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# FALL 2011 EA-2A EXAM SOLUTIONS

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## Fall 2011 EA-2A Exam Solutions

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These solutions were prepared based on the law as in effect at June 30, 2011. 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:

November 1, 2017	Revised solution for problem 44
October 18, 2016	Added notes at end of solutions for problems 39, 48 and 50
July 25, 2015	Revised solutions for problems 22 and 45
December 18, 2013	Revised solution for problem 33
October 29, 2013	Revised solution for problem 34
October 23, 2013	Revised note at end of the solution for problem 48
October 10, 2013	Revised solutions for problems 16, 21 and 34
September 9, 2013	Revised solutions for problems 39 and 44
August 22, 2013	Revised solutions for problems 26, 45 and 46
July 31, 2013	Revised solutions for problems 7, 16 and 42
July 9, 2013	Revised solutions for problems 30 and 47
October 22, 2012	Revised solutions for problems 21 and 40
October 15, 2012	Revised solution for problem 31
August 31, 2012	Original solutions

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

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

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

### Modified assets

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

Based on 2011 exam conditions 26 and 27, the plan sponsor does elect to apply both the CB and the PB against the MRC. As a result, you should set up the modified asset as AAV - PB. In general, the only time you should not do this is when the problem states that the plan sponsor does not elect to apply the CB and the PB against the MRC, or when the plan's funding ratio for the prior year is less than 80% (see note 6 on next page).

### Modified funding target

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

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

The new shortfall base is equal to

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

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

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### Single employer minimum contribution steps - continued:

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

### **Funding ratio**

2011 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:

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

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

1. Calculate the normal cost plus limit adjustments with interest to the earlier of the end of the plan year or the end of the tax year.
2. Calculate the Full Funding Limitation under Section 404 with interest to the end of the plan year. If this is less than the result of step one, then you can skip to step four.
3. Calculate the absolute minimum amount necessary to produce a non-negative credit balance in the Minimum Funding Standard Account. This is the "smallest amount to satisfy the minimum funding standard" as defined in 2011 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  $140\% \times (\text{Current Liability}) - \text{AAV}$ . If this exceeds the deductible limit in step 4, then the final deductible limit will equal the UCL limit. This UCL limit ignores recent benefit improvements for small plans with highly compensated employees.

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### Problem 1 – Page 1

Similar to 2010 #31

This is the third question asked on 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 2011 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 2011 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:

$$\begin{aligned}\text{Funding S/F} &= \text{Funding target} - (\text{AAV} - \text{CB} - \text{PB}) \\ &= 850,000 - (685,000 - 0 - 5,000) \\ &= 170,000\end{aligned}$$

### **Shortfall Base Exemption**

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

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

### **Shortfall amortization installment**

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

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

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

This problem gives you the 2011 shortfall amortization installment as 8,000. It also gives you the 6-year amortization factor, so you can calculate the new shortfall base:

$$\begin{aligned}\text{S/F Amort base} &= 1.0 * 850,000 - (685,000 - 0 - 5,000) - (\text{PV of PY Amortizations}) \\ &= 170,000 - 8,000(5.0167) \\ &= 129,866\end{aligned}$$

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### Problem 1 – Page 2

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

$$\begin{aligned}\text{S/F amort} &= 129,866 / 5.6354 \\ &= 23,045\end{aligned}$$

$$\begin{aligned}\text{S/F charge} &= 23,045 + 8,000 \\ &= 31,045\end{aligned}$$

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.

### Target normal cost

The problem states that there are 22,500 of expected plan-related expenses:

$$\begin{aligned}\text{01/2012 TNC} &= 50,000 + 22,500 \text{ expenses} \\ &= 72,500\end{aligned}$$

### 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.

$$\begin{aligned}\text{MRC} &= \text{TNC} + \text{Shortfall amort charge} + \text{Waiver amort charge} \\ &= 72,500 + 31,045 + 0 \\ &= 103,545\end{aligned}$$

### Smallest amount

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

$$\begin{aligned}\text{Smallest contr} &= \text{MRC} - \text{CB} - \text{PB} \\ &= 103,545 - 0 - 5,000 \\ &= 98,545\end{aligned}$$

**Answer is D**

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### Problem 2

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 01/01/2012**

Age	65
Service	35 years
Participation	35 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:

<b>Plan Year Beginning</b>	<b>Applicable 401(a)(17) limit</b>	<b>Plan year Ending</b>	<b>Plan year Pay</b>	<b>Limited pay</b>
01/01/06	220,000	12/31/06	255,000	220,000
01/01/07	225,000	12/31/07	220,000	220,000
01/01/08	230,000	12/31/08	225,000	225,000
01/01/09	245,000	12/31/09	210,000	210,000
01/01/10	245,000	12/31/10	205,000	205,000
01/01/11	245,000	12/31/11	205,000	205,000

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

$$\begin{aligned} \text{3 year average compensation} &= (220,000 + 220,000 + 225,000)/3 \\ &= 221,667 \end{aligned}$$

$$\begin{aligned} \text{Accrued benefit} &= 221,667 * 1\% * 35 \\ &= 77,583 \end{aligned}$$

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.

