the periods for discounting based on half-months.

<u>Due date</u>	<u>Required Installment</u>	<u>Amount Available</u>	<u>OVER (UNDER)</u>	<u>Months</u>
04/15/2013	2,000	0	(2,000)	3.5
07/15/2013	2,000	0	(2,000)	6.5
10/15/2013	2,000	0	(2,000)	9.5
01/15/2014	2,000	0	(2,000)	12.5
09/01/2014		11,500	3,500	20.0

To answer the question, you need to calculate the discounted present value of the contributions. If that exceeds the minimum required contribution (MRC) of 10,000, then the statement is true.

Each underpayment is eliminated by the contribution at 09/01/14. The period of underpayment is measured from each due date to 09/01/14. Each payment shown above will be discounted for a total of 20 months.

Payments will be discounted at the effective interest rate of 6.0% from the valuation date up to the due date for each required quarterly installment. Payments will be discounted at the penalty rate (11.0% = 5.0% + 6.0%) from the due date up to 09/01/14.

$$\begin{aligned} PV &= 2,000 * [(1.06)^{-3.5/12} (1.11)^{-16.5/12} + (1.06)^{-6.5/12} (1.11)^{-13.5/12} + (1.06)^{-9.5/12} (1.11)^{-10.5/12} \\ &\quad + (1.06)^{-12.5/12} (1.11)^{-7.5/12}] + 3,500 * (1.06)^{-20.0/12} \\ &= 2,000 * [.8517 + .8616 + .8716 + .8817] + 3,500 * (.9075) \\ &= 10,109 \end{aligned}$$

The present value of the contributions paid exceeds the MRC for 2013, so the statement is true.

Answer is A

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Problem 50 – Page 1

The key point of this problem is knowing various details related to the rehabilitation plan under IRC 432.

I. FALSE

This is a bit of a trick question. The deadline for adopting the rehabilitation plan is 240 days after the date the plan is certified in critical status. From 03/30 to 11/30 is about 8 months - but it is actually 245 days. If every month from April through September had 30 days, then the period from 03/30 to 11/30 would be exactly 240 days.

II. FALSE

This is a simpler version of question 25 on this exam. IRC 432(e)(4)(A) defines the beginning date of the rehabilitation period:

*“(4) Rehabilitation period
For purposes of this section--*

(A) In general

The rehabilitation period for a plan in critical status is the 10-year period beginning on the first day of the first plan year of the multiemployer plan following the earlier of--

- (i) the second anniversary of the date of the adoption of the rehabilitation plan, or*
- (ii) the expiration of the collective bargaining agreements in effect on the due date for the actuarial certification of critical status for the initial critical year under subsection (a)(1) and covering, as of such date at least 75 percent of the active participants in such multiemployer plan.”*

2014 is the first year the plan is certified in critical status. For the 2014 valuation year, the due date of the actuarial certification is 03/31/2014. You are given the expiration date of the collective bargaining agreement as 12/31/2014.

The problem does not give the date of adoption of the rehabilitation plan. Based on item I, you should assume it is adopted on 11/25/2014. The date for item (i) is 11/25/2016, which is the second anniversary of the date of adoption. The date for item (ii) is 12/31/2014.

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Problem 50 – Page 2

II. FALSE - continued

The earlier of the two dates is 12/31/2014. The first day of the plan year following that date is 01/01/2015. The ten year rehabilitation period begins on 01/01/2015 and ends 12/31/2024.

III. FALSE

There is a special exception in IRC 432(f)(1)(B) which allows the plan to increase benefits, but only if the cost is paid through additional contributions.

None of the items are true.

Answer is A

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Problem 51 – Page 1

Similar to 2010 #51

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 problem asks for the "smallest amount" at 12/31/2014. Based on 2013 exam condition 35, the "smallest amount" reflects offsetting the funding standard account credit balance (CB) against the minimum contribution.

