



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 2012 EA-2A EXAM SOLUTIONS

Copyright © 2013 by
Rick Groszkiewicz FSA EA

Fall 2012 EA-2A Exam Solutions

These solutions were prepared based on the law as in effect at May 31, 2012. 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 7, 2018	Corrected solution for problem 3
October 18, 2016	Added note at end of solution for problem 38
August 29, 2016	Changed note at end of solution for problem 20
July 25, 2015	Corrected solution for problem 3
October 10, 2014	Corrected solutions for problems 5 and 52
September 15, 2014	Corrected solutions for problems 3, 13, 37, 40, 43 and 52
August 11, 2014	Corrected solutions for problems 3, 9 and 23
October 29, 2013	Corrected note at end of solution for problem 45
October 24, 2013	Corrected solution for problem 4
August 1, 2013	Original solutions

<u>Exam Year</u>	<u>Pass Mark</u>	<u>Percentage Who passed</u>
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

Fall 2012 EA-2A Exam Solutions

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

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

Modified assets

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

Based on 2012 exam conditions 27 and 28, 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

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

Fall 2012 EA-2A Exam Solutions

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

2012 exam condition 27 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 27. 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:

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

Fall 2012 EA-2A Exam Solutions

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

1. Calculate the normal cost plus limit adjustments with interest to the earlier of the end of the plan year or the end of the tax year.
2. Calculate the Full Funding Limitation under Section 404 with interest to the end of the plan year. If this is less than the result of step one, then you can skip to step four.
3. Calculate the absolute minimum amount necessary to produce a non-negative credit balance in the Minimum Funding Standard Account. This is the “smallest amount to satisfy the minimum funding standard” as defined in 2012 exam condition 31. This may be increased by the amount of any "includible employer contribution."
4. The maximum deductible limit is the greater of (1) and (3), but not greater than (2).
5. The UCL limit is equal to $140\% \times (\text{Current Liability})$ minus AAV. If this exceeds the deductible limit in step 4, then the final deductible limit will equal the UCL limit. This UCL limit ignores recent benefit improvements for small plans with highly compensated employees.

Fall 2012 EA-2A Exam Solutions

Problem 1 – Page 1

This is the first 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 "minimum required contribution" at 01/01/13. Based on 2012 exam condition 30, the plan sponsor does not offset the carryover balance (CB) or the prefunding balance (PB) against the minimum contribution under IRC 430.

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:

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

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. Since the CB and PB are zero for all three plans, the modified funding shortfall is identical to the Funding shortfall:

$$\text{Modified S/F} = 100\% * (\text{Funding target}) - (\text{AAV} - \text{PB})$$

Shortfall amortization installment

Assume that a 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:

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

This problem gives you the 7-year amortization factor, so you can calculate the new shortfall base.

Fall 2012 EA-2A Exam Solutions

Problem 1 – Page 2

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.

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

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).

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

Here are the calculations for all three plans

	Employer A	Employer B	Employer C
Funding shortfall	500,000 - 505,000 = zero	600,000 - 620,000 = zero	700,000 - 600,000 = 100,000
Shortfall base exemption	N/A	N/A	Not exempt
Shortfall base	N/A	N/A	100,000
Shortfall amortization	N/A	N/A	100,000 / 6.0 = 16,667
Minimum required contribution	10,000 - 5,000 = 5,000	15,000 - 20,000 = zero	20,000 + 16,667 = 36,667

The total for all three plans is 41,667.

Answer is C

Fall 2012 EA-2A Exam Solutions

Problem 2 – Page 1

Similar to 2011 #47

This is the third question asked on the “new 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 PB or the carryover balance (CB) at the beginning of the year must be increased with interest based on the plan's rate of return on assets.

AFTAP deemed reduction

The problem asks for the prefunding balance at 01/01/13. The problem states that the plan sponsor elects to offset 50,000 of the PB against the 2012 minimum contribution under IRC 430.

The hidden trick in the problem is that you must also reduce the PB due to the deemed reduction rules in IRC 436. The problem states that the plan pays accelerated distributions. This means that the plan is subject to the IRC 436(d) restrictions.

In order to pay those distributions, the AFTAP must be at least 80%. You need to calculate the AFTAP at 01/01/2012 to see if it satisfies IRC 436(d):

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

$$\begin{aligned}\text{AFTAP} &= \frac{0 + 950,000 - 0 - 200,000}{0 + 1,000,000} \\ &= 75.0\%\end{aligned}$$

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).

Since the denominator of the ratio is 1,000,000, it is clear that the desired numerator is 800,000. This means that the deemed reduction in the PB is 50,000:

$$\begin{aligned}\text{AFTAP} &= \frac{950,000 - (200,000 - 50,000)}{1,000,000} \\ &= 80.0\%\end{aligned}$$

$$\begin{aligned}\text{Remaining} \\ \text{01/2012 PB} &= 200,000 - 50,000 \text{ deemed reduction} \\ &= 150,000\end{aligned}$$

Fall 2012 EA-2A Exam Solutions

Problem 2 – Page 2

Excess contribution

You can calculate the amount of the excess contribution at 01/01/2012. You need to compare the present value of the actual contribution to the minimum required contribution (MRC). The present value is calculated using the effective rate of interest for the 2012 plan year:

$$\begin{aligned}\text{PV of contrib} &= 300,000 \times (1.06)^{-1} \\ &= 283,019\end{aligned}$$

$$\begin{aligned}\text{Addition to} \\ \text{2012 PB} &= 283,019 - (250,000 \text{ MRC} - 50,000 \text{ PB}) \\ &= 83,019 \\ &= 33,019 \text{ excess contribution} + 50,000 \text{ PB applied to MRC}\end{aligned}$$

$$\begin{aligned}\text{Remaining} \\ \text{01/2012 PB} &= 150,000 - 50,000 \text{ applied to MRC} \\ &= 100,000\end{aligned}$$

If there was no PB applied towards the MRC, then the 01/2013 PB equals the sum of

- the 01/2012 PB brought forward with the 2012 rate of return on assets
- the excess contribution brought forward with the effective rate of interest for the 2012 plan year.

But the calculation is not actually done that way, due to the rule defined in the regulation. The portion of the prefunding balance that is attributed to the sponsor's use of the CB or the PB at the beginning of the year must be increased with interest based on the 2012 rate of return on assets.

$$\begin{aligned}\text{01/2013 PB} &= 1.06(33,019 \text{ excess contribution}) + 1.30(100,000 \text{ PB} + 50,000 \text{ PB}) \\ &= 230,000\end{aligned}$$

Answer is B

NOTES

1. As expected, you get the wrong answer range if you use the 2012 effective interest rate (or the 2012 asset return rate) to bring forward the entire PB.
2. If you do not make the IRC 436(d) deemed reduction in the PB, you get a value of 295,000 for the 01/2013 PB. This falls outside the implied range for E, which is a hint you probably did something wrong.
3. As a check, if the plan sponsor does not elect to apply the PB towards the 2012 MRC, you should get the same value for the 01/2013 PB. The rule in the final regulation is designed to produce this result. Actuaries can not use the difference between the rate of return on assets and the effective interest rate to affect the value of next year's PB.

Fall 2012 EA-2A Exam Solutions

Problem 2 – Page 3

NOTES - continued

4. There is another way to determine the 2013 PB, which you may find easier to understand. The calculation on the prior page determines the 2012 addition to the PB based on applying 50,000 of the PB towards the MRC.

As mentioned in the prior note, you get the same result if none of the PB is applied toward the MRC:

$$\begin{aligned}\text{PV of contrib} &= 300,000 \cdot (1.06)^{-1} \\ &= 283,019\end{aligned}$$

$$\begin{aligned}\text{Addition to} \\ \text{2012 PB} &= 283,019 - (250,000 \text{ MRC}) \\ &= 33,019 \text{ excess contribution}\end{aligned}$$

$$\begin{aligned}01/2013 \text{ PB} &= 1.06(33,019 \text{ excess contribution}) + 1.30(150,000 \text{ PB}) \\ &= 230,000\end{aligned}$$

Problem 3 – Page 1

Similar to 2011 #22

Revised 09/07/18

The IRS released Notice 2009-22 in March 2009. It includes two detailed examples of the asset valuation method in IRC 430(g)(3), which include determination of the adjustment for expected earnings. The first example is very similar to the one in the 1.430(g)-1 proposed regulation. It is essentially a three year average market value calculation. The second example shows calculation of the average market value over the four prior quarters of the plan year.

There are two calculation techniques shown for the first example in Notice 2009-22. The first one requires calculation of the adjusted cash flows, which are used to adjust market values from prior dates up to the valuation date. Then the average market value is calculated. The final actuarial value of assets must be limited to be within 10% of the market value.

The second calculation method in Notice 2009-22 is based on the technique shown in Revenue Procedure 2000-40. The actuarial value of assets is calculated using decreasing fractions of each of the prior year's gain or loss. The alternate calculation is shown at the end of this solution.

This problem states the AAV uses the average market value over one year. The first step is calculation of the adjusted cash flows, which are used to adjust market values from prior dates up to the valuation date.

You must calculate the expected return on assets for 2012. The problem states that the actuary's assumed annual rate of return on assets is 7.00%. 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. The result is that the assumed rate of return is limited to 6.00%.

Based on the 6.00% assumed return, you can calculate the expected return on assets for 2012. The calculation must allow for the timing of the cash flows during the year. You are told that all the cash flows occur at the end of the year:

Expected return calculation	6.00%
Plan year	2012
Beginning of year values	
Market value at 1-1	4,300,000
End of year values (no interest)	
Contribution paid 12/31/12	500,000
Benefit pmt + expenses	(114,000)
Expected return (compound)	258,000

Fall 2012 EA-2A Exam Solutions

Problem 3 – Page 2

Revised 09/07/18

Now you can calculate the cash flow adjustment for 2012. This is the sum of the cash flows and the expected return.

Adjustment for year

Year	2012
Trust assets at 1-1	4,300,000
Market value at 1-1	4,300,000
Benefit payments	(100,000)
Expenses	(14,000)
Contribution paid 12/31/12	500,000
Expected return (compound)	<u>258,000</u>
Adjustment for year	644,000

Now you can calculate the adjusted market values. The 2013 market value was given in the problem as 4,250,000. Each prior year's market value must be increased to reflect cash flows and expected interest from the date the market value is determined up to 01/01/2013:

Average market value calculation

Year	2012	2013
Market value at 1-1	4,300,000	4,250,000
Adjustment for 2012	<u>644,000</u>	
Adjusted fair market value	4,944,000	4,250,000

The preliminary actuarial asset value (AAV) is the average of the two adjusted market values:

$$4,597,000 = (4,944,000 + 4,250,000) / 2.$$

This preliminary actuarial asset value of 4,597,000 must be compared to the corridors. The final AAV must be limited to be within 10% of the market value.

The bottom of the corridor is 90% of market value, or 3,825,000. The top of the corridor is 110% of market value, or 4,675,000. The final actuarial value of assets is 4,597,000.

Answer is C

NOTE

There is an alternative solution for this problem. You can use an asset valuation technique from Revenue Ruling 2000-40 (pre-PPA 2006), and produce exactly the same AAV.

Method 15 - Smoothed market value without phase-in

The actuarial value of assets equals the market value less a decreasing fraction (i.e., $[n-1]/n$, $[n-2]/n$, etc. where n is the number of years in smoothing period) of the G/L for each of the prior $n-1$ years. The G/L is defined as the difference between the expected value and market value of assets at the valuation date. The expected value is calculated by bringing forward all cash flows with interest at the valuation rate up to this year's valuation date. If the expected value is less than the market value, the difference is a gain (and vice versa).

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

$$01/2013 \text{ AAV} = 01/2013 \text{ MVA} - 1/2(2012 \text{ G/L})$$

You need to calculate the value of the G/L for 2012. This is the difference between the expected value (previously calculated) and the actual market value given.

The first thing you need to calculate is the expected MVA each year. The calculation uses the same numbers as the adjustment for the year. The 12/31 expected MVA equals the sum of the 01/01 MVA and the adjustment for the year:

$$\begin{aligned} 01/2013 \text{ } e\text{MVA} &= 01/2012 \text{ MVA} + \text{adjustment for 2012} \\ 4,944,000 &= 4,300,000 + 644,000 \end{aligned}$$

$$\begin{aligned} 2012 \text{ G/L} &= 01/2013 \text{ MVA} - 01/2013 \text{ } e\text{MVA} \\ &= 4,250,000 - 4,944,000 \\ &= -694,000 \quad (\text{Gain}) \end{aligned}$$

$$\begin{aligned} 01/2013 \text{ AAV} &= 01/2013 \text{ MVA} - 1/2(2012 \text{ G/L}) \\ &= 4,250,000 - (1/2)(-694,000) \\ &= 4,597,000 \end{aligned}$$

This preliminary actuarial asset value of 4,597,000 must be compared to the corridors. The bottom of the corridor is 90% of market value, or 3,825,000. The final actuarial value of assets is 4,597,000.

This is identical to the earlier result calculated using the method in Notice 2009-22.

Fall 2012 EA-2A Exam Solutions

Problem 4 – Page 1

Similar to 2010 #40

Revised 10/24/13

This is the second question asked on the EA-2A exam regarding post-PPA 2006 waivers. This is a relatively “forgiving” question, since you get the correct answer range if you determine the waiver amortization factor incorrectly.

The problem states that both the funding standard carryover balance (CB) and the prefunding balance (PB) are equal to zero. There were no shortfall bases or waiver bases prior to 2013.

2013 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.

$$\begin{aligned}\text{Funding S/F} &= \text{Funding target} - (\text{AAV} - \text{CB} - \text{PB}) \\ &= 3,000,000 - (2,700,000 - 0 - 0) \\ &= 300,000\end{aligned}$$

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 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 2012 waiver is amortized starting in 2013. Based on the regulations, the amount of the waiver amortization payment is determined using the 2012 segment rates. The amortization factor assumes waiver payments starting in 2013, 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 2012 for four years, and the 2nd segment rate for 2012 for one year:

$$\begin{aligned}\text{Amort factor} &= a_{\overline{4}|.02} + (1.04)^{-5} \\ &= 4.6297\end{aligned}$$

Fall 2012 EA-2A Exam Solutions

Problem 4 – Page 2

$$\begin{aligned}\text{Waiver amort} &= 25,000 / 4.6297 \\ &= 5,400\end{aligned}$$

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 are five years left in the amortization of the 2012 waiver. You can directly calculate the 5 year amortization factor for the 2012 waiver, which is $\ddot{a}_{\overline{5}|.03}$, or 4.7171. The problem states there are no prior shortfall bases.

$$\begin{aligned}\text{S/F Amort base} &= 100\% * (\text{Funding target}) - (\text{AAV} - \text{CB} - \text{PB}) - (\text{PV of PY Amortizations}) \\ &= 1.0 * 3,000,000 - (2,700,000 - 0 - 0) - (5,400 * 4.7171) \\ &= 300,000 - 25,472 \\ &= 274,528\end{aligned}$$

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

$$\begin{aligned}\text{S/F amort} &= 274,528 / 6.2468 \\ &= 43,947\end{aligned}$$

$$\text{S/F charge} = 43,947$$

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.

Maximum funding waiver

This problem asks for X, which is the “maximum funding waiver” for 2013. X is equal to the sum of the target normal cost and the shortfall amortization for 2013:

$$\begin{aligned}X &= \text{TNC} + \text{Shortfall amort charge} \\ &= 5,000 + 43,947 \\ &= 48,947\end{aligned}$$

Fall 2012 EA-2A Exam Solutions

Problem 4 – Page 3

The key point of the problem is that the plan sponsor must pay the waiver amortization in 2013 - even if they are granted a waiver for 2013.

Answer is B

NOTE

This is the first exam question where you must calculate the waiver amortization factor. But you can get the same answer range, even though you calculate the waiver amortization incorrectly.

If you incorrectly use the 2013 segment rates (3% for 4 years and 5% for the fifth year), the amortization factor is 4.5006. The resulting waiver amortization payment is 5,555, which eventually gives a shortfall amortization charge of 43,830.

The value of X is 48,830, which is still in answer range B. I would expect future exam problems on waiver calculations would punish this type of error.