**Answer is C**



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### Problem 3 – Page 1

Similar to 2010 #22

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. You don’t have enough information to calculate the shortfall amortization installment in this problem, so you should ignore the minimum contribution.

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

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

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

$$\begin{aligned}\text{Cushion amount} &= 50\%(\text{FT}) + \Delta\text{FT due to pay increases} \\ &= .5(10,000,000) + (11,500,000 - 10,000,000) \\ &= 6,500,000\end{aligned}$$

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 2011 exam condition 42.

Target normal cost	435,000
+ Funding target	10,000,000
+ Cushion amount	6,500,000
Sub-total	16,935,000
Less unreduced AAV	16,500,000
Deductible limit	435,000

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### Problem 3 – 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	500,000
+ At-Risk Funding target	16,500,000
Sub-total	17,000,000
Less unreduced AAV	16,500,000
Deductible limit	500,000

The alternative definition produces a higher value for the deductible limit. The final deductible limit is 500,000.

**Answer is B**

#### **NOTE**

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

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### Problem 4 – Page 1

This is the first 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 carryover balance (CB) at the beginning of the year must be increased with interest based on the plan’s rate of return on assets.

#### **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:

$$\begin{aligned}\text{Funding S/F} &= \text{Funding target} - (\text{AAV} - \text{CB} - \text{PB}) \\ &= 100,000 - (94,000 - 5,500 - 0) \\ &= 11,500\end{aligned}$$

#### **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 similar to the previously calculated Funding shortfall:

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

#### **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:

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

This problem states there were no shortfall amortization bases prior to 2012.

$$\begin{aligned}\text{S/F Amort base} &= 1.0 * 100,000 - (94,000 - 5,500 - 0) - (\text{PV of PY Amortizations}) \\ &= 11,500 - \text{zero} \\ &= 11,500\end{aligned}$$

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### Problem 4 – Page 2

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

$$\begin{aligned}\text{S/F amort} &= 11,500 / 5.9982 \\ &= 1,917\end{aligned}$$

$$\begin{aligned}\text{S/F charge} &= 1,917 + \text{zero} \\ &= 1,917\end{aligned}$$

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

### Minimum Required Contribution

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

$$\begin{aligned}\text{MRC} &= \text{TNC} + \text{Shortfall amort charge} + \text{Waiver amort charge} \\ &= 8,000 + 1,917 + 0 \\ &= 9,917\end{aligned}$$

### Excess contribution

The problem asks for the maximum amount that can be added to the prefunding balance at 01/01/13. The problem states that the plan sponsor elects to offset 4,000 of the CB against the minimum contribution under IRC 430.

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 MRC. The present value is calculated using the effective rate of interest for the 2012 plan year:

$$\begin{aligned}\text{PV of contrib} &= 8,400*(1.0652)^{-3/12} + 10,000*(1.0652)^{-15/12} \\ &= 17,509\end{aligned}$$

$$\begin{aligned}\text{Excess contrib} &= 17,509 - (9,917 - 4,000 \text{ CB}) \\ &= 7,592 + 4,000\end{aligned}$$

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### Problem 4 – Page 3

If there was no CB used, then the 01/01/2013 PB equals 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 in this problem. The portion of the prefunding balance that is attributed to the sponsor's use of 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.

$$\begin{aligned} 01/2013 \text{ PB} &= 7,592*(1.0652) + 4,000(1.03) \\ &= 12,207 \end{aligned}$$

**Answer is C**

### NOTE

As expected, you get the wrong answer range if you only use the 2012 effective interest rate.

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### Problem 5

This is the first question on funding method changes under PPA 2006. This had not been tested in prior years, since all plans had a “free pass” to make changes for the 2011 and earlier plan years:

*“... any change in a plan’s funding method for the first plan year that begins on or after January 1, 2010, is treated as having been approved by the Commissioner and does not require the Commissioner’s specific prior approval.”*

For single employer plans, the rules in Revenue Procedure 2000-40 no longer apply. Under PPA 2006, the rules in IRC 412(d)(1) apply. In the final regulations under IRC 430, any change in funding method after the 2011 plan year requires approval from “the Commissioner”.

Each of the three items is a method change, and each one requires approval. All three of these items are false.

**Answer is A**

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### Problem 6

This is a simple question on the effect of not certifying the 2012 AFTAP. The 2011 AFTAP is certified at 11/01/2011 at 92.00%. Nothing is stated about any earlier value of the 2011 AFTAP, so the presumed AFTAP was less than 60% at 10/01/2011.

At 01/01/2012, the presumed AFTAP is equal to 92% (the same value as the 2011 certified AFTAP). At 04/01/2012, the presumed AFTAP is still equal to 92%. There is no reduction in the value at that date (the “10% haircut”), since it would not trigger any IRC 436 restrictions.

Since the 2012 AFTAP is not certified by 09/30/2012, the presumed AFTAP becomes less than 60% at 10/01/2012. But this is after the time period in the question.

The plan was not subject to any restrictions from 01/01/2012 to 09/30/2012. It was able to pay unrestricted lump sums for that time period.