01/01/2014 data

The plan population consists of 10 clones with the same data:

Age	60
Past service	30

The Unit Credit accrued liability is defined as the present value of the actual accrued benefit. One key to this problem is handling the multiple retirement decrements correctly in calculating the Accrued liability as an active employee. The accrued liability must be calculated as a complicated summation:

$$AL = \sum_{t=0}^5 v^t p_{60}^{(T)} q_{60+t}^{(r)} (ER \text{ Ben})_{60} \ddot{a}_{60+t}^{(12)}$$

The first step is to calculate the participant's accrued benefit at the valuation date. With a benefit rate of \$204 per month, the benefits are quite large.

$$\begin{aligned} \text{Accd ben} &= 12(204)(30) \\ &= 73,440 \end{aligned}$$

$$\begin{aligned} \Delta \text{Accd ben} &= 12(204) \\ &= 2,448 \end{aligned}$$

Accrued Liability

The second step is to calculate the Accrued Liability. You should calculate the early retirement benefits at each decrement age:

$$\begin{aligned} \text{ER ben}_{63} &= 73,440 * (1 - 5\%(65 - 63)) \\ &= 66,096 \end{aligned}$$

$$\begin{aligned} \text{ER ben}_{64} &= 73,440 * (1 - 5\%(65 - 64)) \\ &= 69,768 \end{aligned}$$

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Problem 51 – Page 2

	(1)	(2)	(3)		(4)	(5)	(6)	
<u>t</u>	<u>60+t</u>	<u>v^t</u>	<u>_tp^(T)₆₀</u>	<u>q^(r)_{60+t}</u>	<u>p^(T)_{60+t}</u>	<u>ERB_{60+t}</u>	<u>$\ddot{a}^{(12)}_{60+t}$</u>	<u>(1)(2)(3)(4)(5)</u>
3	63	.8396	1.000	0.20	0.80	66,096	12.78	141,846
4	64	.7921	0.800	0.20	0.80	69,768	12.53	110,791
5	65	.7473	0.640	1.00	0.00	73,440	12.27	<u>430,951</u>
								683,588

The column which shows the one year probability of survival is not used in the summation. But it is used to develop the value of column 2 at the next calculation age.

The total accrued liability for the 10 participants is $6,835,883 = 10 \times 683,588$. The normal cost uses the same PV factor as the accrued liability. You can use the ratio of the benefit accrual to the accrued benefit to calculate the normal cost:

$$\begin{aligned} NC &= 6,835,883(1/30) \\ &= 227,863 \end{aligned}$$

2013 G/L calculation

The hidden trick in this question is that you need to set up a gain / loss base for 2013. The problem states that the CB at 01/01/2014 is zero, and there are no amortization bases established prior to 2014.

You need to use the actuarial equation of balance to solve for the G/L base. Then you can complete the minimum funding standard account (MFSA).

$$\begin{aligned} UAL &= AL - AAV \\ &= 6,835,883 - 6,200,000 \\ &= 635,883 \end{aligned}$$

$$\begin{aligned} 01/01/14 \text{ UAL} &= O/S \text{ 431 bases} - CB - ARA \\ 635,883 &= 635,883 \text{ loss base} - \text{zero} \end{aligned}$$

To set up the MFSA, you need to determine the amortization for the 431 loss base.

$$\begin{aligned} \text{Loss amort} &= 635,883 / \ddot{a}_{15|.06} \\ &= 61,766 \end{aligned}$$

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Problem 51 – Page 3

Now you can set up the MFSA and calculate the 12/31/14 “smallest amount”:

2011 Minimum Funding Standard Account			
Charges		Credits	
Normal Cost	227,863	Credit Balance	0
Loss amortization	61,766	12/31 minimum	X
6% interest	17,378	6% interest	0
Total charges	307,007	Total credits	X

The “smallest amount” at 12/31/14 is 307,007. This includes interest to 12/31, and reflects offsetting the credit balance against the minimum contribution.

Answer is B

NOTE

Since you have an individual cost method, you should also think about the Full Funding Limitation. Since the UAL is very large, it should be clear that the FFL does not have any effect on the MFSA.

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Problem 52 – Page 1

Similar to 2010 #19

There are two key ideas in this problem:

- Calculation of 415 limits
- Calculation of the Funding target and Target normal cost

The problem give the values of both the IRC 415 dollar limit and the 401(a)(17) compensation limit for 2014. Those values were not known when the problem was written in 2013. The main point of the problem is correctly calculating the benefits for both the Funding target and the Target normal cost.

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.

Valuation date	01/01/14	01/01/15
Age	50	51
Past service	3	4
Participation service	3	4
		240,000*(1.10)
Prior year's pay	240,000	= 264,000

PLAN BENEFIT

Since the problem asks for the Target normal cost, you must calculate the accrued benefit at both 01/01/2014 and 01/01/2015. 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. The problem states that the assumed pay increase is 10% per year, but you can't allow for any increases in the 401(a)(17) limit.