Fall 2012 EA-2A Exam Solutions

Problem 5

Similar to 2011 #02

Revised 10/10/14

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

At 06/30/2012

Age	unknown
Service	7 years
Participation	7 years

The first step is determining the pay that can be used to calculate Smith's accrued benefit. In general, the 401(a)(17) limit for a calendar year applies to any plan year that begins in that calendar year:

Plan Year Beginning	Applicable 401(a)(17) limit	Plan year Ending	Plan year Pay	Limited pay
07/01/05	210,000	06/30/06	217,000	210,000
07/01/06	220,000	06/30/07	240,000	220,000
07/01/07	225,000	06/30/08	250,000	225,000
07/01/08	230,000	06/30/09	255,000	230,000
07/01/09	245,000	06/30/10	230,000	230,000
07/01/10	245,000	06/30/11	210,000	210,000
07/01/11	245,000	06/30/12	205,000	205,000

The first five consecutive years give the highest value of Smith's average annual compensation:

$$\begin{aligned} \text{5 year average compensation} &= (210,000 + 220,000 + 225,000 + 230,000 + 230,000) / 5 \\ &= 223,000 \end{aligned}$$

$$\begin{aligned} \text{Accrued benefit} &= 223,000 * 1.2\% * 7 \\ &= 18,732 \end{aligned}$$

One simplification is that the benefit is low enough that you can ignore the IRC 415 limits. When you calculate the accrued benefit, it is assumed payable at normal retirement age, which is 65 by default. In this problem you don't know the participant's age, which is slightly confusing.

Answer is B

Fall 2012 EA-2A Exam Solutions

Problem 6 – Page 1

Similar to 2010 #49

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 1,000 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.

01/01/2013 data

Birth date	01/01/55
Age	58
2012 pay	31,200 at age 57

$$\begin{aligned}\text{Age 64 pay} &= 31,200(1.04)^7 \\ &= 41,057\end{aligned}$$

$$\begin{aligned}\text{Proj ben}_{65} &= 41,057(25\%) \\ &= 10,264\end{aligned}$$

$$\begin{aligned}\text{PVB}_{58} &= 10,264(D_{65}/D_{58}) \ddot{a}_{65}^{(12)} \\ &= 10,264(v^7)({}_7p_{58}) \ddot{a}_{65}^{(12)}\end{aligned}$$

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).

$$\begin{aligned}\text{PVB}_{58} &= 10,264(1.06)^{-7}(10.00) \\ &= 68,263\end{aligned}$$

$$\begin{aligned}\text{Total PVB} &= 1,000(68,263) \\ &= 68,263,244\end{aligned}$$

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”.

Fall 2012 EA-2A Exam Solutions

Problem 6 – Page 2

$$\begin{aligned}\text{AGG PVNC} &= \text{PVB} - \text{AAV} - (\text{O/S 431 bases} - \text{CB}) \\ &= 68,263,244 - 10,600,000 - (0 - 0) \\ &= 57,663,244\end{aligned}$$

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:

$$\begin{aligned}{}^s\ddot{a}_{58:\overline{7}|} &= [1 + (1.04/1.06)^1 + (1.04/1.06)^2 + \dots + (1.04/1.06)^6] \\ &= \ddot{a}_{\overline{7}|j} \quad \text{where } 1+j = 1.06/1.04 \rightarrow j = 1.923\% \\ &= 6.6160\end{aligned}$$

$$\begin{aligned}\text{AGG NC} &= 57,663,244 / 6.6160 \\ &= 8,715,725\end{aligned}$$

Answer is C

Fall 2012 EA-2A Exam Solutions

Problem 7

Similar to 2011 #47

This is a straightforward question on the calculation of the prefunding balance at 01/01/2013. This problem is simpler than some other exam questions, since the plan sponsor did not elect to apply any portion of the 2012 prefunding balance towards the 2012 minimum required contribution.

Excess contribution

The first step is to calculate the amount of the excess contribution at 01/01/2012. You need to compare the present value of the actual contribution to the MRC. The present value is calculated using the effective rate of interest for the 2012 plan year:

$$\begin{aligned}\text{PV of contrib} &= 40,000 \cdot (1.07)^{-1} \\ &= 37,383\end{aligned}$$

$$\begin{aligned}\text{Addition to} \\ \text{2012 PB} &= 37,383 - 35,000 \text{ MRC} \\ &= 2,383 \text{ excess contribution}\end{aligned}$$

2012 Rate of return on assets

The 01/2013 PB equals the sum of the 01/2012 PB (brought forward using the rate of return on assets for the 2012 plan year) plus the excess contribution (brought forward with the effective rate of interest for the 2012 plan year). You must determine the rate of return on assets for 2012.

You are given the market values at the beginning and end of 2012, as well as the cash flows for 2012. You can solve for the rate of return on assets for 2012:

$$01/2013 \text{ MVA} = (1+j)(01/2012 \text{ MVA}) + 12/31 \text{ contribution} - 12/31 \text{ benefit payments}$$

$$\begin{aligned}473,000 &= (1+j) \cdot 460,000 + 40,000 - 50,000 \\ 483,000 &= (1+j) \cdot 460,000 \\ (1+j) &= 483,000 / 460,000 \\ j &= 5.0\%\end{aligned}$$

2013 Prefunding balance

$$\begin{aligned}01/2013 \text{ PB} &= 1.07(2,383 \text{ excess contribution}) + 1.050(50,000 \text{ PB}) \\ &= 55,050\end{aligned}$$

Answer is B

Fall 2012 EA-2A Exam Solutions

Problem 8

TRUE

This is a simple question on the effect on treatment of plan amendments for single employer plans. Under IRC 430, any plan amendment that is adopted on or before the valuation date and which becomes effective during the plan year must be reflected in the valuation for the plan year.

The point of this question is that a plan amendment is not allowed to go into effect if the adjusted funding target attainment percentage for the plan year is less than 80% (or would be less than 80% after reflecting the plan amendment). See the regulation at 1.436-1(c)(1).

Since the problem refers to “plan amendments permitted under IRC 436(c)”, then they will go into effect, and they must be reflected in the valuation.

Answer is A

Fall 2012 EA-2A Exam Solutions

Problem 9

Similar to 2005 #12

Revised 08/11/14

FALSE

The excise tax on a funding deficiency is 10% for single employer plans. For multiemployer plans, the excise tax is 5%.

See IRC 4971(a).

Answer is B

Fall 2012 EA-2A Exam Solutions

Problem 10

FALSE

There are two requirements for a plan to not use a pre-retirement mortality assumption. Plans with fewer than 100 participants not in pay status may assume no pre-retirement mortality - but only if the assumption of no pre-retirement mortality would be a reasonable assumption.

See the regulation at 1.430(d)-1(f)(2)-1(a)

Answer is B

Fall 2012 EA-2A Exam Solutions

Problem 11

FALSE

In IRC 430(h)(5), there are two requirements for a single employer plan to be subject to IRS approval for a change in assumptions:

- The total unfunded vested benefits liability in the entire controlled group must be at least \$50,000,000 and
- The assumption change will reduce the funding shortfall by either
 - More than \$50,000,000 or
 - More than both \$5,000,000 and 5% of the funding target (before the change)

Answer is B

Fall 2012 EA-2A Exam Solutions

Problem 12

Similar to 2011 #21

This is a straightforward problem on the minimum funding standard account (MFSA). The key to this problem is knowing that you do not set up a waiver amortization unless the problems tells you to do so. This is based on 2012 exam condition 33:

“No waivers of funding deficiencies or extensions of amortization periods have been granted.”

You need to set up the MFSA for both 2011 and 2012. There is a deficiency at the end of 2011, which will be eliminated by the contribution paid for 2012.

2011 Minimum Funding Standard Account			
Charges		Credits	
Normal Cost	1,500,000	Credit Balance	350,000
Amortization charges	200,000	Amortization credits	150,000
		12/31 contribution	1,250,000
7% interest	119,000	7% interest	35,000
Total charges	1,819,000	Total credits	1,785,000

At 12/31/2011, the funding deficiency is $1,819,000 - 1,785,000 = 34,000$.

2012 Minimum Funding Standard Account			
Charges		Credits	
Deficiency	34,000	Credit Balance	0
Normal Cost	1,600,000		
Amortization charges	225,000	Amortization credits	150,000
		12/31 contribution	1,850,000
7% interest	130,130	7% interest	10,500
Total charges	1,989,130	Total credits	2,010,500

At 12/31/2012, the credit balance is $2,010,500 - 1,989,130 = 21,370$.

Answer is A

NOTE

Since you have an individual cost method, you should also think about the Full Funding Limitation. Since the unfunded accrued liability and normal cost are both very large, the FFL does not have any effect on the MFSA.

Fall 2012 EA-2A Exam Solutions

Problem 13 – Page 1

Similar to 2011 #11

The key point of this question is how you calculate the accrued benefit based on expected compensation for 2012. In general, the funding target and target normal cost are determined based on the plan benefits in effect during the plan year. The plan benefit is defined based on 3 year average compensation. The expected compensation for 2012 uses the 3% salary increase assumption:

$$\begin{aligned} 2012 \text{ Pay} &= 1.03 * 100,000 \\ &= 103,000 \end{aligned}$$

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

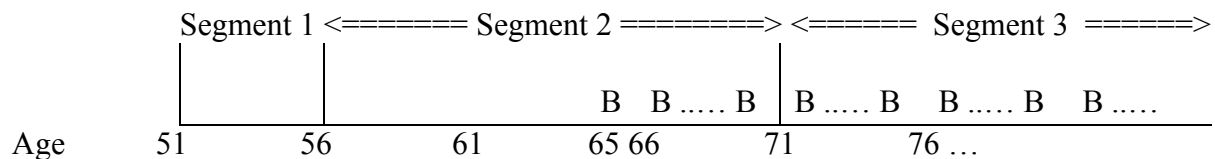
Most of the work in the problem is calculating the present value factor for the Funding target. The remainder of this question is fairly typical on the EA-2A exam.

Present value factor

At 01/01/2013

Age	51
Service	11 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 14 years from retirement, so their benefit payments will be valued using the second and third segment rates.



The second segment covers age 56 up to age 71 (15 years). Since normal retirement age is 65, there are 6 years of benefit payments valued using the second segment rate. The third segment rate is used to value benefit payments at and after age 71.

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 monthly annuity rates:

$$\text{Age 51 FT} = AB * [{}_{14|} \ddot{a}_{51:6|, \text{seg}_2}^{(12)} + {}_{20|} \ddot{a}_{51 \text{ seg}_3}^{(12)}]$$

Problem 13 – Page 2

Revised 09/15/14

Present value factor – continued

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

$$\text{Age 51 FT} = AB * [{}_{14|} \ddot{a}_{51:\overline{6}| \text{seg}_2}^{(12)} + {}_{20|} \ddot{a}_{51 \text{seg}_3}^{(12)}]$$

$${}_{14|} \ddot{a}_{51:\overline{6}| \text{seg}_2}^{(12)} = (v^{14} {}_{14}p_{51}) \ddot{a}_{65:\overline{6}| \text{seg}_2}^{(12)} \quad \text{all at segment 2 rate}$$

$$= (N_{65}^{(12)} - N_{71}^{(12)}) / D_{51} \quad \text{all at segment 2 rate}$$

$${}_{20|} \ddot{a}_{51 \text{seg}_3}^{(12)} = (v^{20} {}_{20}p_{51}) \ddot{a}_{71 \text{seg}_3}^{(12)} \quad \text{all at segment 3 rate}$$

$$= (N_{71}^{(12)} / D_{51}) \quad \text{all at segment 3 rate}$$

$$\begin{aligned} \text{Age 51 FT} &= AB \left[\frac{(23,241 - 12,896)}{5,028} + \frac{(6,202)}{3,115} \right] \\ &\quad \text{Segment 2} \quad \text{Segment 3} \end{aligned}$$

$$= AB * 4.0485$$

Accrued benefit

The problem asks for the difference in the Funding target due to the difference between the actual and expected compensation for 2012. You need to calculate the accrued benefit at 01/01/2013 using both compensation values.

Actual Compensation

2010	95,000
2011	100,000
2012	115,000

Expected Compensation

2010	95,000
2011	100,000
2012	103,000

$$\begin{aligned} \text{Highest} \\ \text{FAE3} &= (95,000 + 100,000 + 115,000) / 3 \\ &= 103,333 \end{aligned}$$

$$\begin{aligned} \text{Highest} \\ \text{FAE3} &= (95,000 + 100,000 + 103,000) / 3 \\ &= 99,333 \end{aligned}$$

You can use the difference in the FAE to calculate the difference in the accrued benefit based on both values:

$$\begin{aligned} \Delta \text{FAE3} &= 103,333 - 99,333 \\ &= 4,000 \end{aligned}$$

Fall 2012 EA-2A Exam Solutions

Problem 13 – Page 3

Accrued benefit – continued

$$\begin{aligned}\Delta AB &= 2\%(11)(4,000) \\ &= 880\end{aligned}$$

$$\begin{aligned}X - Y &= \Delta AB * 4.0485 \\ &= 880(4.0485) \\ &= 3,563\end{aligned}$$

Answer is C

Fall 2012 EA-2A Exam Solutions

Problem 14

Similar to 2009 #39

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.

In 2009 exam question 39, the problem required you to calculate the Funding target, which is the present value of the accrued benefit. That calculation was based on the current hypothetical account balance.

The main point of this problem is determination of the Target normal cost, which 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 Target normal cost is the present value at 01/01/13 of the projected value at normal retirement age (NRA) of this year's pay credit. To project the pay credit, you use the interest crediting rate. Be careful that you project the pay credit forward for only 14 years - it is made at the end of the year.

Valuation date	01/01/2013
Age	50

Pay credit at 12/31	5,000
Normal Retirement age	65
Projected Pay credit	$9,900 = 5,000(1.05)^{14}$

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%:

$$\begin{aligned}\text{TNC} &= \text{PV of } \Delta \text{AB} \\ &= 9,900(D_{65} / D_{50}) \\ &= 9,900(1+i)^{-15}({}_{15}p_{50}) \\ &= 9,900(1.06)^{-15} \\ &= 4,131\end{aligned}$$

Answer is B

NOTE

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

Fall 2012 EA-2A Exam Solutions

Problem 15

FALSE

This is straight from the instructions for the Schedule SB and for the Form 5500-EZ:

“Note. The Schedule SB (Form 5500) does not have to be filed with the Form 5500-EZ, but it must be retained (in accordance with the Instructions for Form 5500-EZ under the What To File section).”

Answer is B

Fall 2012 EA-2A Exam Solutions

Problem 16 – Page 1

Similar to 2011 #39

The key point of this question is that you must know numerous definitions related to the quarterly contribution requirement. There are several steps in the solution to this question:

1. Is the plan sponsor subject to the quarterly contribution requirement?
2. What is the amount of the required quarterly contribution installment?
3. How do you discount the payments made back to the valuation date?

Subject to the quarterly contribution requirement?

The problem states that quarterly installments are required for 2012.

Calculate required quarterly installment

The next step is calculation of the required annual payment (RAP). The required annual payment (RAP) is defined as the lesser of

- 100% of last year's minimum required contribution or
- 90% of this year's minimum required contribution

In this problem, you are not given any details for calculation of the MRC. Instead, you are given the MRC for both 2011 and 2012. The required annual payment (RAP) is the lesser of the 2011 MRC (50,000) or 90% of the 2012 MRC (50,000). The resulting RAP is 45,000. The 2012 required quarterly installment is 25% of the RAP, which is 11,250.

Calculate 09/15/2013 required contribution

The problem states that there is a single contribution of X at 09/15/2013. Some of the required quarterly installments are paid on a timely basis, and some are not. On 04/15/2012, the plan sponsor elected to apply the prefunding balance of 11,150 toward the minimum required contribution for 2012.

You can treat the prefunding balance of 11,150 as a contribution to meet the quarterly installments. Since this election was made on or before the due date of the first quarterly installment, you can increase the prefunding balance with interest to 04/15/2012 (at the 2012 effective rate). See the note at the end of the solution for the interest adjustment based on an election after 04/15/2012.