**Answer is A**

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### Problem 7 – Page 1

The problem asks for the contribution equal to the "smallest amount" at 12/31/12. Based on 2011 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 2011 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:

$$\begin{aligned}\text{Funding S/F} &= \text{Funding target} - (\text{AAV} - \text{CB} - \text{PB}) \\ &= 93,900,000 - (95,700,000 - 1,685,000 - 0) \\ &= \text{zero}\end{aligned}$$

Since the funding shortfall is zero, no new shortfall base is established. In addition, all prior shortfall bases are considered fully amortized.

#### **Minimum Required Contribution**

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

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

$$\begin{aligned}01/2012 \text{ MRC} &= \text{TNC} + \text{Funding target} - (\text{AAV} - \text{CB} - \text{PB}) \\ &= 2,750,000 + 93,900,000 - (95,700,000 - 1,685,000 - 0) \\ &= 2,635,000\end{aligned}$$

#### **Smallest amount**

The problem asks for "the smallest amount that satisfies the minimum funding standard", as of 12/31/2012. The first step is to calculate this amount at the valuation date:

$$\begin{aligned}01/01/12 \\ \text{Smallest contr} &= \text{MRC} - \text{CB} - \text{PB} \\ &= 2,635,000 - 1,685,000 - 0 \\ &= 950,000\end{aligned}$$



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### Problem 7 – Page 2

Revised 07/31/13

The plan sponsor makes two contributions for 2012. 200,000 is paid at 07/01/2012, and the contribution of X is paid at 12/31/2012.

The discounted value of the contributions paid (using the 2012 effective interest rate of 6.0%) is equal to the “smallest amount” at 01/01/2012:

$$\begin{aligned}\text{PV of contrib} &= 200,000*(1.06)^{-6.0/12} + X*(1.06)^{-12/12} && \text{(using compound interest)} \\ &= 950,000\end{aligned}$$

$$\begin{aligned}X*(1.06)^{-1} &= 950,000 - 200,000*(1.06)^{-.5} \\ X &= 950,000*(1.06)^1 - 200,000*(1.06)^{.5} \\ &= 801,087\end{aligned}$$

**Answer is B**

### NOTE

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

$$\begin{aligned}\text{PV of contrib} &= 200,000/(1 + .06*(6/12)) + X/(1 + .06) && \text{(using simple interest)} \\ &= 950,000\end{aligned}$$

$$\begin{aligned}X &= 950,000*(1.06) - 200,000*(1.06)/[1 + .06*(6/12)] \\ &= 801,175\end{aligned}$$

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### Problem 8

**FALSE**

The plan sponsor can elect to add excess contributions to the prefunding balance up to the last payment date (09/15 of the following plan year).

See 1.430(f)-1(f)(2).

**Answer is B**

### **NOTE**

The problem was trying to trick you with respect to a different election under IRC 436. If you want to designate a contribution as a special “436 contribution” to escape a restriction under IRC 436, that election must be made on or before the last day of the plan year for which the contribution applies.

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### Problem 9

**FALSE**

In general, plans are not allowed to project increases in the current IRC 415 limit. If the plan is covered by the PBGC, it can project increases in the current IRC 401(a)(17) limit.

See IRC 404(o)(3).

**Answer is B**

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### Problem 10 – Page 1

This is the first question asked on the definition of the funding target (and normal cost) attributable to a flat death benefit. At 1.430(d)-1(c)(1)(ii)(D), it states that for a benefit not based on service, you use a simple pro-rata portion of the benefit to calculate the funding target.

The fraction is 
$$\frac{\text{Service on first day of the plan year}}{\text{Service at time of event where benefit becomes payable}}$$

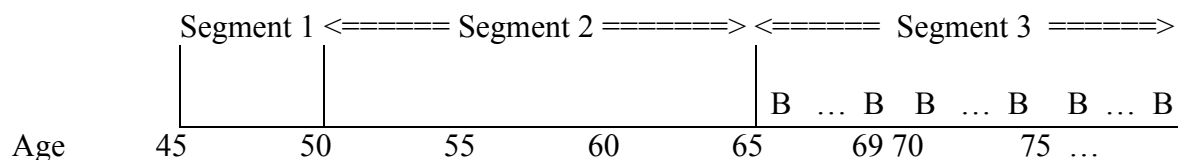
This essentially allocates the same fraction of benefit to all years of service (one divided by total service), which is then used to calculate the normal cost.

### Valuation calculations

You need to calculate the Funding target at 01/01/2012. The first step is to determine the “accrued benefit” at the valuation date:

Valuation date	01/01/2012
Age	45
Past service	21
Future service	20
	$(21/41)(5,000)$
Accrued benefit	$= 2,560.98$

The participant is currently 20 years from retirement, so their benefit payments will be valued using the third segment rate of 7%:



$$\begin{aligned} AL &= \text{PV of AB} = \text{Funding target} \\ &= 2,560.98(D_{65} / D_{45}) A_{65} \end{aligned}$$

Note that we are valuing a post-retirement death benefit. You need to know a little bit of EA-1 definitions for life contingencies to value the life insurance:

$$\begin{aligned} A_{65} &= M_{65} / D_{65} \\ &= 1 - d(\ddot{a}_{65}) \\ &= 1 - (iv)(N_{65} / D_{65}) \\ &= 1 - [.07/1.07][122,078/11,408] \\ &= .2999 \end{aligned}$$

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### Problem 10 – Page 2

$$\begin{aligned} \text{FT} &= \text{PV of AB} \\ &= 2,560.98(D_{65} / D_{45}) A_{65} \\ &= 2,560.98(11,408/46,958)(.2999) \\ &= 186.61 \end{aligned}$$

The funding target for the death benefit is 186.61.