Valuation date	01/01/14	01/01/15
Prior year pay	240,000	240,000*(1.10) = 264,000
401(a)(17) limit	255,000	255,000
Limited pay	240,000	255,000
	$(100,000+200,000+240,000) / 3$	$(200,000+240,000+255,000) / 3$
3 year average pay	= 180,000	= 231,667
	10%(3)(180,000)	10%(4)(231,667)
Accrued benefit	= 54,000	= 92,667

The key point of the problem is that you also need to consider the 415 limit.

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Revised 10/29/14

415 COMP LIMIT

The §415(b)(1)(B) compensation limit is based on the high consecutive three years. It is reduced when service is less than ten years. You previously calculated the final 3 year average compensation for the plan benefit. The 415 compensation limit has the same value as the plan benefit at both 01/2014 and 01/2015.

415 DOLLAR LIMIT

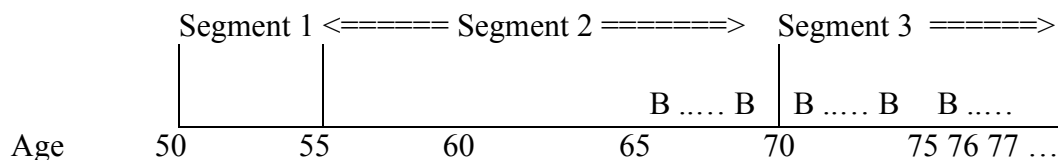
The next step is calculation of the §415 dollar limit under §415(b)(1)(A). The dollar limit is reduced when participation is less than ten years. Smith has 3 years of participation service at 01/01/2014.

Valuation date	01/01/14	01/01/15
415 compensation limit	$(100,000+200,000+240,000) / 3 = 180,000$	$(200,000+240,000+255,000) / 3 = 231,667$
415 dollar limit	$(3/10)*205,000 = 61,500$	$(4/10)*205,000 = 82,000$
Final 415 limit	61,500	82,000
Final accrued benefit limited by 415	54,000	82,000

$$\begin{aligned}\Delta AB &= 82,000 - 54,000 \\ &= 28,000\end{aligned}$$

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. Based on the default exam conditions, normal retirement age is 65, and the benefit is assumed payable monthly, starting at normal retirement age. Since the participant is currently age 50, their benefit payments will be valued using the last two segment rates:



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

$$\text{Age 50 FT} = 54,000 * [{}_{15|} \ddot{a}_{50:\overline{5}|}^{(12)}_{seg_2} + {}_{20|} \ddot{a}_{50}^{(12)}_{seg_3}]$$

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Problem 52 – Page 3

Now you need to express these annuities in terms of commutation functions. One complicating factor is that there are no pre-retirement decrements. The period between age 50 and 65 must be calculated using an interest-only discount. One nice thing about this problem is they did not try to trick you by giving commutation functions prior to age 65.

$$\begin{aligned} {}_{15|} \ddot{a}_{50:\overline{5}|}^{(12)}_{seg_2} &= (v^{15} {}_{15}p_{50}) \ddot{a}_{65:\overline{5}|}^{(12)}_{seg_2} && \text{all at segment 2 rate} \\ &= (1.065)^{-15} (N_{65}^{(12)} - N_{70}^{(12)}) / D_{65} && \text{all at segment 2 rate} \end{aligned}$$

$$\begin{aligned} {}_{20|} \ddot{a}_{50}^{(12)}_{seg_3} &= (v^{20} {}_{20}p_{50}) \ddot{a}_{70}^{(12)}_{seg_3} && \text{all at segment 3 rate} \\ &= (1.075)^{-15} N_{70}^{(12)} / D_{65} && \text{all at segment 3 rate} \end{aligned}$$

$$\begin{aligned} \text{Age 50 FT} &= 54,000 \left[\frac{(1.065)^{-15} (16,118 - 9,666)}{1,540} + \frac{(1.075)^{-15} (4,714)}{839} \right] \\ &= 54,000 [1.6290 + 1.8989] \\ &= 190,508 \end{aligned}$$

$$\begin{aligned} \text{Age 50 TNC} &= 28,000 [1.6290 + 1.8989] \\ &= 98,782 \end{aligned}$$

$$\begin{aligned} \text{FT} + \text{TNC} &= 190,508 + 98,782 \\ &= 289,290 \end{aligned}$$

Answer is B

NOTE

This is exactly the type of IRC 415 problem that I expect on the EA-2F exam. It is primarily a funding question, and the calculations of the 415 limit were not overly complex.