It appears the 2012 effective interest rate of 3.1% was designed to increase the prefunding balance to a value at 04/15/2012 that is identical to the required quarterly installment:

$$\begin{aligned} 04/15 \text{ PB} &= 11,150(1.031)^{3.5/12} \\ &= 11,250 \end{aligned}$$

Fall 2012 EA-2A Exam Solutions

Problem 16 – Page 2

<u>Due date</u>	<u>Required Installment</u>	<u>Amount Available</u>	<u>OVERPMT (UNDERPMT)</u>
01/01/2012		11,150	0
04/15/2012	11,250	11,250	0
07/15/2012	11,250	0	(11,250)
10/15/2012	11,250	0	(11,250)
01/15/2013	11,250		(11,250)
09/15/2013		X	0

To determine the value of X, you need to discount all of the contributions paid back to 01/01/2012. You need to do extra calculations to separately handle each of the underpayments of 11,250. The difference between the discounted values and the 50,000 MRC is the amount of the contribution, assuming payment at the valuation date. From this point forward, the solution has some very ugly arithmetic. Someone spent a little too much time constructing this problem.

The key idea of the problem is that the 2012 plan year contributions are normally discounted back to the valuation date using the 2012 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 does not give you the exact number of days for each due date. I chose to use half-month periods to do the calculations.

<u>Due date</u>	<u>Required Installment</u>	<u>Amount Available</u>	<u>OVERPMT (UNDERPMT)</u>	<u>UNDERPMT MONTHS</u>
01/01/2012	0	11,150	0	
04/15/2012	11,250	11,250	0	
07/15/2012	11,250	0	(11,250)	14.0 = 20.5 - 6.5
10/15/2012	11,250	0	(11,250)	11.0 = 20.5 - 9.5
01/15/2013	11,250	0	(11,250)	8.0 = 20.5 - 12.5
09/15/2013		X	0	

The tricky part of this calculation is the present value of the underpayments. The 07/15/12 underpayment is eliminated by payment of the contribution at 09/15/13. The period from 01/01/12 to the due date of the required installment is 6.5 months. The period of underpayment runs from the due date to 09/15/13, which is 14 months (= 20.5 - 6.5). This underpayment must be discounted for the period of underpayment using the penalty rate (8.1% = 5.0% + 3.1%). It must be discounted for the rest of the period back to 01/01/12 at the effective rate of 3.1%.

Fall 2012 EA-2A Exam Solutions

Problem 16 – Page 3

<u>Due date</u>	<u>Required Installment</u>	<u>Amount Available</u>	<u>OVER (UNDER)</u>	<u>MOS</u>	<u>Present value</u>
01/01/2012	0	11,150	0	0	11,150
04/15/2012	11,250	11,250	0		0
07/15/2012	11,250	0	(11,250)	14	$11,250(1.081)^{-14.0/12}(1.031)^{-6.5/12}$
10/15/2012	11,250	0	(11,250)	11	$11,250(1.081)^{-11.0/12}(1.031)^{-9.5/12}$
01/15/2013	11,250	0	(11,250)	8	$11,250(1.081)^{-8.0/12}(1.031)^{-12.5/12}$
09/15/2013		X	0		

The 10/15/12 underpayment is eliminated by payment of the contribution at 09/15/13. The period from 01/01/12 to the due date of the required installment is 9.5 months. The period of underpayment runs from the due date to 09/15/13, which is 11 months (= 20.5 - 9.5). This underpayment must be discounted for 11 months using the penalty rate of 8.1%, and discounted for 9.5 months at the effective rate of 3.1%.

The 01/15/13 underpayment is eliminated by payment of the contribution at 09/15/13. The period from 01/01/12 to the due date of the required installment is 12.5 months. The period of underpayment runs from the due date to 09/15/13, which is 8 months (= 20.5 - 12.5). This underpayment must be discounted for 8 months using the penalty rate of 8.1%, and discounted for 12.5 months at the effective rate of 3.1%.

The present value of the 09/15/13 contribution of X must be calculated as four separate pieces. Let Y be the portion of X that does not satisfy the prior underpayments:

$$Y = X - 3 \times 11,250$$

The contribution of Y is discounted using only the effective rate of 3.1%. Here is the calculation of the present value of the 2012 contributions, which is equal to the MRC of 50,000:

$$50,000 = 11,150 + 11,250[(1.081)^{-14.0/12}(1.031)^{-6.5/12}] + 11,250[(1.081)^{-11.0/12}(1.031)^{-9.5/12}] + 11,250[(1.081)^{-8.0/12}(1.031)^{-12.5/12}] + Y(1.031)^{-20.5/12}$$

$$\begin{aligned} &= 11,150 + 11,250[.8982 + .9089 + .9197] + Y(.9492) \\ Y &= [50,000 - 11,150 - 11,250(2.7267)]/.9492 \\ &= 8,612 \end{aligned}$$

$$\begin{aligned} X &= Y + 3 \times 11,250 \\ &= 42,362 \end{aligned}$$

Answer is D

Fall 2012 EA-2A Exam Solutions

Problem 16 – Page 4

NOTE

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

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

If the plan sponsor elects to apply the CB (or PB) towards the MRC after the due date for a quarterly installment, then you use a different interest rate to adjust for the time period from the quarterly installment due date up to the plan sponsor's date of election. Instead of using the effective rate of interest, you use the effective rate plus 5% (the penalty rate).

See the example in the regulation at 1.430(f)-1(d)(1).

Fall 2012 EA-2A Exam Solutions

Problem 17 – Page 1

Similar to 2011 #25

The key to working this problem is knowing the calculation details under IRC 436. Since this plan offers a lump sum payment option, it is subject to the IRC 436(d) benefit restrictions on accelerated benefit distributions.

In order for the plan to pay lump sum benefits, the AFTAP must be at least 80%. You are told that the 2012 AFTAP was certified at 91%. For 2013, the presumed AFTAP is also 91%, so there is no deemed reduction at 01/01/2013.

You are told that the 2013 AFTAP was certified at 08/01/2013. You are given valuation results for 2013, and you should check that the AFTAP is at least 80%:

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

$$\begin{aligned}\text{AFTAP} &= \frac{0 + 68,000,000 - 18,000,000 - 4,000,000}{0 + 65,000,000} \\ &= 70.77\%\end{aligned}$$

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).

But there is a trick to this question - the 08/01/2013 AFTAP is not really 70.77%. You need to be careful any time you have a problem with a very large AFTAP value, or a very large carryover balance.

There is a special rule in IRC 436(j)(3) that allows you to use the assets unreduced by any balances to calculate the AFTAP. If the value of the FTAP is at least 100% using the assets unreduced by any balances, then you can calculate the AFTAP in the same manner. I will denote these alternate definitions as FTAP₂ and AFTAP₂:

$$\begin{aligned}\text{FTAP}_2 &= \frac{\text{AAV} - \text{zero}}{\text{Funding Target (non At-Risk)}} \\ &= \frac{68,000,000 - 0}{65,000,000}\end{aligned}$$

$$\text{FTAP}_2 = 104.6\%$$

Since FTAP₂ is at least 100%, you can use the alternate AFTAP definition:

$$\text{AFTAP}_2 = \frac{\text{NHAP} + \text{AAV} - \text{zero}}{\text{NHAP} + \text{Funding Target (non At-Risk)}}$$

Fall 2012 EA-2A Exam Solutions

Problem 17 – Page 2

Since the non-HCE annuity purchases are zero, the value of AFTAP₂ is the same as the value of FTAP₂:

$$\begin{aligned}\text{AFTAP}_2 &= \frac{0 + 68,000,000 - 0}{0 + 65,000,000} \\ &= 104.6\%\end{aligned}$$

Since there is no deemed reduction, the value of X is zero.

Answer is A

Fall 2012 EA-2A Exam Solutions

Problem 18 – Page 1

Similar to 2010 #27

The key to working this question is knowing how to calculate the minimum contribution under both the Frozen Initial Liability (FIL) cost method, and the Aggregate cost method.

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

FIL Cost Method

You need to use the actuarial equation of balance to solve for the UAL. Then you can determine the FIL normal cost, and the minimum contribution.

$$01/01/13 \text{ UAL} = \text{O/S 431 bases} - \text{CB} - \text{ARA}$$

The plan effective date is 01/01/1987. There are only 4 years left in the initial accrued liability base at 01/01/2013:

$$\begin{aligned} \text{O/S 431 base} &= 50,000,000 * (\ddot{a}_{4|.07} / \ddot{a}_{30|.07}) \\ &= 13,648,159 \end{aligned}$$

$$\begin{aligned} \text{UAL} &= 13,648,159 - 700,000 - 0 \\ &= 12,948,159 \end{aligned}$$

$$\begin{aligned} \text{FIL PVNC} &= \text{PVFB} - \text{AAV} - \text{UAL} \\ &= 350,000,000 - 300,000,000 - 12,948,159 \\ &= 37,051,841 \end{aligned}$$

$$\begin{aligned} \text{PVE/E} &= 750,000,000 / 75,000,000 \\ &= 10.0 \end{aligned}$$

$$\begin{aligned} \text{FIL NC} &= 37,051,841 / 10.0 \\ &= 3,705,184 \end{aligned}$$

To set up the MFSA, you need to determine the amortizations for the 431 bases. There is only the IAL base, which had a 30 year amortization period:

$$\begin{aligned} \text{IAL amort} &= 50,000,000 / \ddot{a}_{30|.07} \\ &= 3,765,720 \end{aligned}$$

Fall 2012 EA-2A Exam Solutions

Problem 18 – Page 2

FIL Cost Method - continued

Now you can set up the MFSA and calculate the 12/31/13 “smallest amount”:

2013 Minimum Funding Standard Account			
Charges		Credits	
Normal Cost	3,705,184	Credit Balance	700,000
IAL amortization	3,765,720	12/31 minimum	x
7% interest	522,963	7% interest	49,000
Total charges	<u>7,993,867</u>	Total credits	<u>x + 749,000</u>

The “smallest amount” at 12/31/13 is $7,244,867 = 7,993,867 - 749,000$. This includes interest to 12/31, and reflects offsetting the credit balance against the minimum contribution.

Aggregate Cost Method

When changing to the Aggregate method, most prior MFSA bases under IRC 431 are eliminated. The typical exception tested on the exam is that you do not eliminate waiver amortization bases.

The definition of the PVNC under the Aggregate method is slightly different than FIL:

$$\begin{aligned}\text{AGG PVNC} &= \text{PVFB} - \text{AAV} - (\text{O/S 431 bases} - \text{CB}) \\ &= 350,000,000 - 300,000,000 - (0 - 700,000) \\ &= 50,700,000\end{aligned}$$

$$\begin{aligned}\text{PVE/E} &= 750,000,000 / 75,000,000 \\ &= 10.0\end{aligned}$$

$$\begin{aligned}\text{NC} &= 50,700,000 / 10.0 \\ &= 5,070,000\end{aligned}$$

Now you can set up the MFSA and calculate the 12/31/13 “smallest amount”:

2013 Minimum Funding Standard Account			
Charges		Credits	
Normal Cost	5,070,000	Credit Balance	700,000
		12/31 minimum	x
7% interest	354,900	7% interest	49,000
Total charges	<u>5,424,900</u>	Total credits	<u>x + 749,000</u>

The “smallest amount” at 12/31/13 is $4,675,900 = 5,424,900 - 749,000$. This includes interest to 12/31, and reflects offsetting the credit balance against the minimum contribution.

Fall 2012 EA-2A Exam Solutions

Problem 18 – Page 3

The difference in the “smallest amount” at 12/31/2013 is $2,568,967 = 7,244,867 - 4,675,900$. You could also calculate this as the difference in the 12/31 MFSA charges, since the MFSA credits are the same.

Answer is B

Fall 2012 EA-2A Exam Solutions

Problem 19

Similar to 2009 #47

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 01/01/2013. 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

01-01-13 Age	55
Past service	9

Accrued benefit	$9 \times (4,000) = 36,000$
Early retirement reduction factor	$1 - (65 - 55)(3\%) = .70$
Early retirement benefit	$.70(36,000) = 25,200$

	$\ddot{a}_{55}^{(12)} = N_{55}^{(12)} / D_{55}$
	$= 508,056 / 38,635$
Retirement annuity	$= 13.1501$

PVB as retiree	$25,200 \times (13.15) = 331,384$
----------------	-----------------------------------

Active AL calculations

01-01-13 Age	55
Accrued benefit	36,000

	$\ddot{a}_{65}^{(12)} = N_{65}^{(12)} / D_{65}$
	$= 220,966 / 20,301$
Retirement annuity	$= 10.8845$

Accrued liability	$36,000(1.06)^{-10} \ddot{a}_{65}^{(12)} = 218,802$
-------------------	---

Since the PVB as a retiree is greater, there is a loss at Smith's retirement of $112,581 = 331,384 - 218,802$.

Answer is C

Problem 20

Revised 08/29/16

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

01/01/2013 data

Description

Age 63
Past service 17

There is no early retirement, so the participant will retire at age 65. With pre-retirement mortality decrements, the accrued liability must be calculated as a complicated summation. There are two pieces, one for the retirement benefit, and one for the death benefit:

$$AL = v^2 {}_2p_{63}^{(T)} (NR \text{ Ben}) \ddot{a}_{65}^{(12)} + \sum_{t=0}^1 v^t {}_t p_{63}^{(T)} q_{63+t}^{(d)} (\text{Death Ben})_{63+t}$$

The summation reflects the timing of the mortality decrement (deaths occur at the beginning of the year). In general, you should always assume the participant retires at the beginning of the year. The result is that no death benefit is payable at age 65, and the mortality at age 65 is not used.

This problem is somewhat simplified, since both the normal retirement benefit and the death benefit are the same - a flat benefit of 120,000.

$$\begin{aligned} AL &= 120,000[v^2 {}_2p_{63}^{(T)} \ddot{a}_{65}^{(12)} + v^0 {}_0p_{63}^{(T)} q_{63}^{(d)} + v^1 {}_1p_{63}^{(T)} q_{64}^{(d)}] \\ &= 120,000[v^2(1-q_{63}^{(d)})(1-q_{64}^{(d)})(N_{65}^{(12)}/D_{65}) + v^0(1-0)q_{63}^{(d)} + v^1(1-q_{63}^{(d)})(q_{64}^{(d)})] \\ &= 120,000[(1.06)^{-2}(1-.0083)(1-.0091)(220,966/20,301) + (1)(1)(.0083) \\ &\quad + (1.06)^{-1}(1-.0083)(.0091)] \\ &= 120,000[.8746(10.8845) + .0083 + .0085] \end{aligned}$$

$$AL = 1,144,337$$

Answer is A

NOTE

You could calculate the accrued liability using the commutation functions instead. The final answer is different due to more digits in the Dx factors, but it falls in the same answer range:

$$\begin{aligned} AL &= 120,000[(N_{65}^{(12)}/D_{63}) + q_{63}^{(d)} + (D_{64}/D_{63})q_{64}^{(d)}] \\ &= 120,000[9.5191 + .0083 + .0085] \\ &= 1,144,305 \end{aligned}$$

Fall 2012 EA-2A Exam Solutions

Problem 21 – Page 1

There are two key points to the solution of this problem. One is how you calculate the Shortfall amortization (and shortfall base) at 01/01/2013 under IRC Section 430. The other point is the problem states that the plan has a lump sum option.

The plan is subject to the IRC 436(d) restrictions. The hidden trick in the problem is that you must reduce the prefunding balance (PB) due to the deemed reduction rules in IRC 436.

OLD ASSET VALUATION METHOD

AFTAP deemed reduction

In order to pay lump sum distributions, the AFTAP must be at least 80%. You need to calculate the AFTAP at 01/01/2013 to see if it satisfies IRC 436(d).

One tricky aspect of the question is that it says nothing about AFTAP certification. The problem gives you valuation results at 01/01/2013. Based on 2012 exam condition 45, the AFTAP was certified on a timely basis. You must assume that the actuary certified the 2013 AFTAP before they started doing any valuation calculations.

$$\text{AFTAP} = \frac{\text{NHAP} + \text{old AAV} - \text{CB} - \text{PB}}{\text{NHAP} + \text{Funding Target (non At-Risk)}}$$

$$\begin{aligned}\text{AFTAP} &= \frac{0 + 50,000,000 - 0 - 4,000,000}{0 + 60,000,000} \\ &= 76.67\%\end{aligned}$$

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).