**Answer is A**

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### Problem 11 – Page 1

The key point of this question is how you handle the two benefit increases due to the amendment at 01/01/2012. In general, the funding target and target normal cost are determined based on the plan benefits in effect during the plan year. As a result, you should ignore the increase in benefits that is scheduled to occur at 01/01/2013.

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

#### At 01/01/2012

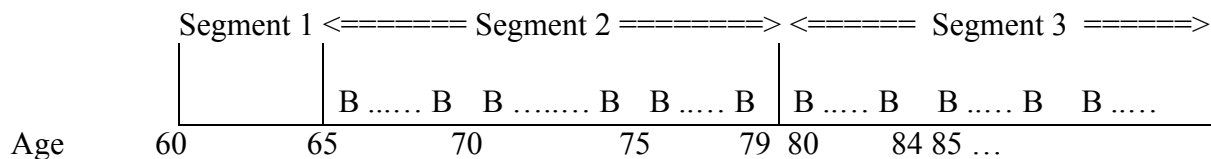
Age	60
Service	25 years

$$\begin{aligned}\text{Accrued benefit} &= 22(12)(25) \\ &= 6,600\end{aligned}$$

#### Funding Target

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

Based on the default exam conditions, normal retirement age is 65, and the benefit is assumed payable monthly, starting at normal retirement age. The participant is currently 5 years from retirement, so their benefit payments will be valued using the second and third segment rates.



The second segment covers benefit payments from age 65 up to age 79 (15 years). Since normal retirement age is 65, there are 15 years of benefit payments valued using the second segment rate. The third segment rate is used to value benefit payments at and after age 80.

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 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:

$$\text{Age 60 FT} = 6,600 * [ {}_{5|} \ddot{a}_{60:15|seg_2}^{(12)} + {}_{20|} \ddot{a}_{60seg_3}^{(12)} ]$$

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### Problem 11 – Page 2

#### Funding Target – 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 after age 65:

$$\text{Age 60 FT} = 6,600 * [ {}_{5|} \ddot{a}_{60:\overline{15}| \text{seg}_2}^{(12)} + {}_{20|} \ddot{a}_{60 \text{ seg}_3}^{(12)} ]$$

$${}_{5|} \ddot{a}_{60:\overline{15}| \text{seg}_2}^{(12)} = (v^5 {}_5p_{60}) \ddot{a}_{65:\overline{15}| \text{seg}_2}^{(12)} \quad \text{all at segment 2 rate}$$

$$= (N_{65}^{(12)} - N_{80}^{(12)}) / D_{60} \quad \text{all at segment 2 rate}$$

$${}_{20|} \ddot{a}_{60 \text{ seg}_3}^{(12)} = (v^{20} {}_{20}p_{60}) \ddot{a}_{80 \text{ seg}_3}^{(12)} \quad \text{all at segment 3 rate}$$

$$= (N_{80}^{(12)} / D_{60}) \quad \text{all at segment 3 rate}$$

$$\begin{aligned} \text{Age 60 FT} &= 6,600 \left[ \frac{(232,565 - 41,453)}{29,032} + \frac{(18,666)}{16,527} \right] \\ &= 6,600 [6.5828 + 1.1294] \\ &= 50,901 \end{aligned}$$

$$\begin{aligned} \text{Normal cost} &= \text{Funding target} * (\Delta AB / AB) \\ &= 50,901 (12)(22) / 6,600 \\ &= 2,036 \end{aligned}$$

The sum of the funding target and the target normal cost is 52,937.

**Answer is B**

#### **NOTE**

The calculations for the funding target and target normal cost are simplified because the pre-retirement mortality and post-retirement mortality are the same. Things get complicated when there are no pre-retirement mortality decrements.

## Fall 2011 EA-2A Exam Solutions

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### Problem 12

This is a basic question on your understanding of calculations using 417(e) segment interest rates. In this problem, you need to calculate the lump sum distribution.

In general, you must do two lump sum calculations. One uses the plan assumptions, and the other uses the mandated assumptions in 417(e)(3). The final lump sum can't be less than the value under the mandated assumptions. In this problem, the plan basis for lump sum calculations is the same as the 417(e)(3) applicable interest rate, so there is only one calculation.

**At 01/01/2012**

Age	40
Service	13 years

$$\begin{aligned}\text{Accrued benefit} &= 200(12)(13) \\ &= 31,200\end{aligned}$$

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 25 years from normal retirement age, so their benefit payments will be valued using the third segment rate.

$$\begin{aligned}\text{Plan Lump sum} &= 31,200(v^{25} {}_{25}p_{40}) \ddot{a}_{65}^{(12)} && \text{at segment rate 3} \\ &= 31,200(1.07)^{-25}(1.0)(N_{65}^{(12)}/D_{65}) \\ &= 31,200(1.07)^{-25}(116,222/11,387) \\ &= 58,673\end{aligned}$$

The plan actuarial equivalence basis has no pre-retirement mortality. The final lump sum is the greater of the plan lump sum and the 417(e) lump sum. As described earlier, the plan lump sum is defined using the same assumptions as the 417(e) lump sum.