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Problem 53

2013 exam condition 31 states that the plan sponsor's funding ratio for the prior year was at least 80%, so they are eligible to apply both the CB and the PB against the MRC. Since this problem gives you the prior year's valuation results, you should not rely on exam condition 31.

You should check the "funding ratio" for 2013 to be sure that the plan can apply the CB and the PB towards the 2014 MRC. This calculation is defined in IRC 430(f)(3):

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

The problem asks for the value of X, which is the numerator of the fraction.

$$\begin{aligned} X &= 900,000 - 200,000 \\ &= 700,000 \end{aligned}$$

Answer is B

Fall 2013 EA-2F Exam Solutions

Problem 54 – Page 1

The key to this problem is that you must know how to do calculations under the Entry Age Normal method. The main point of this question is using the commutation functions to calculate the Entry Age Normal accrued liability.

In general, the Entry Age Normal Cost (EANC) is defined as the present value of benefits at entry age, divided by a temporary annuity at entry age.

$$\text{EANC} = \text{PVB}_{\text{EA}} / \ddot{s}_{\overline{\text{EA:RA-EA}}|}$$

01/01/14 data

In this problem, the benefits are not based on pay. As a result, the annuity in the denominator has no salary scale, which simplifies the calculations. You are given data for three participants.

	Smith	Jones	Brown
Hire age	45	45	45
Entry age	45	45	45
01/01/14 age	45	55	65

Based on the exam conditions, normal retirement age is 65 by default. To calculate the present value of future benefits at entry age, you need to calculate the projected monthly benefit at age 65. Another simplification is that all three were hired at the same age, so they all have the same projected benefit, and the same EANC.

Accrued Liability

The problem asks for the total accrued liability at 01/01/2014. There are three ways to calculate the EAN accrued liability. The prospective and retrospective formulas require you to calculate the Entry Age Normal cost:

Prospective

$$\text{EAN AL} = \text{PVB} - \text{PV}(\text{EANC})$$

Retrospective

$$\text{EAN AL} = (\text{EANC}) \ddot{s}_{\overline{\text{EA:CA-EA}}|}$$

The third formula uses the ratio of two annuities (at entry age) times the PVB at the current age:

$$\text{EAN AL} = \text{PVB}_{\text{CA}} * (\ddot{s}_{\overline{\text{EA:CA-EA}}|} / \ddot{s}_{\overline{\text{EA:RA-EA}}|})$$

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Problem 54 – Page 2

I will use the retrospective formula to calculate the accrued liability. The first step is calculation of the EANC:

$$\begin{aligned}\text{Proj ben} &= 20(\$300) \\ &= 6,000\end{aligned}$$

$$\begin{aligned}\text{PVB}_{45} &= 6,000(D_{65} / D_{45}) \ddot{a}_{65} \\ &= 6,000(N_{65} / D_{45}) \\ &= 6,000(22,745 / 7,142) \\ &= 19,108\end{aligned}$$

There is a minor trick to this calculation. It does not use a monthly life annuity, since the benefit is defined as payable “at the beginning of the year”.

$$\begin{aligned}\text{EA NC} &= \text{PVB}_{\text{EA}} / \ddot{a}_{\overline{\text{EA:RA-EA}}|} \\ &= 19,108 / [(N_{45} - N_{65}) / D_{45}] \\ &= 19,108 / [(106,115 - 22,745) / 7,142] \\ &= 1,637\end{aligned}$$

Now you can calculate the EAN accrued liability:

$$\text{EAN AL} = (\text{EANC}) \ddot{s}_{\overline{\text{EA:CA-EA}}|}$$

	Smith	Jones	Brown
Entry age	45	45	45
01/01/14 age	45	55	65
$\ddot{s}_{\overline{\text{EA:CA-EA}} }$	zero	$(N_{45} - N_{55}) / D_{55}$ $(106,115 - 52,143) / 3,932$ $= 13.7263$	$(N_{45} - N_{65}) / D_{65}$ $(106,115 - 22,745) / 2,090$ $= 39.8900$
EAN AL	zero	$1,636.92(13.7263)$ $= 22,469$	$1,636.92(39.8900)$ $= 65,297$

The total accrued liability is 87,766.