The denominator of the ratio is 60,000,000. For an AFTAP of 80.0%, the desired numerator is $.80(60,000,000) = 48,000,000$. This means that the deemed reduction in the PB is 2,000,000, and the resulting PB is 2,000,000:

$$\begin{aligned}\text{AFTAP} &= \frac{0 + 50,000,000 - 0 - 2,000,000}{0 + 60,000,000} \\ &= 80.0\%\end{aligned}$$

Fall 2012 EA-2A Exam Solutions

Problem 21 – Page 2

OLD ASSET VALUATION METHOD

2013 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.

$$\begin{aligned}\text{Funding S/F} &= \text{Funding target} - (\text{AAV} - \text{CB} - \text{PB}) \\ &= 60,000,000 - (50,000,000 - 0 - 2,000,000) \\ &= 12,000,000\end{aligned}$$

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.

The problem states there are no shortfall amortization bases prior to 2013. The 2013 shortfall base is the same as the Funding shortfall, or 12,000,000.

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

$$\begin{aligned}\text{S/F amort} &= 12,000,000 / 5.9991 \\ &= 2,000,300\end{aligned}$$

NEW ASSET VALUATION METHOD

The new asset value is 47,000,000, which is a decrease of 3,000,000. You need to re-do some of the prior calculations to identify the resulting change in the shortfall amortization installment.

Fall 2012 EA-2A Exam Solutions

Problem 21 – Page 3

NEW ASSET VALUATION METHOD

AFTAP deemed reduction

In order to pay lump sum distributions, the AFTAP must be at least 80%. You need to calculate the AFTAP at 01/01/2013 to see if it satisfies IRC 436(d).

$$\text{AFTAP} = \frac{\text{NHAP} + \text{new AAV} - \text{CB} - \text{PB}}{\text{NHAP} + \text{Funding Target (non At-Risk)}}$$

$$\begin{aligned}\text{AFTAP} &= \frac{0 + 47,000,000 - 0 - 4,000,000}{0 + 60,000,000} \\ &= 71.67\%\end{aligned}$$

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). In the prior calculation, you determined that the desired AFTAP is given by a numerator of 48,000,000.

Since the asset value is less than 48,000,000, it is not possible to increase the AFTAP to 80%. The result is that the deemed reduction in the PB does not occur.

2013 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.

$$\begin{aligned}\text{Funding S/F} &= \text{Funding target} - (\text{AAV} - \text{CB} - \text{PB}) \\ &= 60,000,000 - (47,000,000 - 0 - 4,000,000) \\ &= 17,000,000\end{aligned}$$

2013 Shortfall amortization installment

The problem asks for the change in the shortfall amortization installment due to the change in the asset valuation method.

$$\begin{aligned}\Delta\text{S/F base} &= 17,000,000 - 12,000,000 \\ &= 5,000,000\end{aligned}$$

$$\begin{aligned}\Delta\text{S/F amort} &= 5,000,000 / 5.9991 \\ &= 833,458\end{aligned}$$

Answer is C

Fall 2012 EA-2A Exam Solutions

Problem 21 – Page 4

NOTE

Based on 2012 exam conditions 27 and 28, the plan sponsor elects to offset both the CB and the PB against the minimum contribution under IRC 430. As a result, the Funding shortfall exemption 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.

Fall 2012 EA-2A Exam Solutions

Problem 22 – Page 1

This is a straightforward question on IRC 430 minimum funding calculations. You need to do calculations for both 2012 and 2013. This plan has a funding standard carryover balance (CB) of zero and a prefunding balance (PB) of 200,000 at 01/01/2012.

This problem asks for “the minimum required contribution”. Based on 2012 exam condition 30, this amount does not reflect a reduction for the funding standard carryover balance (CB) or for the prefunding balance (PB).

2012 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:

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

2012 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:

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

2012 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:

The problem states there are no shortfall amortization bases prior to 2012. The 2012 shortfall base is the same as the Funding shortfall, or 100,000.

You must calculate the shortfall amortization installment for 2012. You are given the 7-year annuity factor:

$$\begin{aligned}\text{S/F amort} &= 100,000 / 5.9982 \\ &= 16,672\end{aligned}$$

Fall 2012 EA-2A Exam Solutions

Problem 22 – Page 2

You don't need to do any additional calculations for 2012. The problem states that the 01/01/2013 PB is 225,000.

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:

$$\begin{aligned}\text{Funding S/F} &= \text{Funding target} - (\text{AAV} - \text{CB} - \text{PB}) \\ &= 2,200,000 - (2,400,000 - 0 - 225,000) \\ &= 25,000\end{aligned}$$

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:

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

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

$$\begin{aligned}\text{S/F Amort base} &= 1.0 * 2,200,000 - (2,400,000 - 0 - 225,000) - (\text{PV of PY Amortizations}) \\ &= 25,000 - 16,672(5.2932) \\ &= -63,246\end{aligned}$$

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

$$\begin{aligned}\text{S/F amort} &= -63,246 / 5.9982 \\ &= -10,544\end{aligned}$$

Fall 2012 EA-2A Exam Solutions

Problem 22 – Page 3

$$\begin{aligned}\text{S/F charge} &= 16,672 - 10,544 \\ &= 6,127\end{aligned}$$

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.

2013 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.

$$\begin{aligned}\text{MRC} &= \text{TNC} + \text{Shortfall amort charge} + \text{Waiver amort charge} \\ &= 95,000 + 6,127 + 0 \\ &= 101,127\end{aligned}$$

Answer is D

Problem 23 – Page 1

Revised 08/11/14

One key to this problem is knowing how to calculate the target normal cost using segment interest rates. The other key is knowing how to value early retirement benefits based on the two retirement decrements given.

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

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

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

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

Target normal cost

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.

You need to determine the accrued benefit at the valuation date, and the benefit accrual during 2013. The problem gives you the 2012 compensation, and the salary scale assumption. The 2013 compensation reflects that salary assumption:

Valuation date	01/01/2013	01/01/2014
Age	30	31
Past service	7	8
Prior compensation	125,000	125,000*1.03 = 128,750
Accrued benefit	2.5%(7)(125,000) = 21,875	2.5%(8)(128,750) = 25,750

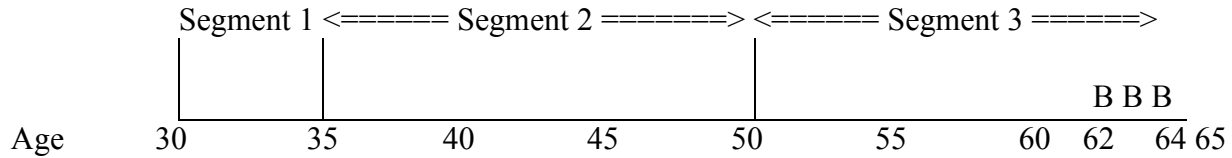
$$\Delta AB = 3,875$$

Based on the default exam conditions, normal retirement age is 65, and the benefit is assumed payable monthly, starting at normal retirement age. In this problem, there is an early retirement decrement at age 62.

Fall 2012 EA-2A Exam Solutions

Problem 23 – Page 2

The participant is currently 32 years from early retirement age, so their benefit payments will be valued using the third segment rate.



The third segment rate is used to value all benefit payments. Here is the formula for the Target normal cost using monthly annuity rates, assuming 100% retirement at age 65:

$$\begin{aligned} \text{TNC-65} &= 3,875 \cdot {}_{35|}\ddot{a}_{30 \text{ seg}_3}^{(12)} \\ &= 3,875 \cdot (v^{35} {}_{35}p_{30}) \ddot{a}_{65 \text{ seg}_3}^{(12)} \end{aligned}$$

Here is the formula for the Target normal cost using monthly annuity rates, assuming 100% retirement at age 62:

$$\begin{aligned} \text{TNC-62} &= 3,875 [1 - 4\%(65-62)] \cdot {}_{32|}\ddot{a}_{30 \text{ seg}_3}^{(12)} \\ &= 3,875 (.88) \cdot (v^{32} {}_{32}p_{30}) \ddot{a}_{62 \text{ seg}_3}^{(12)} \end{aligned}$$

Based on 2012 exam condition 15, there are no pre-retirement decrements. The present values should use interest-only discounting prior to benefit commencement age.

With decrements at only two ages, there is a simplified approach to calculating the Target normal cost. You can think of the calculation as allowing for 40% of the participant to retire at age 62, and the remaining 60% of the participant to retire at age 65:

$$\begin{aligned} \text{TNC} &= 40\% [3,875 (.88) \cdot (v^{32} {}_{32}p_{30}) \ddot{a}_{62 \text{ seg}_3}^{(12)}] + 60\% [3,875 \cdot (v^{35} {}_{35}p_{30}) \ddot{a}_{65 \text{ seg}_3}^{(12)}] \\ &= .40(3,875)(.88)(1.08)^{-32}(10.07) + .60(3,875)(1.08)^{-35}(9.53) \\ &= 1,170 + 1,499 \\ &= 2,669 \end{aligned}$$

Answer is A

Fall 2012 EA-2A Exam Solutions

Problem 24 – Page 1

Similar to 2011 #26

The key point to the problem is knowing how to calculate the Projected Unit Credit (PUC) accrued liability and the normal cost. Under PUC, the accrued liability is defined as the present value of the “funding accrued benefit” (FAB). The normal cost is defined as the present value of the change in the FAB for the year.

$$AL = PV (FAB)$$

$$NC = PV (\Delta FAB)$$

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

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

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

01/01/13 valuation calculations

The plan benefit is based on the final pay. The normal retirement age is 65 by default. You have retirement decrements from age 62 to age 65, so you need to project pay to those ages. For a participant retiring upon attaining age 62, their benefit is based on pay at age 61.

01/2013 Age	60
Past service	10
2012 pay (age 59)	101,000

Retirement age x	62	63	65
Projected final pay at x-1	$101,000 \times (1.03)^2$ = 107,151	$101,000 \times (1.03)^3$ = 110,365	$101,000 \times (1.03)^5$ = 117,087
Early retirement factor	$.85 = 1 - (65-62)5\%$	$.90 = 1 - (65-63)5\%$	1.00
Funding accrued benefit	$.85(107,151)(15\%)$ = 13,662	$.90(110,365)(15\%)$ = 14,899	$1.0(117,087)(15\%)$ = 17,563

There is one minor trick in the problem. It asks for the sum of the accrued liability and the normal cost. The first step is to determine the accrued liability. Then it is one small change to get the sum of the accrued liability and the normal cost.

Fall 2012 EA-2A Exam Solutions

Problem 24 – Page 2

Accrued Liability

The PUC AL must be calculated as a summation:

$$AL = \sum_{t=2}^5 v^t p_{60}^{(T)} q_{60+t}^{(r)} (FAB)_{60+t} \ddot{a}_{60+t}^{(12)}$$

Now I will rewrite the various terms of the summation. You only need to do calculations at the ages with retirement decrements:

	(1)	(2)	(3)		(4)	(5)	(6)	
t	<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>FAB_{60+t}</u>	<u>$\ddot{a}^{(12)}_{60+t}$</u>	<u>(1)(2)(3)(4)(5)</u>
2	62	.8734	1.000	0.50	0.50	13,662	10.90	65,033
3	63	.8163	0.500	0.25	0.75	14,899	10.70	16,267
5	65	.7130	0.375	1.00	0.00	17,563	10.30	<u>48,367</u>
								129,667

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.

Sum of AL + NC

The value calculated above is the PUC AL. The problem asks for the sum of the accrued liability and the normal cost. You do not need to do any lengthy calculations for the PUC NC.

To calculate this sum, you need to think about the original definitions of the PUC AL and PUC NC:

$$AL = PV (FAB)$$

$$NC = PV (\Delta FAB)$$

The FAB at 01/01/2014 is based on 11 years of service. Since the benefit accrues at the same rate for all years of service, the change in the FAB is 1/10. The PUC NC is exactly (1/10) times the FAB:

$$PUC\ AL = 129,667$$

$$PUC\ NC = 129,667(1/10)$$

$$\begin{aligned} AL + NC &= 129,667(11/10) \\ &= 142,634 \end{aligned}$$

Answer is B

Fall 2012 EA-2A Exam Solutions

Problem 25

FALSE

This is a simple question on the exemption from establishing a new shortfall base. The shortfall base exemption is a messy calculation. Define the “modified funding shortfall” as the 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.

Answer is B

NOTE

The definition given in the problem is when the funding shortfall is zero. When that happens, ALL shortfall and waiver bases are considered fully amortized.

Fall 2012 EA-2A Exam Solutions

Problem 26

One key to this problem is knowing how to do calculations under the Aggregate (AGG) cost method. The problem asks for the credit balance at 12/31/2013. Another key to working the problem is handling of interest on the contributions in the Minimum Funding Standard Account (MFSA). There are two contributions paid for the 2013 plan year. There is no interest adjustment made for the contribution that is paid after 12/31/2013.

The normal cost is equal to the present value of future normal costs (PVNC) divided by the average temporary annuity for active participants. In this problem, you are given the present value of future working years, which implies the plan benefits are not based on pay. The problem gives you counts of both active and non-active participants. To calculate the average temporary annuity, you ignore the non-active participants (because their future working lifetime is zero).

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".

$$\begin{aligned}\text{AGG PVNC} &= \text{PVFB} - \text{AAV} - (\text{O/S 431 bases} - \text{CB}) \\ &= 10,000,000 - 4,000,000 - (0 - 300,000) \\ &= 6,300,000\end{aligned}$$

$$\begin{aligned}\text{PVL/L} &= 8,000 / 1,000 \\ &= 8.0\end{aligned}$$

$$\begin{aligned}\text{NC} &= 6,300,000 / 8.0 \\ &= 787,500\end{aligned}$$

Now you can set up the MFSA and calculate the credit balance at 12/31/13:

2013 Minimum Funding Standard Account			
Charges		Credits	
Normal Cost	787,500	Credit Balance	300,000
		07/01/13 contrib	500,000
		07/01/14 contrib	200,000
6% interest	47,250	6% interest	33,000
Total charges	834,750	Total credits	1,033,000

The credit balance at 12/31/13 is $198,250 = 1,033,000 - 834,750$. The interest on the credits reflects half of a year for the contribution paid at 07/01/13 ($33,000 = .06 \times (6/12) \times 500,000 + .06 \times 300,000$).

Answer is D

Fall 2012 EA-2A Exam Solutions

Problem 27 – Page 1

The problem asks for the contribution equal to the "smallest amount" at 01/01/13. Based on 2012 exam conditions 27 and 28, the plan sponsor elects to offset both the CB and the PB against the minimum contribution under IRC 430. Based on 2012 exam condition 31, 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:

$$\begin{aligned}\text{Funding S/F} &= \text{Funding target} - (\text{AAV} - \text{CB} - \text{PB}) \\ &= 45,700,000 - (46,200,000 - 3,700,000 - 0) \\ &= 3,200,000\end{aligned}$$

Shortfall Base Exemption

The transition rule for the applicable percentage expired at the end of the 2010 plan year. The modified funding shortfall is not the same as the previously calculated Funding shortfall:

$$\begin{aligned}\text{Modified S/F} &= 100\% * (\text{Funding target}) - (\text{AAV} - \text{PB}) \\ &= 45,700,000 - (46,200,000 - 0) \\ &= \text{zero}\end{aligned}$$

Shortfall amortization installment

The plan is eligible for the shortfall base exemption, so there is no new shortfall amortization installment. The problem gives the prior year shortfall amortization installment as 110,000.

Minimum Required Contribution

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

$$\begin{aligned}\text{MRC} &= \text{TNC} + \text{Shortfall amort charge} + \text{Waiver amort charge} \\ &= 6,900,000 + 110,000 + 0 \\ &= 7,010,000\end{aligned}$$

Smallest amount

The problem asks for "the smallest amount that satisfies the minimum funding standard", as of 01/01/2013.