The final lump sum is 58,673.

**Answer is B**



## Fall 2011 EA-2A Exam Solutions

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### Problem 13

FALSE

In order for a plan to be in at-risk status, you must have more than 500 participants on at least one day of the prior plan year. This participant count is determined by using all plans in the controlled group.

But there is a minor trick to this question. It is impossible for multiemployer plans to be in at-risk status. As a result, the participant count for multiemployer plans is ignored.

Since the participant count for the single employer plan is less than 501, this plan can not be in at-risk status.

**Answer is B**

### NOTE

In addition, for this plan to be in at-risk status for 2012, two conditions must be satisfied:

- The 2011 funding target attainment percentage (FTAP) must be less than 80%, and
- The 2011 FTAP determined using the 430(i)(1)(B) assumptions must be less than 70%

Based on the data given in the problem, both of these conditions are met.

## Fall 2011 EA-2A Exam Solutions

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### Problem 14

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. In the absence of any specific data in the problem, you should assume the T-H averaging period is five years.

This problem is simplified, since it gives you the participants' five year average earnings, as well as the accrued benefit under the plan. It also gives you the number of years of T-H service for each participant.

	Smith	Jones	Brown
Service at 12/31/11	16	14	6
T-H service	13	11	4
5 year average comp	225,000	185,000	110,000
Plan accrued benefit	42,000	35,000	11,000
Key employee?	YES	NO	NO
T-H minimum	N/A N/A	$2.0\% \times (10)(185,000)$ $= 37,000$	$2.0\% \times (4)(110,000)$ $= 8,800$
Final accrued benefit	42,000	37,000	11,000

The total accrued benefit for all three participants is  $90,000 = 42,000 + 37,000 + 11,000$ .

**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. And the problem asks for “the minimum top-heavy benefits required by law”.

## Fall 2011 EA-2A Exam Solutions

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### Problem 15 – Page 1

The key to this problem is the determination of the Funding target (and target normal cost) under IRC Section 430(i). This plan has a funding standard carryover balance (CB) of zero and a prefunding balance (PB) of 200,000 at 01/01/2012.

#### **At-Risk Determination**

The problem gives you 2012 valuation data related to the At-Risk values for both the Funding target and the target normal cost. The problem gives you the information required to determine if the plan was in At-Risk status for 2012. One part of the definition is that a plan must have at least 501 participants for one day of the prior plan year. The problem states that the plan has always had at least 501 participants.

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

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

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

The problem states that the 2011 FTAP (on a non-At-Risk basis) is 69.0%. You can safely assume that the 2011 FTAP (using 430(i)(1)(B) assumptions) is less than or equal to 69.0%. The result is that this plan is in At-Risk status for 2012.

#### **At-Risk plan - Load factors**

For plans in At-Risk status for at least 2 of the 4 preceding plan years, a loading factor of 4% of the Funding target (and target normal cost) is applied. The load is based on the value ignoring the 430(i) rules.

Based on 2011 exam condition 42, the plan has never been in At-Risk status for any prior year. The plan is in At-Risk status only for 2011 - for one consecutive year. As a result, there are no load factors applied.

#### **At-Risk plan - Weighting factors**

2011 exam condition 43 defines terms related to At-Risk plans:

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

## Fall 2011 EA-2A Exam Solutions

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### Problem 15 – Page 2

#### **At-Risk plan - Weighting factors - continued**

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

Consecutive years plan has been in at-risk status	Percent of item based on 430(i) rules	Percent of item ignoring 430(i) rules
1	20%	80%
2	40%	60%
3	60%	40%
4	80%	20%
5	100%	zero

The “Final” At-Risk value will equal the sum of 20% times the At-Risk value (including any load factors) and (1-20%) times the non-At-Risk value:

$$\begin{aligned}\text{A-R Funding Target} &= 80\%*(10,000,000) + 20\%*(12,000,000) \\ &= 10,400,000\end{aligned}$$

$$\begin{aligned}\text{A-R target NC} &= 80\%*(1,000,000) + 20\%*(1,200,000) \\ &= 1,040,000\end{aligned}$$

The remainder of this problem is a typical IRC 430 calculation of the “smallest amount”.

#### **Funding Shortfall**

The problem asks for the "smallest amount" at 01/01/2012. Based on 2011 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 exam condition 31, the "smallest amount" reflects offsetting both the CB and the PB against the minimum contribution.

There is one thing you need to be careful of. The problem gives you the value of the 2011 FTAP (on a non-At-Risk basis) as 69.0%. Since this is less than 80%, the plan sponsor can not elect to use the PB to satisfy the 2012 minimum.