Answer is D

NOTE

You can also check your work by calculating the EAN accrued liability using one of the other two formulas. I will leave that as an exercise for the student.

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Problem 55 – Page 1

Similar to 2012 #01

Revised 09/08/15

This is the second question asked on the IRC 413(c) rules for multiple employer plans. Under 413(c)(4)(A) the minimum funding calculations are done separately for each employer's plan. There is an alternative election to treat the multiple plans as a single plan for minimum funding calculations. That election is only available for plans established before 12/31/88, so it does not apply in this problem.

The problem asks for the "smallest amount" at 01/01/2014 for Employer A. Since the funding calculations are done separately, you can ignore the information for Employer B and Employer C.

Based on 2013 exam conditions 31 and 32, the plan sponsor elects to offset both the CB and the PB against the minimum contribution under IRC 430. Based on 2013 exam condition 35, the "smallest amount" reflects offsetting both the CB and the PB against the minimum required contribution (MRC).

Funding Shortfall

The first step is calculation of the funding shortfall. If this amount is zero, then the definition of the minimum required contribution (MRC) will be different:

$$\begin{aligned}\text{Funding S/F} &= \text{Funding target} - (\text{AAV} - \text{CB} - \text{PB}) \\ &= 3,500,000 - (3,250,000 - 150,000 - 100,000) \\ &= 500,000\end{aligned}$$

Shortfall Base Exemption

You do not need to think too much about whether this plan satisfies the shortfall base exemption. The problem gives you the 2014 shortfall charge.

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.

$$\begin{aligned}\text{MRC} &= \text{TNC} + \text{Shortfall amort charge} + \text{Waiver amort charge} \\ &= 400,000 + 80,000 + 0 \\ &= 480,000\end{aligned}$$

Smallest amount

The problem asks for "the smallest amount that satisfies the minimum funding standard", as of 01/01/2014.

$$\text{Smallest contr} = \text{MRC} - \text{CB} - \text{PB}$$

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$$\begin{aligned}\text{Smallest contr} &= 480,000 - 150,000 - 100,000 \\ &= 230,000\end{aligned}$$

Answer is A

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Problem 56

Similar to 2002 #20

Revised 10/19/16

The key to this problem is handling mandatory employee contributions, and understanding the definition of employer normal cost. The employer normal cost simply means the normal cost, reduced to reflect the effect of the mandatory employee contributions. The remainder of the problem is determining the normal cost under the Aggregate method.

With no mandatory employee contributions the Aggregate cost method definitions are:

$$\begin{aligned}\$431 \text{ PVNC} &= \text{PVB} - \text{AAV} - (\text{O/S } \$431 \text{ bases} - \text{CB}) && \text{NOTE: no ARA under Aggregate} \\ \text{AGG NC} &= \text{PVNC} / \left(\text{average } \frac{\text{X:RA-X}}{\text{X:RA-X}} \right)\end{aligned}$$

With mandatory employee contributions, you increase both the PVB and the AAV. You increase the PVB by the amount of expected future refunds of contributions. The AAV should include the accumulated past mandatory employee contributions (EECWI). The AAV is also increased by the present value of future expected mandatory employee contributions (PVEEC):

$$\$431 \text{ PVNC} = (\text{PVB} + \text{refunds}) - (\text{AAV} + \text{PVEEC}) - (\text{O/S } \$431 \text{ bases} - \text{CB})$$

The present value of future mandatory employee contributions is given as 200,000. Based on the default exam conditions, there are no pre-retirement decrements. As a result, the present value of future refunds is zero.

$$\begin{aligned}\$431 \text{ PVNC} &= 10,000,000 - (4,500,000 + 200,000) - (0 - 0) \\ &= 5,300,000\end{aligned}$$

$$\begin{aligned}\text{PVE} / \text{E} &= 6,500,000 / 1,000,000 \\ &= 6.5\end{aligned}$$

$$\begin{aligned}\text{AGG NC} &= 5,300,000 / 6.5 \\ &= 815,385\end{aligned}$$

Answer is A

NOTE:

This is the second problem of this type that did not allow an alternate method of solution. Since the contribution rate is not specified, you can't determine the mandatory employee contributions for the current year. These calculations are shown in the alternate solution for problem 29 on this exam.