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

Fall 2012 EA-2A Exam Solutions

Problem 27 – Page 2

$$\begin{aligned}\text{Smallest contr} &= 7,010,000 - 3,700,000 - 0 \\ &= 3,310,000\end{aligned}$$

Answer is D

Fall 2012 EA-2A Exam Solutions

Problem 28 – Page 1

Similar to 2011 #07

The key to this question 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 12/31/13. Based on 2012 exam conditions 27 and 28, the plan sponsor elects to offset both the CB and the PB against the minimum contribution under IRC 430. Based on 2012 exam condition 31, 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:

$$\begin{aligned}\text{Funding S/F} &= \text{Funding target} - (\text{AAV} - \text{CB} - \text{PB}) \\ &= 95,759,000 - (95,700,000 - 500,000 - 0) \\ &= 559,000\end{aligned}$$

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:

$$\begin{aligned}\text{Modified S/F} &= 100\% * (\text{Funding target}) - (\text{AAV} - \text{PB}) \\ &= 95,759,000 - (95,700,000 - 0) \\ &= 59,000\end{aligned}$$

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:

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 559,000.

You must calculate the shortfall amortization installment for 2013. The problem gives the 7 year annuity factor:

$$\begin{aligned}\text{S/F amort} &= 559,000 / 5.7800 \\ &= 96,713\end{aligned}$$

Fall 2012 EA-2A Exam Solutions

Problem 28 – Page 2

$$\text{S/F charge} = 96,713$$

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 750,000:

$$\begin{aligned} 01/2013 \text{ TNC} &= 2,200,000 - 750,000 \text{ employee contributions} \\ &= 1,450,000 \end{aligned}$$

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.

$$\begin{aligned} \text{MRC} &= \text{TNC} + \text{Shortfall amort charge} + \text{Waiver amort charge} \\ &= 1,450,000 + 96,713 + 0 \\ &= 1,546,713 \end{aligned}$$

Smallest amount

The problem asks for “the smallest amount that satisfies the minimum funding standard”, as of 12/31/2013. The first step is to calculate this amount at the valuation date:

$$\begin{aligned} 01/01/13 \\ \text{Smallest contr} &= \text{MRC} - \text{CB} - \text{PB} \\ &= 1,546,713 - 500,000 - 0 \\ &= 1,046,713 \end{aligned}$$

The plan sponsor makes two contributions for 2013. 100,000 is paid at 07/01/2013, and the contribution of X is paid at 12/31/2013.

The discounted value of the contributions paid (using the 2013 effective interest rate of 6.0%) is equal to the “smallest amount” at 01/01/2013:

$$\begin{aligned} \text{PV of contrib} &= 100,000*(1.06)^{-6.0/12} + X*(1.06)^{-12/12} && \text{(using compound interest)} \\ &= 1,046,713 \end{aligned}$$

Fall 2012 EA-2A Exam Solutions

Problem 28 – Page 3

$$\begin{aligned} X*(1.06)^{-1} &= 1,046,713 - 100,000*(1.06)^{-5} \\ X &= 1,046,713*(1.06)^1 - 100,000*(1.06)^5 \\ &= 1,006,559 \end{aligned}$$

Answer is B

NOTE

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

$$\begin{aligned} \text{PV of contrib} &= 100,000/(1 + .06*(6/12)) + X/(1 + .06) && \text{(using simple interest)} \\ &= 1,046,713 \end{aligned}$$

$$\begin{aligned} X &= 1,046,713*(1.06) - 100,000*(1.06)/[1 + .06*(6/12)] \\ &= 1,006,603 \end{aligned}$$

Fall 2012 EA-2A Exam Solutions

Problem 29 – Page 1

Similar to 2011 #01

The key to this question 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 01/01/11. Based on 2012 exam conditions 27 and 28, the plan sponsor elects to offset both the CB and the PB against the minimum contribution under IRC 430. Based on 2012 exam condition 31, 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:

$$\begin{aligned}\text{Funding S/F} &= \text{Funding target} - (\text{AAV} - \text{CB} - \text{PB}) \\ &= 1,140,000 - (880,000 - 0 - 12,000) \\ &= 272,000\end{aligned}$$

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:

The problem states there are no shortfall amortization bases prior to 2013. The 2013 shortfall base is the same as the Funding shortfall, or 272,000.

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

$$\begin{aligned}\text{S/F amort} &= 272,000 / 5.9782 \\ &= 45,499\end{aligned}$$

Fall 2012 EA-2A Exam Solutions

Problem 29 – Page 2

$$\text{S/F charge} = 45,499$$

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 there are 9,000 of expected plan-related expenses. In addition, the plan was frozen on 01/01/2013. Since there are no future benefit accruals, the normal cost only reflects the anticipated expenses:

$$\begin{aligned} 01/2013 \text{ TNC} &= \text{zero} + 9,000 \text{ expenses} \\ &= 9,000 \end{aligned}$$

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.

$$\begin{aligned} \text{MRC} &= \text{TNC} + \text{Shortfall amort charge} + \text{Waiver amort charge} \\ &= 9,000 + 45,499 + 0 \\ &= 54,499 \end{aligned}$$

Smallest amount

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

$$\begin{aligned} \text{Smallest contr} &= \text{MRC} - \text{CB} - \text{PB} \\ &= 54,499 - 0 - 12,000 \\ &= 42,499 \end{aligned}$$

Answer is D

Fall 2012 EA-2A Exam Solutions

Problem 30 – Page 1

Similar to 2010 #14

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

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

At 01/01/13 Smith

Retirement age	55
Past service	13 years
Participation	5 years

Since this participant retires in 2013, you need the 415 dollar limit for 2013. That value was not known when the problem was written, so it is given as 200,000 in the data for the problem.

Plan benefit

This problem does not give any yearly pay history, so you can't compare individual pay values against the 401(a)(17) limit. You need to calculate the participant's early retirement benefit:

$$\begin{aligned}\text{Accrued benefit} &= 5\%(13)(125,000) \\ &= 81,250\end{aligned}$$

$$\begin{aligned}\text{Early ret factor} &= 1 - (65-55)3\% \\ &= .70\end{aligned}$$

$$\begin{aligned}\text{Early ret ben} &= .70(81,250) \\ &= 56,875\end{aligned}$$

415 COMP LIMIT

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

$$\text{High 3 year average pay} = 128,000 \quad (\text{given})$$

$$\begin{aligned}\text{3 year comp §415 limit} &= 128,000(10/10) \\ &= 128,000\end{aligned}$$

Since Smith has more than ten years of service, there is no reduction in the 415 compensation limit.

Fall 2012 EA-2A Exam Solutions

Problem 30 – Page 2

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 5 years of participation service:

$$\begin{aligned}\$415 \text{ dollar limit during 2013} &= 200,000 * (5/10) && \text{for ages 62-65} \\ &= 100,000\end{aligned}$$

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

Mandated basis reduction factor

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

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

Death benefit definition	Factor
Waived QPSA, or NO death benefit (complete forfeiture on death)	$N_{62}^{(12)} / N_X^{(12)}$
QPSA death benefit, and plan charges participants for cost of QPSA (default per exam condition 9)	$N_{62}^{(12)} / N_X^{(12)}$
100% of PV of accrued benefit (no forfeiture on death)	$v^{62-x} (\ddot{a}_{62}^{(12)} / \ddot{a}_X^{(12)})$
QPSA death benefit, and plan does NOT charge for cost of QPSA (treat as no forfeiture on death)	$v^{62-x} (\ddot{a}_{62}^{(12)} / \ddot{a}_X^{(12)})$

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

Based on 2012 exam condition 9, in the absence of any other information, you should assume that the plan charges the participants for the cost of the QPSA. This means that a forfeiture DOES occur upon the death of a participant, and you must reflect pre-retirement mortality in the actuarial reduction prior to age 62.

Mandated basis reduction factor

$$\begin{aligned}\text{Actuarial reduction from 62 to 55} &= N_{62}^{(12)} / N_{55}^{(12)} \\ &= 598,284 / 989,900 \\ &= .6044\end{aligned}$$

Fall 2012 EA-2A Exam Solutions

Problem 30 – Page 3

Plan basis reduction factor

The plan basis reduction factor from 62 to 55 is determined using the ratio of the plan's early retirement reduction factors:

$$\begin{aligned}\text{Plan basis reduction from 62 to 55} &= \text{ERF}_{55} / \text{ERF}_{62} \\ &= [1 - (65-55)(3\%)] / [1 - (65-62)(3\%)] \\ &= .70 / .91 \\ &= .7692\end{aligned}$$

Final benefit determination

$$\begin{aligned}\$415 \text{ dollar limit at age 55} &= 100,000 * \text{lesser of } [.6044 \text{ or } .7692] \\ &= 60,439\end{aligned}$$

$$\begin{aligned}\text{Life annuity } \$415 \text{ limit at 55} &= \text{lesser of 3 year comp limit and dollar limit} \\ &= \text{lesser of 128,000 and 60,439} \\ &= 60,439\end{aligned}$$

$$\begin{aligned}\text{Final benefit payable at age 61} &= \text{lesser of plan benefit and 415 limit} \\ &= \text{lesser of 56,875 and 60,439} \\ &= 56,875\end{aligned}$$

Answer is D

NOTES

This is not the typical result - usually the 415 limit does apply, and provides the final benefit payable to the participant. If you did the 415 limit completely wrong, you might still get the correct answer for this problem!

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

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

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

Fall 2012 EA-2A Exam Solutions

Problem 30 – Page 4

Actuarial reduction of 415 dollar limit below age 62 - continued

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

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

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

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

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

If there is no death benefit, then there is a full forfeiture upon death. This can happen if the participant is single, or if they are married, and they elect out of the Qualified Pre-retirement Survivor Annuity (QPSA). With a typical QPSA death benefit, there will be a forfeiture on death. Based on exam condition 9, in the absence of any other information, you should assume that the plan does charge the participants for the cost of the QPSA.

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

Death benefit definition	Factor
Waived QPSA, or NO death benefit (complete forfeiture on death)	$N_{62}^{(12)} / N_x^{(12)}$
QPSA death benefit, and plan charges participants for cost of QPSA (default per exam condition 9)	$N_{62}^{(12)} / N_x^{(12)}$
100% of PV of accrued benefit (no forfeiture on death)	$v^{62-x}(\ddot{a}_{62}^{(12)} / \ddot{a}_x^{(12)})$
QPSA death benefit, and plan does NOT charge for cost of QPSA (treat as no forfeiture on death)	$v^{62-x}(\ddot{a}_{62}^{(12)} / \ddot{a}_x^{(12)})$

Fall 2012 EA-2A Exam Solutions

Problem 31

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

I. TRUE

There are multiple definitions of critical status in the code. The definitions in IRC 432(b)(2)(A), IRC 432(b)(2)(C) and IRC 432(b)(2)(D) are based on comparisons of the present value of future contributions and the present value of future benefit payments. Under IRC 432(b)(2)(B)(i), the plan is in critical status if it has an accumulated funding deficiency for the current year.

II. FALSE

This question tried to confuse you about what is required for a plan in critical status, versus a plan in endangered status. If the plan is in endangered status, then you must adopt a funding improvement plan within 240 days of the actuarial certification of the plan's status. If the plan is in critical status, then you must adopt a rehabilitation plan within 240 days of the actuarial certification of the plan's status.

III. 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.”

Only items I and III are true.

Answer is B

Fall 2012 EA-2A Exam Solutions

Problem 32 – Page 1

The key to this problem is knowing how to do calculations under the Aggregate (AGG) cost method. The normal cost is equal to the present value of future normal costs (PVNC) divided by the average temporary annuity for active participants. In this problem, the plan benefits are pay related. You must calculate the average temporary annuity including a salary scale.

01/01/2012 valuation

You are given the compensation for a single participant. The plan population consists of 100 clones, with identical data. The default normal retirement age (NRA) is age 65. You need to determine the projected benefit at NRA for one participant.

Then you can calculate the total present value of future benefits and the present value of future normal costs. Then you can calculate the normal cost and the minimum required contribution for both 2012 and 2013.

At 01/01/2012

Date of birth	01/01/62
Current age	50
2011 compensation (age 49)	43,000

$$\begin{aligned}\text{Projected pay @ 64} &= 43,000 * (1.04)^{15} \\ &= 77,441\end{aligned}$$

$$\begin{aligned}\text{Projected ben @ 65} &= 77,441 * (50\%) \\ &= 38,720\end{aligned}$$

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”.

This plan was newly established at 01/01/2012, so the actuarial asset value is zero.

$$\begin{aligned}\text{PVB} &= 100(v_{15}^{15} p_{50}^{(T)} \ddot{a}_{65}^{(12)})(38,720) \\ &= 100(1.07)^{-15}(1.0)(8.33)(38,720) \\ &= 11,690,333\end{aligned}$$

The present value calculations only reflect an interest discount prior to NRA 65. Based on 2012 exam condition 15, there are no pre-retirement decrements.

$$\begin{aligned}\text{AGG PVNC} &= \text{PVB} - \text{AAV} - (\text{O/S 431 bases} - \text{CB}) \\ &= 11,690,333 - 0 - (0 - 0) \\ &= 11,690,333\end{aligned}$$

Fall 2012 EA-2A Exam Solutions

Problem 32 – Page 2

$$\text{AGG NC} = \text{PVNC} / \text{average } {}^s\ddot{a}_{\overline{\text{CA:RA-CA}}|}$$

Now you need to calculate the average temporary annuity with salary scale.

$$\begin{aligned} {}^s\ddot{a}_{\overline{50:15}|} &= [1 + (1.04/1.07)^1 + (1.04/1.07)^2 + \dots + (1.04/1.07)^{14}] \\ &= \ddot{a}_{\overline{15}|j} \quad \text{where } 1+j = 1.07/1.04 \quad \rightarrow j = 2.885\% \\ &= 12.3854 \end{aligned}$$

$$\begin{aligned} \text{AGG NC} &= 11,690,333 / 12.3854 \\ &= 943,877 \end{aligned}$$

Now you have enough information to complete the 2012 MFSA:

2012 Minimum Funding Standard Account			
Charges		Credits	
Normal Cost	943,877	Credit Balance	0
		12/31/12 minimum	x
7% interest	66,071	7% interest	0
Total charges	<u>1,009,948</u>	Total credits	<u>x</u>

The problem states that the plan sponsor paid the minimum required contribution at 12/31/2012. Based on 2012 exam condition 31, the "minimum required contribution" (MRC) does not reflect the credit balance (CB). The 2012 MRC is 1,009,948.

01/01/2013 valuation

The actuarial asset value at 01/01/2013 is equal to the 12/31/2012 contribution. The only item of experience G/L during 2012 is the salary increase. You need to construct the valuation results reflecting the actual compensation increase of 8%. Then you can calculate the 2013 normal cost.

If all the assumptions were met, then the present value of future benefits would increase with 7% interest. This is because all the participants survived the year and are now one year closer to retirement.

At 01/01/2013

Date of birth	01/01/62
Current age	51
2012 compensation (age 50)	(1.08)*43,000

Fall 2012 EA-2A Exam Solutions

Problem 32 – Page 3

$$\begin{aligned}\text{Projected pay @ 64} &= (1.08)*43,000*(1.04)^{14} \\ &= (1.08/1.04)*77,441\end{aligned}$$

$$\text{Projected ben @ 65} = (1.08/1.04)*38,720$$

$$\begin{aligned}\text{PVB} &= 100(v^{14} {}_{14}p_{51}^{(T)} \ddot{a}_{65}^{(12)})(1.08/1.04)(38,720) \\ &= (1.07)*(1.08/1.04)*11,690,333 \\ &= 12,989,758\end{aligned}$$

$$\text{AAV} = 1,009,948$$

$$\begin{aligned}\text{AGG PVNC} &= \text{PVB} - \text{AAV} - (\text{O/S 431 bases} - \text{CB}) \\ &= 12,989,758 - 1,009,948 - (0 - 0) \\ &= 11,979,810\end{aligned}$$

$$\text{AGG NC} = \text{PVNC} / \text{average } {}^s\ddot{a}_{\overline{\text{CA:RA-CA}}|}$$

Now you need to calculate the average temporary annuity with salary scale.

$$\begin{aligned}{}^s\ddot{a}_{\overline{51:14}|} &= \ddot{a}_{\overline{14}|j} \quad \text{where } 1+j = 1.07/1.04 \quad \rightarrow j = 2.885\% \\ &= 11.7139\end{aligned}$$

$$\begin{aligned}\text{AGG NC} &= 11,979,810 / 11.7139 \\ &= 1,022,704\end{aligned}$$

Answer is B

NOTE

There are alternate solution methods for this problem. I used the most straightforward method, which is to simply do two years' worth of valuation calculations.