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:

$$\begin{aligned}\text{Funding S/F} &= \text{Funding target} - (\text{AAV} - \text{CB} - \text{PB}) \\ &= 10,400,000 - (7,900,000 - 0 - 200,000) \\ &= 2,700,000\end{aligned}$$

## Fall 2011 EA-2A Exam Solutions

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### Problem 15 – Page 3

#### **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 almost identical to the previously calculated Funding shortfall:

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

Note that the modified funding S/F does not offset the PB. This is because the plan sponsor can not elect to use the PB to satisfy the 2012 minimum.

#### **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:

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

This problem gives you the 2011 shortfall amortization installment as 75,000. It also gives you the 6-year amortization factor, so you can calculate the new shortfall base:

$$\begin{aligned}\text{S/F Amort base} &= 1.0 * 10,400,000 - (7,900,000 - 0 - 200,000) - (\text{PV of PY Amortizations}) \\ &= 2,700,000 - 75,000(5.2932) \\ &= 2,303,010\end{aligned}$$

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

$$\begin{aligned}\text{S/F amort} &= 2,303,010 / 5.9982 \\ &= 383,950\end{aligned}$$

$$\begin{aligned}\text{S/F charge} &= 383,950 + 75,000 \\ &= 458,950\end{aligned}$$

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.

## Fall 2011 EA-2A Exam Solutions

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### Problem 15 – Page 4

#### **Minimum Required Contribution**

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

$$\begin{aligned}\text{MRC} &= \text{TNC} + \text{Shortfall amort charge} + \text{Waiver amort charge} \\ &= 1,040,000 + 458,950 + 0 \\ &= 1,498,950\end{aligned}$$

#### **Smallest amount**

The problem asks for “the smallest amount that satisfies the minimum funding standard”. As described earlier, this has the same value as the MRC. This is because the plan sponsor can not elect to use the PB to satisfy the 2012 minimum.

$$\begin{aligned}\text{Smallest contr} &= \text{MRC} - \text{CB} - \text{PB} \\ &= 1,498,950 - \text{zero}\end{aligned}$$

**Answer is C**

## Fall 2011 EA-2A Exam Solutions

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### Problem 16 – Page 1

Revised 10/10/13

The problem asks for the "smallest amount" at 12/31/2012. Based on exam condition 31, the "smallest amount" reflects offsetting the standard account credit balance (CB) against the minimum contribution.

#### 2012 Balance equation

The hidden trick in this question is that you need to set up a gain / loss base for 2011. You must use the balance equation to determine the amount of the base.

Another point of the problem is that there are no bases set up for the plan amendment at 01/01/2012. The reason is that the cost method is Unit Credit, and the plan amendment does not change the accrued benefit at 01/01/2012. The Unit Credit accrued liability at 01/01/2012 is not affected by the plan amendment.

$$\begin{aligned} 01/01/12 \\ \$25 \text{ UAL} &= \text{AL} - \text{AAV} \\ &= 7,500,000 + 7,500,000 - 12,000,000 \\ &= 3,000,000 \end{aligned}$$

$$\$25 \text{ UAL} = \text{O/S 431 bases} - \text{CB} - \text{ARA}$$

The problem gives you the values of the prior years' amortization payments. You can use those to calculate the outstanding bases from prior years, and the new G/L base at 01/01/2012:

$$\begin{aligned} \text{O/S 431 bases} &= 150,000 * (\ddot{a}_{\overline{13}|.07}) + 125,000 * (\ddot{a}_{\overline{14}|.07}) + \text{LOSS} \\ \$25 \text{ UAL} &= 150,000 * (\ddot{a}_{\overline{13}|.07}) + 125,000 * (\ddot{a}_{\overline{14}|.07}) + \text{LOSS} - 500,000 - 0 \\ 3,000,000 &= 2,011,109 + \text{LOSS} \\ 2011 \text{ LOSS} &= 988,891 \end{aligned}$$

#### 2012 valuation

You only need to do a few calculations to set up the MFSA for 2012. The normal cost given in the problem is based on the old \$25 benefit accrual. You need to increase it to reflect the new \$30 benefit accrual for active employees.

$$\begin{aligned} \text{Normal cost} &= 500,000(30/25) \\ &= 600,000 \\ \text{Loss amort} &= 988,891 / \ddot{a}_{\overline{15}|.07} \\ &= 101,472 \end{aligned}$$

## Fall 2011 EA-2A Exam Solutions

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### Problem 16 – Page 2

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

2012 Minimum Funding Standard Account			
Charges		Credits	
Normal Cost	600,000	Credit Balance	500,000
2010 amortization	150,000		
2011 amortization	125,000		
Loss amortization	101,472	12/31 minimum	x
7% interest	68,353	7% interest	35,000
Total charges	<u>1,044,825</u>	Total credits	<u>x + 535,000</u>

The “smallest amount” at 12/31/12 is  $509,825 = 1,044,825 - 535,000$ . This includes interest to 12/31, and reflects offsetting the credit balance against the minimum contribution.

**Answer is C**

#### NOTE

This seems a bit easier than most 5 point questions on prior EA-2A exams.



## Fall 2011 EA-2A Exam Solutions

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### Problem 17 – Page 1

Similar to 2009 #16

The key to this problem is recognizing that you need to set up the 2012 assumption change base, and its amortization payment. You also need to calculate the amortization payments for the 2012 Loss base and the 2011 Initial Accrued Liability base.