Another technique is to treat this as a gain / loss question. In general, the expected normal cost should be level as a percentage of pay when all the actuarial assumptions are met. You could use this approach to calculate the expected normal cost for 2013, then analyze the impact of the 8% salary increase.

For an example of this solution technique, see problem 19 from the 2006 exam.

Fall 2012 EA-2A Exam Solutions

Problem 33

FALSE

The description of the limitation for the actuary's assumed rate of return is correct for plans that use the IRC 430(h)(2)(c) segment rates to value the funding target and target normal cost. But this plan is valued using the full yield curve, so the limitation is different.

If the valuation is based on the full yield curve, then 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

Fall 2012 EA-2A Exam Solutions

Problem 34

Similar to 2011 #30

The key to this problem is knowing how to do calculations under the Frozen Initial Liability (FIL) cost method. The normal cost is equal to the present value of future normal costs (PVNC) divided by the average temporary annuity for active participants.

The problem gives you the present value of future compensation. As a result, it appears that the benefits are pay related. You must calculate the average temporary annuity including a salary scale.

In this problem, you are given most items from the 2013 valuation, and a few items from the 2012 valuation. The missing piece of information is the unfunded accrued liability (UAL) at 01/01/2013. Under the FIL cost method, the UAL is brought forward each year using the formula for the expected UAL:

$$UAL_1 = {}_eUAL_1$$

$$\begin{aligned} {}_eUAL_1 &= (1+i)(NC_0 + UAL_0) - (\text{contribution} + \text{interest}) \\ &= (1.07) * (300,000 + 1,600,000) - 500,000[1 + (9/12)(.07)] && \text{simple interest} \\ &= 2,033,000 - 526,250 \\ &= 1,506,750 \end{aligned}$$

$$\begin{aligned} \text{FIL PVNC} &= \text{PVB} - \text{AAV} - \text{UAL} \\ &= 11,500,000 - 8,000,000 - 1,506,750 \\ &= 1,993,250 \end{aligned}$$

$$\begin{aligned} \text{PVE/E} &= 17,000,000 / 1,700,000 \\ &= 10.0 \end{aligned}$$

$$\begin{aligned} \text{FIL NC} &= \text{FIL PVNC} / (\text{PVE/E}) \\ &= 1,993,250 / 10.0 \\ &= 199,325 \end{aligned}$$

Answer is D

NOTE

You will get the same answer range if you decided to use compound interest:

$$\begin{aligned} {}_eUAL_1 &= (1.07) * (300,000 + 1,600,000) - 500,000(1.07)^{9/12} \\ &= 1,506,973 \end{aligned}$$

$$\text{FIL PVNC} = 1,993,027$$

$$\text{FIL NC} = 199,303$$

Fall 2012 EA-2A Exam Solutions

Problem 35 – Page 1

Similar to 2009 #36

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

There are several items that complicate the solution to this problem:

- Contributions for 2012 are paid both before and after the end of the plan year
- Smith and Jones have different benefit amounts
- Benefits are payable monthly (not annually)

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

$$\begin{aligned} 01/2013 \text{ AAV} &= 1,014,000 + 10,000 \\ &= 1,024,000 \end{aligned}$$

$$\begin{aligned} 01/2013 {}_e\text{AAV}_1 &= (1+i) * (\text{AAV}_0) - (\text{benefit payments} + \text{interest}) + (\text{contributions} + \text{interest}) \\ &= 1.07(870,000) - (500 + 1,000)[12 + .07(12/12 + 11/12 + \dots + 1/12)] \\ &\quad + 90,000[1 + .07(5/12)] + 10,000 \end{aligned}$$

This calculation is based on simple interest. The alternative solution based on using compound interest is shown on the next page.

Note that the AAV calculation for multiemployer plans uses different rules. If this was a single employer plan, IRC 430 requires you to adjust the receivable contribution with interest. But there is no similar requirement in IRC 431 for multiemployer plans.

One key point of the problem is handling the monthly interest on the benefit payments. Looking at the benefit payments for Smith, you have

$$\begin{aligned} \text{BP} + \text{int} &= 1,000[12 + .07(12/12 + 11/12 + \dots + 1/12)] \\ &= 1,000[12 + (.07/12) * (12 + 11 + \dots + 1)] \\ &= 1,000[12 + \frac{(.07) * (12)(13)}{2}] \\ &= 1,000(12)[1 + (.07) * (13/24)] \\ &= 12,455 \end{aligned}$$

You should memorize the expression for a full year's interest on twelve monthly benefit payments. It will appear again on the exam in the future.

$$\begin{aligned} 01/2013 {}_e\text{AAV}_1 &= 930,900 - 6,227 - 12,455 + 92,625 + 10,000 \\ &= 1,014,842 \end{aligned}$$

Fall 2012 EA-2A Exam Solutions

Problem 35 – Page 2

$$\begin{aligned}\text{Inv gain} &= 1,024,000 - 1,014,842 \\ &= 9,158\end{aligned}$$

Answer is B

NOTE

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

$$\begin{aligned}01/2013 \text{ } {}_t\text{AAV}_1 &= (1+i) \cdot (\text{AAV}_0) - (\text{benefit payments} + \text{interest}) + (\text{contributions} + \text{interest}) \\ &= 1.07(870,000) - (1.07)(12)(500 + 1,000) \cdot \ddot{a}_{\overline{1}|at 7.0\%}^{(12)} \\ &\quad + 90,000(1.07)^{5/12} + 10,000\end{aligned}$$

One key point of the problem is handling the monthly interest on the benefit payments. Looking at the benefit payments for Smith, you have

$$\begin{aligned}\text{BP} + \text{int} &= (1.07)(12)(1,000) \ddot{a}_{\overline{1}|at 7.0\%}^{(12)} \\ &= 1,000(1.07)(12) \left[(1/12) \ddot{a}_{\overline{12}|j} \right] \quad \text{where } (1+j)^{12} = 1.07 \Rightarrow j = .5654\% \\ &= 1,000(1.07)(11.6358) \\ &= 12,450\end{aligned}$$

$$\begin{aligned}01/2013 \text{ } {}_t\text{AAV}_1 &= 930,900 - 6,225 - 12,450 + 92,573 + 10,000 \\ &= 1,014,798\end{aligned}$$

$$\begin{aligned}\text{Inv gain} &= 1,024,000 - 1,014,798 \\ &= 9,202\end{aligned}$$

Answer is B

Fall 2012 EA-2A Exam Solutions

Problem 36 – Page 1

The key to working this problem is knowing the calculation details under IRC 436. You are told that the 2013 “funding percentage” is 97.91%. You can use this information to determine the 2013 actuarial asset value (AAV).

The “funding percentage” corresponds to the definition in IRC 430(f)(3)(C):

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

$$\begin{aligned} 97.91\% &= (\text{AAV} - 300,000) / 4,800,000 \\ \text{AAV} &= .9791(4,800,000) + 300,000 \\ &= 4,999,680 \end{aligned}$$

The question asks for the value of the 2013 AFTAP (adjusted funding target attainment percentage). In this problem, you do have non-HCE annuity purchases (NHAP) within the prior two years:

$$\begin{aligned} \text{AFTAP} &= \frac{\text{NHAP} + \text{AAV} - \text{CB} - \text{PB}}{\text{NHAP} + \text{Funding Target (non At-Risk)}} \\ &= \frac{(850,000 + 150,000) + 4,999,680 - 100,000 - 300,000}{(850,000 + 150,000) + 4,800,000} \\ &= 96.54\% \end{aligned}$$

But there is a trick to this question - the 2013 AFTAP is not really 96.54%. You need to be careful any time you have a problem with a very large AFTAP value, or a very large carryover balance.

There is a special rule in IRC 436(j)(3) that allows you to use the assets unreduced by any balances to calculate the AFTAP. If the value of the FTAP is at least 100% using the assets unreduced by any balances, then you can calculate the AFTAP in the same manner. I will denote these alternate definitions as FTAP₂ and AFTAP₂:

$$\begin{aligned} \text{FTAP}_2 &= \frac{\text{AAV} - \text{zero}}{\text{Funding Target (non At-Risk)}} \\ &= \frac{4,999,680 - 0}{4,800,000} \end{aligned}$$

$$\text{FTAP}_2 = 104.16\%$$

Fall 2012 EA-2A Exam Solutions

Problem 36 – Page 2

Since FTAP₂ is at least 100%, you can use the alternate AFTAP definition:

$$\begin{aligned}\text{AFTAP}_2 &= \frac{\text{NHAP} + \text{AAV} - \text{zero}}{\text{NHAP} + \text{Funding Target (non At-Risk)}} \\ &= \frac{(850,000 + 150,000) + 4,999,680 - \text{zero}}{(850,000 + 150,000) + 4,800,000} \\ &= 103.44\%\end{aligned}$$

Answer is D

Fall 2012 EA-2A Exam Solutions

Problem 37 – Page 1

The key to this problem is knowing how to calculate the Funding target, Target normal cost and the Shortfall amortization base at 01/01/2013 under IRC Section 430. This plan has a funding standard carryover balance (CB) of 8,000 and a prefunding balance (PB) of 1,000 at 01/01/2013.

Another key to this problem is knowing how to calculate the minimum required contribution (MRC) under IRC Section 430. In general, the MRC is defined as the target normal cost plus the shortfall amortization charge and the waiver amortization charge, all at the valuation date. 2012 exam condition 30 clarifies that “minimum required contribution” means the contribution calculated prior to reflecting the carryover balance or prefunding balance.

Valuation calculations

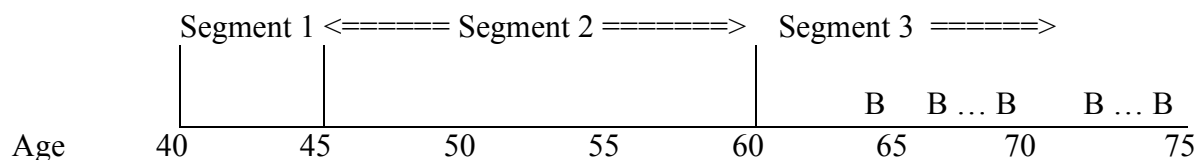
You need to determine values for the Funding target and the Target normal cost at 01/01/2013. You are told that there is only one participant.

At 01/01/2013

Age	40.0
Past service	10.0
Accrued benefit	$10.0(120)(12) = 14,400$

$$\Delta \text{ Accrued benefit} = 1,440 = 12(120)$$

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



$$\begin{aligned}
 FT &= \text{PV of accrued benefit} \\
 &= 14,400(D_{65} / D_{40}) \ddot{a}_{65}^{(12)} \quad \text{at the third segment rate} \\
 &= 14,400(1+i)^{-25}({}_{25}p_{40})(\ddot{a}_{65}^{(12)}) \\
 &= 14,400(1.06)^{-25}(1.0)(11.56) \\
 &= 38,786
 \end{aligned}$$

Fall 2012 EA-2A Exam Solutions

Problem 37 – Page 2

There are three segment interest rates, but the benefit payments are discounted back to the valuation date using a single rate, based on which segment they fall into. The present value of the benefit payments at 65 is calculated using the third segment rate of 6%, and they are all discounted to the valuation date at 6%. With no pre-retirement decrements, the D/D terms are only based on the 6% interest rate.

$$\begin{aligned}\text{TNC} &= \text{PV of change in accrued benefit} \\ &= 1,440(D_{65} / D_{40}) \ddot{a}_{65}^{(12)} \quad \text{at the third segment rate} \\ &= (1,440/14,400)*38,786 \\ &= 3,879\end{aligned}$$

Funding Shortfall

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

$$\begin{aligned}\text{Funding S/F} &= \text{Funding target} - (\text{AAV} - \text{CB} - \text{PB}) \\ &= 38,786 - (41,000 - 8,000 - 1,000) \\ &= 6,786\end{aligned}$$

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:

$$\begin{aligned}\text{Modified S/F} &= 100\% * (\text{Funding target}) - (\text{AAV} - \text{PB}) \\ &= 38,786 - (41,000 - 1,000) \\ &= \text{zero}\end{aligned}$$

Shortfall amortization installment

The plan is eligible for the shortfall base exemption. The problem states that there were no shortfall amortization bases established before 2013. The shortfall amortization charge is zero.

"Minimum Required Contribution"

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

(next page)

Problem 37 – Page 3

Revised 09/15/14

$$\begin{aligned}\text{MRC} &= \text{TNC} + \text{Shortfall amort charge} + \text{Waiver amort charge} \\ &= 3,879 + 0 + 0 \\ &= 3,879\end{aligned}$$

Answer is B

Problem 38

Revised 10/18/16

TRUE

In general, the required annual payment is based on the minimum required contribution for both the current year and the prior year. When the prior year is a short plan year, then the required annual payment is only based on the minimum required contribution for the current year.

See the regulation at 1.430(j)-1(c)(5)

Answer is A

NOTES

1. The answer above is based on the proposed regulations. Under the final regulation released 09/09/2015, the statement is FALSE. When the prior plan year is a short plan year, then the required annual payment is defined as the lesser of
 - 90% of the minimum required contribution for the current year, or
 - 100% of the minimum required contribution for the prior year times (12 months divided by the length of short plan year in months).
2. When the current plan year is a short plan year, you may have less than four required installments for the year.
3. When the current plan year is a short plan year, the required annual payment is defined as the lesser of
 - 90% of the minimum required contribution for the current year, or
 - 100% of the minimum required contribution for the prior year times (length of short plan year in months divided by 12 months)

Fall 2012 EA-2A Exam Solutions

Problem 39

Similar to 2009 #34

This is a straightforward problem on calculating the Top Heavy (T-H) minimum. The problem does not tell you the T-H averaging period. Based on IRC 416(c)(1)(D)(1), the T-H averaging period can not exceed five consecutive years. This problem is a bit simplified, since it states the participant has always earned 75,000.

The plan benefit is based on years of service, which goes back to Smith's hire date. The T-H minimum is based on years the plan has been T-H, which goes back to the 2008 plan year.

	Smith
Effective date	01/01/2003
Hire date	01/01/2007
Service at 01/01/2013	6
3 year average comp	75,000
Plan accrued benefit	$1.25\%(6)(75,000)$ $= 5,625$
Plan payment form	15 year certain & life
Top Heavy service	5
Top Heavy comp	75,000
T-H minimum	$2.0\%*(5)(75,000)$ $= 7,500$
T-H payment form	straight life annuity

The key point of the problem is that the T-H minimum is defined as a straight life annuity. You can't compare the plan benefit until you convert the T-H minimum to the 15 year certain & life payment form:

15 YR C&L

$$\begin{aligned}\text{T-H min} &= 7,500 * (\ddot{a}_{65}^{(12)} / [\ddot{a}_{15|j}^{(12)} + N_{80}^{(12)} / D_{65}]) \\ &= 7,500 * (10.86 / 11.92) \\ &= 6,833\end{aligned}$$

Answer is B

NOTE

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

Fall 2012 EA-2A Exam Solutions

Problem 40 – Page 1

Similar to 2010 #40

This is the third question asked on the EA-2A exam regarding post-PPA 2006 waivers. This problem asks for “the minimum required contribution”. Based on 2012 exam condition 30, this amount does not reflect a reduction for the funding standard carryover balance (CB) or for the prefunding balance (PB).

The problem states that the CB and PB are both equal to zero. The plan obtained a full waiver for the 2012 minimum required contribution (MRC). The key to this problem is the calculation of the MRC for 2012 under IRC Section 430.

2012 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.

$$\begin{aligned}\text{Funding S/F} &= \text{Funding target} - (\text{AAV} - \text{CB} - \text{PB}) \\ &= 1,000,000 - (900,000 - 0 - 0) \\ &= 100,000\end{aligned}$$

2012 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 shortfall amortization charge for both 2012 and 2013. The 2012 shortfall amortization charge is 5,000.

2012 Minimum Required Contribution

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

$$\begin{aligned}\text{MRC} &= \text{TNC} + \text{Shortfall amort charge} + \text{Waiver amort charge} \\ &= 50,000 + 5,000 + \text{zero} \\ &= 55,000\end{aligned}$$

2013 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.

$$\begin{aligned}\text{Funding S/F} &= \text{Funding target} - (\text{AAV} - \text{CB} - \text{PB}) \\ &= 1,100,000 - (925,000 - 0 - 0) \\ &= 175,000\end{aligned}$$

Fall 2012 EA-2A Exam Solutions

Problem 40 – Page 2

2013 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 shortfall amortization charge for both 2012 and 2013. The 2013 shortfall amortization charge is 8,000.