#### 2012 Assumption change base

01-2012

$$\begin{aligned} 6\% \text{ UAL}_1 &= \text{AL} - \text{AAV} \\ &= 1,800,000 - 400,000 \\ &= 1,400,000 \end{aligned}$$

You need to derive the value of the 01/01/2012 UAL under the old 7% interest assumptions. The difference in the UAL values is the amount of the 2012 assumption change base.

01-2012

$$\begin{aligned} 7\% {}_e\text{UAL}_1 &= (1+i)(\text{UAL}_0 + \text{NC}_0) - (\text{contribution} + i) \\ &= 1.07*(1,000,000 + 200,000) - 400,000 \\ &= 884,000 \end{aligned}$$

$$01-2012 \text{ loss} = 200,000 \quad (\text{given})$$

$$\begin{aligned} 7\% \text{ UAL}_1 &= 200,000 + 884,000 \\ &= 1,084,000 \end{aligned}$$

$$\begin{aligned} \text{Assump base} &= 1,400,000 - 1,084,000 \\ &= 316,000 \end{aligned}$$

#### 2012 CB calculation

This problem asks for “the smallest amount”. Based on 2011 exam condition 31, this amount reflects offsetting the funding standard account credit balance (CB).

The problem does not give you the value of the CB at 01/01/2012. You need to use the actuarial equation of balance to solve for the CB. Then you can complete the minimum funding standard account (MFSA).

$$01/01/12 \text{ UAL} = \text{O/S 431 bases} - \text{CB} - \text{ARA}$$

The plan effective date is 01/01/2011, so there are 14 years left in the MFSA amortization base for the Initial accrued liability.

$$\begin{aligned} \text{O/S 7\% IAL base} &= 1,000,000 * ( \ddot{a}_{\overline{14}|.07} / \ddot{a}_{\overline{15}|.07} ) \\ &= 960,205 \end{aligned}$$

## Fall 2011 EA-2A Exam Solutions

### Problem 17 – Page 2

#### 2012 CB calculation - continued

$$\begin{aligned} 6\% \text{ UAL}_1 &= \text{AL} - \text{AAV} \\ &= 1,400,000 \end{aligned}$$

$$\begin{aligned} 01/01/12 \text{ UAL} &= \text{O/S 431 bases} - \text{CB} - \text{ARA} \\ 1,400,000 &= (960,205 + 200,000 + 316,000) - \text{CB} - \text{zero} \\ &\quad \text{IAL} \quad \text{LOSS} \quad \text{ASSM} \end{aligned}$$

$$\begin{aligned} \text{CB} &= 1,476,205 - 1,400,000 \\ &= 76,205 \end{aligned}$$

#### 2012 MFSA amortizations

Now you need to recalculate the IAL amortization payment at the new 6% interest rate, and also determine the amortizations for the new Assumption change and Loss bases:

Base Description	Remaining Years 01/01/12	Outstanding 7.0% base	New 6.0% amortization
1-1-2011 IAL base	14	960,205	$960,205 / \ddot{a}_{14 .06} = 97,456$
1-1-2012 Loss base	15	200,000	$200,000 / \ddot{a}_{15 .06} = 19,427$
1-1-2012 Assump base	15	316,000	$316,000 / \ddot{a}_{15 .06} = 30,695$

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

#### **2012 Minimum Funding Standard Account**

Charges		Credits	
Normal Cost	250,000	Credit Balance	76,205
IAL amortization	97,456		
Loss amortization	19,427		
Assump amortization	30,695	12/31 minimum	x
6% interest	23,855	6% interest	4,572
Total charges	421,433	Total credits	x + 80,777

The “smallest amount” at 12/31/12 is  $340,656 = 421,433 - 80,777$ . This includes interest to 12/31, and reflects offsetting the credit balance against the minimum contribution.

**Answer is C**

## Fall 2011 EA-2A Exam Solutions

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### Problem 18 – Page 1

The key to this problem is knowing the funding relief rules under IRC 430(c)(5). You need to do IRC 430 minimum funding calculations for both 2011 and 2012. This plan has a funding standard carryover balance (CB) of zero and a prefunding balance (PB) of 10,000 at 01/01/2011.

The problem asks for the "smallest amount" at 01/01/12. Based on 2011 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 2011 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:

$$\begin{aligned}\text{Funding S/F} &= \text{Funding target} - (\text{AAV} - \text{CB} - \text{PB}) \\ &= 140,000 - (130,000 - 0 - 10,000) \\ &= 20,000\end{aligned}$$

### **2011 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:

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

### **2011 Shortfall amortization installment**

The plan is not eligible for the shortfall base exemption. You have to set up the 2011 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 states there were no shortfall amortization installments prior to 2011.

$$\begin{aligned}\text{S/F Amort base} &= 1.0 * 140,000 - (130,000 - 0 - 10,000) - (\text{PV of PY Amortizations}) \\ &= 20,000\end{aligned}$$

## Fall 2011 EA-2A Exam Solutions

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### Problem 18 – Page 2

You must calculate the shortfall amortization installment for 2011. You are given both the 7-year and the 15-year annuity factors. The problem states that the sponsor elected to use the 15-year amortization for the 2011 shortfall base:

$$10.7931 = \ddot{a}_{\overline{5}|j} + (\ddot{a}_{\overline{15}|k} - \ddot{a}_{\overline{5}|k})$$

$$\begin{aligned} \text{S/F amort} &= 20,000 / 10.7931 \\ &= 1,853 \end{aligned}$$

### 2011 Minimum Required Contribution

You don't need to do any additional calculations for 2011. The problem states that the 01/01/2012 PB is zero. Apparently the plan sponsor paid the "smallest amount" for 2011 - or they elected to reduce the PB to zero.