2013 Waiver amortization

The plan obtained a full waiver for the 2012 minimum required contribution, which was 55,000. The first step is to calculate amortization factor for the waiver.

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 2012 waiver is amortized starting in 2013. Based on the regulations, the amount of the waiver amortization payment is determined using the 2012 segment rates. The amortization factor assumes waiver payments starting in 2013, so the segment rates used are 4% for 4 years, and 5% for the fifth year. The amortization factor is calculated using an end of year annuity based on the 1st segment rate for 2012 for four years, and the 2nd segment rate for 2012 for one year:

$$\begin{aligned}\text{Amort factor} &= (1.04)^{-1} + (1.04)^{-2} + (1.04)^{-3} + (1.04)^{-4} + (1.05)^{-5} \\ &= a_{\overline{4}|4\%} + (1.05)^{-5} \\ &= 4.4134\end{aligned}$$

$$\begin{aligned}\text{Waiver amort} &= 55,000 / 4.4134 \\ &= 12,462\end{aligned}$$

2013 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.

$$\begin{aligned}\text{MRC} &= \text{TNC} + \text{Shortfall amort charge} + \text{Waiver amort charge} \\ &= 54,000 + 8,000 + 12,462 \\ &= 74,462\end{aligned}$$

Answer is C

Problem 40 – Page 3

Revised 09/15/14

NOTE

I was surprised that you can calculate the waiver amortization factor incorrectly, and still get the correct answer range. If you use the 2013 segment rates and determine the factor at 01/01/2013, the factor is $\ddot{a}_{\overline{5}|4.75\%} = 4.5666$.

The incorrect waiver amortization is $12,044 = 55,000 / 4.5666$, and the 2013 MRC is 74,044.

Fall 2012 EA-2A Exam Solutions

Problem 41 – Page 1

Similar to 2009 #32

The key to this problem is knowing the gain / loss formulas. The problem asks for the mortality G/L due to the death of one retiree during 2012.

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

Smith and Jones both retired at 01/01/2012 at age 65 with a ten year certain and life payment form. Since the participants are retired, the normal cost is zero.

At 01/01/2013, only Smith is alive. But Jones still has a liability for the remaining 9 year certain annuity. One thing simplifies this problem - the benefits are paid annually at 1/1 (instead of monthly).

$$\begin{aligned}AL_0 &= (30,000 + 6,000) * [\ddot{a}_{\overline{10}|.07} + (D_{75} / D_{65}) \ddot{a}_{75}] \\ &= 36,000 * [\ddot{a}_{\overline{10}|.07} + N_{75} / D_{65}] \\ AL_1 &= 30,000 * [\ddot{a}_{\overline{9}|.07} + N_{75} / D_{66}] + 6,000 * \ddot{a}_{\overline{9}|.07}\end{aligned}$$

You need to calculate the values for both D_{65} and D_{66} first. This requires a little knowledge of commutation functions:

$$\begin{aligned}D_{65} &= N_{65} - N_{66} & D_{66} &= N_{66} - N_{67} \\ &= 102,245 - 92,585 & &= 92,585 - 83,649 \\ &= 9,660 & &= 8,936\end{aligned}$$

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

$$\begin{aligned}{}_eAL_1 &= (1+i)(AL_0 + \text{zero}) - (\text{actual benefit payments} + i) \\ &= 1.07 * 36,000 * (N_{75} / D_{65}) - \text{zero} && \text{(ignoring period certain benefits)} \\ &= 1.07(36,000)(33,380/9,660) \\ &= 133,105\end{aligned}$$

$$\begin{aligned}AL_1 &= 30,000 * [N_{75} / D_{66}] && \text{(ignoring period certain benefits)} \\ &= 30,000 * [33,380/8,936] \\ &= 112,064\end{aligned}$$

There is one minor trick to this problem. It asks for the absolute value of (X plus Y) - not for the absolute value of X plus the absolute value of Y. That is why we can calculate the G/L in total.

Fall 2012 EA-2A Exam Solutions

Problem 41 – Page 2

$$\begin{aligned}\text{Non-inv G/L} &= eAL_1 - AL_1 \\ &= 133,105 - 112,064 \\ &= 21,042\end{aligned}$$

Answer is A

NOTES

1. Using the shortcut approach shown earlier, this is NOT a very long problem. They were very generous in making this a 5 point question.
2. You can calculate the separate values of X and Y, but it is less confusing to calculate the total G/L. If the problem had asked for the absolute value of X plus the absolute value of Y, then you must calculate the values separately.

It should be clear there is a loss for Smith and a gain for Jones. This means that X and Y must have opposite signs.

$$\text{Non-inv G/L} = eAL_1 - AL_1$$

The gain for Jones is

$$\begin{aligned}Y &= 1.07 * 6,000 * (N_{75} / D_{65}) - \text{zero} \\ &= 22,184\end{aligned}$$

The loss for Smith is

$$\begin{aligned}X &= 1.07 * 30,000 * (N_{75} / D_{65}) - 112,064 \\ &= -1,142\end{aligned}$$

The absolute value of the sum is

$$\begin{aligned}Z &= |X + Y| \\ &= 21,042\end{aligned}$$

Problem 43

Revised 09/15/14

FALSE

The definition of at-risk status is almost correct. Two words are incorrect:

- instead of “either”, it should say “both”
- instead of “or” between the two clauses, it should say “and”

See IRC 430(i)(4)(A)

Answer is B

Fall 2012 EA-2A Exam Solutions

Problem 44 – Page 1

The key point to the problem is knowing how to calculate the Projected Unit Credit (PUC) accrued liability and the normal cost. Under PUC, the accrued liability is defined as the present value of the “funding accrued benefit” (FAB). The normal cost is defined as the present value of the change in the FAB for the year.

$$AL = PV (FAB)$$

$$NC = PV (\Delta FAB)$$

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

1. Project pay to retirement age
2. Calculate the projected benefit
3. Pro-rate the projected benefit based on service today versus service at retirement.

This pro-rata calculation must reflect each year's rate of benefit accrual.

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

The plan benefit is based on the three year final average pay. The normal retirement age is 65 by default. For a participant retiring upon attaining age 65 at 01/01, their benefit is based on pay for the prior three ages: 62, 63 and 64.

The plan has a population of 1,000 clones with identical data. First you need to determine the projected pay, and the funding accrued benefit for a single participant:

Data at 01/2013

Age	40
Past service	4
2012 pay (age 39)	34,000

$$\begin{aligned}\text{Projected pay @ 64} &= 34,000 * (1.02)^{25} \\ &= 55,781\end{aligned}$$

$$\begin{aligned}\text{Final average pay @ 65} &= 55,781 * (\ddot{a}_{\overline{3}|2\%} / 3) \\ &= 54,694\end{aligned}$$

$$\begin{aligned}\text{Funding accrued benefit} &= 54,694(1\%)(4) \\ &= 2,188\end{aligned}$$

Fall 2012 EA-2A Exam Solutions

Problem 44 – Page 2

Now you can calculate the PUC AL in total:

$$\begin{aligned}\text{PUC AL} &= \text{PV (FAB)} \\ &= v^{25} {}_{25}p_{40}^{(T)} (1000)(2,188) \ddot{a}_{65}^{(12)}\end{aligned}$$

$$\ddot{a}_{65}^{(12)} = N_{65}^{(12)} / D_{65}$$

$$v^{25} {}_{25}p_{40}^{(T)} = D_{65} / D_{40}$$

The problem states that this plan does have pre-retirement mortality. This allows you to simplify the present value calculations a bit:

$$\begin{aligned}\text{PUC AL} &= 2,188,000 N_{65}^{(12)} / D_{40} \\ &= 2,188,000(1,517,247/1,118,969) \\ &= 2,966,457\end{aligned}$$

The plan benefit accrues uniformly over years of service. At 12/31/2013, the participant will have 5 years of service. The change in the Funding accrued benefit is simply one fourth of the total:

$$\begin{aligned}\Delta \text{FAB} &= \text{FAB} / 4 \\ &= 547\end{aligned}$$

$$\begin{aligned}\text{NC} &= \text{PV} (\Delta \text{FAB}) \\ &= 2,966,457 / 4 \\ &= 741,614\end{aligned}$$

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

Now you can set up the MFSA and calculate the 12/31/13 "smallest amount":

2013 Minimum Funding Standard Account			
Charges		Credits	
Normal Cost	741,614	Credit Balance	100,000
Amortization charges	550,000	Amortization credits	200,000
		12/31 minimum	x
7.5% interest	96,871	7.5% interest	22,500
Total charges	<u>1,388,485</u>	Total credits	<u>x + 322,500</u>

Fall 2012 EA-2A Exam Solutions

Problem 44 – Page 3

The “smallest amount” at 12/31/13 is $1,065,985 = 1,388,485 - 322,500$. This includes interest to 12/31, and reflects offsetting the credit balance against the minimum contribution.

Answer is D

Fall 2012 EA-2A Exam Solutions

Problem 45 – Page 1

Similar to 2004 #14

The key to this problem is handling the retirement decrements at age 62 and 65. In addition, you must calculate the normal cost under the Aggregate method. Under the Aggregate method, the present value of normal costs (PVNC) is defined as the present value of benefits less the actuarial asset value and the outstanding §431 bases (reduced by the credit balance).

The Aggregate normal cost is calculated by dividing the PVNC by the average temporary annuity from current age to the assumed retirement age. In this problem, the plan benefit is not based on pay, so the temporary annuity reflects the future working lifetime.

For each participant, the Aggregate PVB could be calculated as a summation:

$$PVB = \sum_{t=Z}^Y v_t p_x^{(T)} q_{x+t}^{(r)} (BEN)_{x+t} \ddot{a}_{x+t}^{(12)}$$

With decrements at only two ages, there is a simplified approach to calculating the PVB. You can think of the calculation as allowing for 25% of the participant to retire at age 62, and the remaining 75% of the participant to retire at age 65.

<u>Description</u>	<u>Participant #1</u>	<u>Participant #2</u>
01/2013 Age	55	63
Past service	10	20
Projected service at 62	17	N/A
Projected service at 65	20	22

The first participant will be eligible for unreduced benefits at age 62. The second participant is over age 62, so there are no early retirement calculations for them.

<u>Description</u>	<u>Participant #1</u>	<u>Participant #2</u>
Projected benefit at 62	(100)(12)(17) = 20,400	N/A N/A
Projected benefit at 65	(100)(12)(20) = 24,000	(100)(12)(22) = 26,400
PV future benefits	$(.25)(20,400)(D_{62} / D_{55}) \ddot{a}_{62}^{(12)}$ $+ (.75)(24,000)(D_{65} / D_{55}) \ddot{a}_{65}^{(12)}$ $= (.25)(20,400)(1.075)^{-7}(9.86)$ $+ (.75)(24,000)(1.075)^{-10}(9.25)$ $= 111,095$	$26,400(D_{65} / D_{63}) \ddot{a}_{65}^{(12)}$ $= 26,400(1.075)^{-2}(9.25)$ $= 211,314$

Fall 2012 EA-2A Exam Solutions

Problem 45 – Page 2

Now you can calculate the Aggregate PVNC:

$$\begin{aligned}\$412 \text{ PVNC} &= \text{PVB} - \text{AAV} - (\text{O/S } \$412 \text{ bases} - \text{CB}) && \text{NOTE: No ARA under Aggregate} \\ &= (111,095 + 211,314) - 250,000 - (0 - 500) \\ &= 72,909\end{aligned}$$

Now you need to calculate the average weighted annuity, which will be used to calculate the normal cost. There are no pre-retirement decrements (based on general exam condition 15). Since the benefit is no based on pay, the temporary annuity is calculated on an interest only basis.

You need to calculate the future working lifetime for each participant. Participant #2 is the easier of the two calculations. Participant #1 takes more thought to simplify the calculation:

Participant #2

$$\begin{aligned}\text{PVL} &= 1 + (1.075)^{-1} \\ &= 1.9302\end{aligned}$$

Participant #1

$$\begin{aligned}\text{PVL} &= 1 + (1.075)^{-1} + \dots + (1.075)^{-6} + 75\% * [(1.075)^{-7} + (1.075)^{-8} + (1.075)^{-9}] \\ &= 25\% * [1 + (1.075)^{-1} + \dots + (1.075)^{-6}] + 75\% * [1 + (1.075)^{-1} + \dots + (1.075)^{-9}] \\ &= 25\%(\ddot{a}_{\overline{7}|.075}) + 75\%(\ddot{a}_{\overline{10}|.075}) \\ &= 6.9576\end{aligned}$$

$$\begin{aligned}\text{PVL} / \text{L} &= (1.9302 + 6.9576) / 2 \\ &= 4.4439\end{aligned}$$

$$\begin{aligned}\$431 \text{ NC} &= \text{PVNC} / (\text{PVL}/\text{L}) \\ &= 72,909 / 4.4439 \\ &= 16,406\end{aligned}$$

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

(next page)

Fall 2012 EA-2A Exam Solutions

Problem 45 – Page 3

Revised 10/24/13

Now you can set up the MFSA and calculate the 12/31/13 “smallest amount”:

2013 Minimum Funding Standard Account			
Charges		Credits	
Normal Cost	16,406	Credit Balance	500
		12/31 minimum	x
7.5% interest	1,230	7.5% interest	37
Total charges	<u>17,636</u>	Total credits	<u>x + 537</u>

The “smallest amount” at 12/31/13 is $17,099 = 17,636 - 537$. This includes interest to 12/31, and reflects offsetting the credit balance against the minimum contribution.

Answer is E

NOTE

There is one minor problem with this answer - the numeric value is outside the “implied range” for this question. Based on prior EA-2A exams, this can happen when the exam writers determine the incorrect numerical answer for a question (or don’t allow for reasonable alternatives). Several students “freaked out” and assumed they had worked the problem incorrectly - and then they randomly changed their answer letter for the question.

The answer range was shown as C when the exam was initially released. The intended solution did not calculate the average temporary annuity correctly. It used a value of 8.8878 (instead of $4.4439 = 8.8878$ divided by 2 lives). This produced a final “smallest amount” equal to 8,281.

Fall 2012 EA-2A Exam Solutions

Problem 46 – Page 1

Similar to 2011 #03

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 states the IRC 430 minimum contribution is 1,600,000.

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.

$$\begin{aligned}\text{Cushion amount} &= 50\%(\text{FT}) + \Delta\text{FT due to pay increases} \\ &= .5(18,000,000) + (19,500,000 - 18,000,000) \\ &= 10,500,000\end{aligned}$$

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 2012 exam condition 42.

Target normal cost	600,000
+ Funding target	18,000,000
+ Cushion amount	10,500,000
Sub-total	<u>29,100,000</u>
Less unreduced AAV	12,750,000
Deductible limit	<u>16,350,000</u>

Since this is greater than the IRC 430 minimum contribution, this is the preliminary deductible limit. In most cases, this will be the final deductible limit - but you need to check the alternative definition, as shown on the next page.

Fall 2012 EA-2A Exam Solutions

Problem 46 – 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	800,000
+ At-Risk Funding target	20,250,000
Sub-total	21,050,000
Less unreduced AAV	12,750,000
Deductible limit	8,300,000

The alternative definition has no effect on the deductible limit. The final deductible limit is 16,350,000.

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.

Fall 2012 EA-2A Exam Solutions

Problem 47 – 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 12/31/2013. Based on exam condition 31, the "smallest amount" reflects offsetting the funding standard account credit balance (CB) against the minimum contribution.

12/31/2012 Credit balance

The problem does not give you the amount of the CB at 12/31/2012. You must set up the 2012 MFSA to calculate it:

2012 Minimum Funding Standard Account			
Charges		Credits	
Normal Cost	250,000	Credit Balance	100,000
Amortization charges	500,000	12/31 contribution	300,000
7% interest	52,500	7% interest	7,000
Total charges	802,500	Total credits	407,000

At 12/31/2012, the plan has a debit balance of $395,500 = 802,500 - 407,000$. One point of the problem is that you do not assume that a waiver is granted for this plan. This is based on 2012 exam condition 33.

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

$$\begin{aligned}\$431 \text{ "ERISA" FFL} &= (1+i)(NC + AL) - (1+i)[\text{lesser (MVA, AAV)} - CB] \\ &= 1.07(250,000 + 5,000,000) - 1.07(4,250,000 - 100,000)\end{aligned}$$

The FFL clearly exceeds the Minimum Funding Standard Account (MFSA) charges less the amortization credits. There is no FFL credit for 2012.

2012 G/L calculation

The hidden trick in this question is that you must set up a gain / loss base at 01/01/2013 for the 2012 experience. The problem specifies the cost method as Unit Credit, but that does not affect the solution. The G/L calculations are the same for all individual cost methods.

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

$${}_e\text{UAL}_1 = (1+i)(NC_0 + \text{UAL}_0) - (\text{contribution} + i)$$

Fall 2012 EA-2A Exam Solutions

Problem 47 – Page 2

$$\begin{aligned}UAL_0 &= AL_0 - AAV_0 \\ &= 5,000,000 - 4,250,000 \\ &= 750,000\end{aligned}$$

$$\begin{aligned}_eUAL_1 &= 1.07*(250,000 + 750,000) - 300,000 \\ &= 770,000\end{aligned}$$

$$\begin{aligned}UAL_1 &= AL_1 - AAV_1 \\ &= 5,400,000 - 4,280,000 \\ &= 1,120,000\end{aligned}$$

$$\begin{aligned}01-2013 \text{ loss} &= 1,120,000 - 770,000 \\ &= 350,000\end{aligned}$$

2013 MFSA

To set up the MFSA, you need to determine the amortizations for the 431 bases. The problem gives you the amortization of bases set up prior to 01/01/2013.

$$\begin{aligned}\text{Loss amort} &= 350,000 / \ddot{a}_{\overline{15}|.07} \\ &= 35,914\end{aligned}$$

Now you can set up the MFSA and calculate the 12/31/13 “smallest amount”. You need to be careful - don’t forget the debit balance.

2013 Minimum Funding Standard Account			
Charges		Credits	
Debit balance	395,500	Credit Balance	0
Normal Cost	350,000		
OLD amortization	500,000		
Loss amortization	35,914	12/31 minimum	x
7% interest	89,699	7% interest	0
Total charges	1,371,113	Total credits	x

The “smallest amount” at 12/31/13 is 1,371,113. This includes interest to 12/31, and reflects offsetting the credit balance against the minimum contribution.

There is one final step required - you need to check the Full Funding Limitation (FFL).

Fall 2012 EA-2A Exam Solutions

Problem 47 – Page 3

$$\begin{aligned}\text{\$431 "ERISA" FFL} &= (1+i) \cdot (\text{NC} + \text{AL}) - (1+i) \cdot [\text{lesser}(\text{MVA}, \text{AAV}) - \text{CB}] \\ &= 1.07 \cdot (350,000 + 5,400,000) - 1.07 \cdot (4,280,000 - 0) \\ &= 1.07 \cdot (1,470,000)\end{aligned}$$

The FFL clearly exceeds the MFSA charges less the amortization credits. There is no FFL credit for 2013. The “smallest amount” at 12/31/13 is 1,371,113.

Answer is D

Fall 2012 EA-2A Exam Solutions

Problem 48

This is the first question asked on calculations related to extension of amortization periods under IRC 431. The key point to this question is that you have to read it carefully. I did not do that the first time, and I misinterpreted several items - and got the wrong answer as a result.

The problem gives information for three bases that were established prior to 2013. Those bases are the ones that could be subject to the five year extension of amortization periods. The problem states that the extension applies to the amortization periods only for 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 12/31/2013 due to the extension of amortization periods. You should ignore the 01/2011 gain base and the 01/2013 loss base, since their amortization periods do not change.

Description	Method change base	Loss base
01/2012 outstanding base	3,000,000	750,000
01/2012 remaining years	12	15
01/2012 amortization payment	$3,000,000 / \ddot{a}_{12 .075}$ $= 360,775$	$750,000 / \ddot{a}_{15 .075}$ $= 79,038$
01/2013 outstanding base	$360,775 * \ddot{a}_{11 .075}$ $= 2,837,167$	$79,038 * \ddot{a}_{14 .075}$ $= 721,285$
01/2013 remaining years	$11 + 5 = 16$	$14 + 5 = 19$
01/2013 amortization payment	$2,837,167 / \ddot{a}_{16 .075}$ $= 288,708$	$721,285 / \ddot{a}_{19 .075}$ $= 67,372$
Decrease in amortization	$360,775 - 288,708$ $= 72,068$	$79,038 - 67,372$ $= 11,666$

The total decrease in the amortization payment at 01/2013 is $83,733 = 72,068 + 11,666$. The change in the "minimum required contribution" at 12/31/2013 is $1.075 * 83,733 = 90,013$.

Answer is D

NOTE

There is a minor typo in the data for this problem. It gives you the MFSA "bases as 1/1/2012". You should interpret this as the MFSA "bases at 1/1/2012".

Fall 2012 EA-2A Exam Solutions

Problem 49

This is a very detailed question on definitions under IRC 432. A plan in endangered status (or seriously endangered status) must adopt a funding improvement plan. The rules in IRC 432(c)(4)(A) for the funding improvement period are really complicated:

432(c)(4)(A) In general

The funding improvement period for any funding improvement plan adopted pursuant to this subsection is the 10-year period beginning on the first day of the first plan year of the multiemployer plan beginning after the earlier of--

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

(ii) the expiration of the collective bargaining agreements in effect on the due date for the actuarial certification of endangered status for the initial determination year under subsection (b)(3)(A) and covering, as of such due date, at least 75 percent of the active participants in such multiemployer plan.

The problem states that they adopted the funding improvement plan on 10/31/13. Item (i) is 10/31/15. The first day of the plan year following 10/31/15 is 01/01/16.

The total number of participants given is $1,150 = 150 + 300 + 500 + 200$. 75% of the total is 863 participants. To meet the criteria in item (ii), the collective bargaining agreements (CBA) for Employers 1, 2 and 3 (or 2, 3 and 4) must expire. Based on the 12/31/14 date for Employer 3, the first day of the plan year following the expiration of all three CBA is 01/01/15.

The earlier of the two dates is 01/01/15.

Answer is C

Fall 2012 EA-2A Exam Solutions

Problem 50

Similar to 2009 #20

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

FALSE

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

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

Under IRC 432(b)(2)(B)(ii), the plan is in critical status if

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

You do not have sufficient information to determine if the plan satisfies either of these definitions. The final result is that the plan is not in critical status.

Answer is B

Fall 2012 EA-2A Exam Solutions

Problem 51 – Page 1

This is a fairly long problem on IRC 430 minimum funding calculations. You need to do calculations for both 2012 and 2013.

This problem asks for the “smallest amount” that satisfies the minimum funding standard as of 01/01/13. Based on 2012 exam conditions 27 and 28, the plan sponsor elects to offset both the CB and the PB against the minimum contribution under IRC 430. Based on 2012 exam condition 31, the "smallest amount" reflects offsetting both the CB and the PB against the minimum required contribution (MRC).

2011 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:

$$\begin{aligned}\text{Funding S/F} &= \text{Funding target} - (\text{AAV} - \text{CB} - \text{PB}) \\ &= 450,000 - (450,000 - 0 - 0) \\ &= \text{zero}\end{aligned}$$

Since the funding shortfall is zero, all prior amortization bases were eliminated at 01/01/2011. The resulting minimum required contribution is the target normal cost, which equals 45,000.

2012 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. The problem states that the 2011 contribution was 45,000 at 01/01/2011. This means that the CB and PB are both equal to zero at 01/01/2012.

$$\begin{aligned}\text{Funding S/F} &= \text{Funding target} - (\text{AAV} - \text{CB} - \text{PB}) \\ &= 500,000 - (455,075 - 0 - 0) \\ &= 44,925\end{aligned}$$

2012 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:

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

Fall 2012 EA-2A Exam Solutions

Problem 51 – Page 2

2012 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:

The shortfall amortization bases were eliminated in 2011. The 2012 shortfall base is the same as the Funding shortfall, or 44,925.

You must calculate the shortfall amortization installment for 2012. You are given the 7-year annuity factor:

$$\begin{aligned}\text{S/F amort} &= 44,925 / 5.9900 \\ &= 7,500\end{aligned}$$

$$\text{S/F charge} = 7,500$$

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.

2012 Minimum Required Contribution

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

$$\begin{aligned}\text{MRC} &= \text{TNC} + \text{Shortfall amort charge} + \text{Waiver amort charge} \\ &= 50,000 + 7,500 + 0 \\ &= 57,500\end{aligned}$$

2012 Smallest amount

The problem states that “the smallest amount that satisfies the minimum funding standard” was contributed as of 01/01/12:

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

Since the CB and PB are both equal to zero at 01/01/12, there is no difference between the MRC and the “smallest amount”. You also know that the CB and PB are both equal to zero at 01/01/13.

Fall 2012 EA-2A Exam Solutions

Problem 51 – Page 3

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:

$$\begin{aligned}\text{Funding S/F} &= \text{Funding target} - (\text{AAV} - \text{CB} - \text{PB}) \\ &= 550,000 - (549,500 - 0 - 0) \\ &= 500\end{aligned}$$

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:

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

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

$$\begin{aligned}\text{S/F Amort base} &= 1.0 * 550,000 - (549,500 - 0 - 0) - (\text{PV of PY Amortizations}) \\ &= 500 - 7,500(5.4100) \\ &= -40,075\end{aligned}$$

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

$$\begin{aligned}\text{S/F amort} &= -40,075 / 6.1600 \\ &= -6,506\end{aligned}$$

$$\begin{aligned}\text{S/F charge} &= 7,500 - 6,506 \\ &= 994\end{aligned}$$

Fall 2012 EA-2A Exam Solutions

Problem 51 – Page 4

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

2013 Minimum Required Contribution

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

$$\begin{aligned}\text{MRC} &= \text{TNC} + \text{Shortfall amort charge} + \text{Waiver amort charge} \\ &= 60,000 + 994 + 0 \\ &= 60,994\end{aligned}$$

2013 Smallest amount

The problem states that “the smallest amount that satisfies the minimum funding standard” was contributed as of 01/01/2013.

$$\begin{aligned}\text{Smallest contr} &= \text{MRC} - \text{CB} - \text{PB} \\ &= 60,994 - 0 - 0 \\ &= 60,994\end{aligned}$$

Answer is D

Problem 52 – Page 1

Revised 09/15/14

This appears to be a straightforward problem on IRC 430 minimum funding calculations. You need to do calculations for both 2012 and 2013.

This problem states that the “smallest amount” that satisfies the minimum funding standard was contributed for 2012. Based on 2012 exam conditions 27 and 28, the plan sponsor elects to offset both the CB and the PB against the minimum contribution under IRC 430. Based on 2012 exam condition 31, the “smallest amount” reflects offsetting both the CB and the PB against the minimum required contribution (MRC).

The problem asks for the “minimum required contribution” for 2013. Based on 2012 exam condition 30, the plan sponsor does not offset the carryover balance (CB) or the prefunding balance (PB) against the minimum contribution under IRC 430.

2012 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.

$$\begin{aligned}\text{Funding S/F} &= \text{Funding target} - (\text{AAV} - \text{CB} - \text{PB}) \\ &= 2,000,000 - (2,250,000 - 100,000 - 250,000) \\ &= 100,000\end{aligned}$$

2012 Shortfall Base Exemption

Since the PB is fairly large, you need to think 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 quite different from the previously calculated Funding shortfall:

$$\begin{aligned}\text{Modified S/F} &= 100\% * (\text{Funding target}) - (\text{AAV} - \text{PB}) \\ &= 2,000,000 - (2,250,000 - 250,000) \\ &= \text{zero}\end{aligned}$$

Note that the modified funding shortfall does offset the PB. This is because the plan sponsor did elect to use the PB to satisfy the 2012 minimum, and they contributed the “smallest amount” in 2012.

Fall 2012 EA-2A Exam Solutions

Problem 52 – Page 2

2012 Shortfall amortization installment

The problem states that there was no funding shortfall for 2011. As a result, all prior amortization bases were eliminated at 01/01/2011.

The plan is eligible for the shortfall base exemption for 2012. The 2012 shortfall amortization installment is zero.

2012 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.

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

2012 Smallest amount

The problem states that “the smallest amount that satisfies the minimum funding standard” was contributed as of 01/01/12:

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

The actual contribution for 2012 was zero. The sum of the CB and PB exceeds the 2012 MRC. The problem gives you the value of the PB at 01/01/13 (and the CB is zero).

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:

$$\begin{aligned}\text{Funding S/F} &= \text{Funding target} - (\text{AAV} - \text{CB} - \text{PB}) \\ &= 2,300,000 - (2,362,500 - 0 - 157,500) \\ &= 95,000\end{aligned}$$

2013 Shortfall Base Exemption

Since the PB is fairly large, you need to think 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.

Fall 2012 EA-2A Exam Solutions

Problem 52 – Page 3

Revised 10/10/14

The modified funding shortfall is different from the previously calculated Funding shortfall:

$$\begin{aligned}\text{Modified S/F} &= 100\% * (\text{Funding target}) - (\text{AAV} - \text{PB}) \\ &= 2,300,000 - (2,362,500 - 0) \\ &= \text{zero}\end{aligned}$$

Note that the modified funding shortfall does not offset the PB. The problem states that the plan sponsor did not elect to use the PB to satisfy the 2013 minimum required contribution.

2013 Shortfall amortization installment

The plan is eligible for the shortfall base exemption. The 2013 shortfall amortization installment is zero.

2013 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.

$$\begin{aligned}\text{MRC} &= \text{TNC} + \text{Shortfall amort charge} + \text{Waiver amort charge} \\ &= 225,000 + 0 + 0 \\ &= 225,000\end{aligned}$$

Answer is B

NOTES

1. I think this was a pretty tricky problem. It appears that this problem was intentionally designed to be very similar to problem 51, which could be misleading. It was placed near the end of the exam - where you would be hurrying through your calculations. But you would get the wrong answer if you miss the difference in the handling of the prefunding balance for the shortfall exemption calculation between 2012 and 2013.
2. One thing that I learned from this problem - be careful when you see a question with two years of calculations, where the “minimum required contribution” is paid in one year, and the “smallest amount” is paid in the other year. In the year where the “minimum required contribution” is paid, the shortfall base exemption calculation will not use any prefunding balance. In the year where the “smallest amount” is paid, the shortfall base exemption calculation will use the prefunding balance.

Fall 2012 EA-2A Exam Solutions

Problem 53

The key to working this problem is knowing how to handle mandatory employee contributions under the Unit Credit cost method. This topic has not been tested on the EA exams since about 1985.

Under Unit Credit, the normal cost is defined as the present value of the change in the accrued benefit for the year:

$$\text{Total NC} = \text{PV}(\Delta \text{AB})$$

Data at 01/2013

Age	56
Past service	26

$$\begin{aligned}\text{UC NC} &= \text{PV}(\Delta \text{AB}) \\ &= (\Delta \text{AB})(D_{65} / D_{56}) \ddot{a}_{65}^{(12)} \\ &= (\Delta \text{AB})(v^9 p_{56}) \ddot{a}_{65}^{(12)} \\ &= 900(1.06)^{-9}(10.85) \\ &= 5,780\end{aligned}$$

The present value is calculated on an interest only basis. Based on 2012 exam condition 15, there are no pre-retirement decrements.

This formula gives the “total normal cost”. You can reduce this by the present value of the mandatory employee contributions, which represents the “employee normal cost”. The difference is often called the “employer normal cost”.

$$\text{EE NC} = v^1 {}_1p_{56}^{(T)}(500)$$

The formula for the “employee normal cost” is an approximation. This approximation assumes that the interest crediting rate on employee contributions is the same as the valuation interest rate. Coincidentally, this is also stated as an assumption in the problem.

$$\begin{aligned}\text{ER NC} &= \text{UC NC} - \text{EE NC} \\ &= 5,780 - v^1 {}_1p_{56}^{(T)}(500) \\ &= 5,780 - (1.06)^{-1}(1.0)(500) \\ &= 5,780 - 472 \\ &= 5,308\end{aligned}$$

Answer is B

THIS PAGE WAS INTENTIONALLY LEFT BLANK