### 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:

$$\begin{aligned} \text{Funding S/F} &= \text{Funding target} - (\text{AAV} - \text{CB} - \text{PB}) \\ &= 155,000 - (130,000 - 0 - 0) \\ &= 25,000 \end{aligned}$$

### 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:

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

## Fall 2011 EA-2A Exam Solutions

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### Problem 18 – Page 3

This problem gives you the 14-year amortization factor, so you can calculate the new shortfall base:

$$\begin{aligned}\text{S/F Amort base} &= 1.0 \times 155,000 - (130,000 - 0 - 0) - (\text{PV of PY Amortizations}) \\ &= 25,000 - 1,853(10.4775) \\ &= 5,585\end{aligned}$$

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

$$\begin{aligned}\text{S/F amort} &= 5,585 / 6.1596 \\ &= 907\end{aligned}$$

$$\begin{aligned}\text{S/F charge} &= 907 + 1,853 \\ &= 2,760\end{aligned}$$

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.

### **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.

$$\begin{aligned}\text{MRC} &= \text{TNC} + \text{Shortfall amort charge} + \text{Waiver amort charge} \\ &= 7,000 + 2,760 + 0 \\ &= 9,760\end{aligned}$$

### **2012 Smallest amount**

The problem asks for “the smallest amount that satisfies the minimum funding standard”. Since both the CB and the PB are equal to zero, this has the same value as the MRC.

$$\begin{aligned}\text{Smallest contr} &= \text{MRC} - \text{CB} - \text{PB} \\ &= 9,760 - \text{zero}\end{aligned}$$

**Answer is C**

## Fall 2011 EA-2A Exam Solutions

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### Problem 19 – Page 1

At first, I thought this problem was a question on calculating the 415 limits - but it is really about the handling of the 401(a)(17) limit. The key point of this question is how you handle the change in assumptions for the 2012 plan year.

#### At 01/01/2012

Age	45
Service	3 years

#### OLD Assumption - no pay increase

The problem states that the pay increase assumption changes in 2012. The problem gives you the target normal cost calculated under the old assumptions, which allow for no pay increases.

Under those assumptions, the 401(a)(17) limit does not impact the participant's benefit calculation. Note that this problem was created prior to the release of the actual 2012 limits. That is why the problem tells you to use a value of 245,000 for the 401(a)(17) limit for 2012:

Year	2009	2010	2011	2012
Pay	240,000	240,000	240,000	240,000
401(a)(17) limit	245,000	245,000	245,000	245,000
Limited pay	240,000	240,000	240,000	240,000

The first step is to calculate the target normal cost. You need to determine the accrued benefit at the valuation date, and the benefit accrual during 2012. If the assumptions allowed for a salary increase during the year, you would need to allow for the salary increase during 2012:

Valuation date	01/01/2012	01/01/2013
Age	45	46
Past service	3	4
Prior FAE3	240,000	240,000
	5.0%(3)(240,000)	5.0%(4)(240,000)
Accrued benefit	= 36,000	= 48,000

$$\Delta AB = 12,000$$

You should think about the 415 limits, since this is a large benefit accrual. You can't determine the 415 dollar limit, since the problem does not give you the effective date for the plan. It should be clear that the 415 compensation limit does not apply, since it accrues at the rate of 10% per year of participation service. It will be twice as large as the plan accrued benefit at both dates.

## Fall 2011 EA-2A Exam Solutions

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### Problem 19 – Page 2

#### **NEW Assumption - 10% pay increase**

The problem states that the pay increase assumption changes in 2012. Under the new assumptions, the 401(a)(17) limit does impact the participant's benefit calculation:

Year	2009	2010	2011	2012
Pay	240,000	240,000	240,000	1.10*240,000 = 264,000
401(a)(17) limit	245,000	245,000	245,000	245,000
Limited pay	240,000	240,000	240,000	245,000

Now you need to calculate the target normal cost. You need to determine the accrued benefit at the valuation date, and the benefit accrual during 2012. You need to allow for the salary increase during 2012. At 01/01/2013, the 3 year average pay is  $241,667 = (240,000 + 240,000 + 245,000)/3$ .

Valuation date	01/01/2012	01/01/2013
Age	45	46
Past service	3	4
Prior FAE3	240,000	241,667
	5.0%(3)(240,000)	5.0%(4)(241,667)
Accrued benefit	= 36,000	= 48,333

$$\Delta AB = 12,333$$

The target normal cost given in the problem is based on the old assumptions. You can use the ratio of the 2012 benefit accruals to determine the new value:

$$\begin{aligned}\text{Normal cost} &= 36,240 * (12,333 / 12,000) \\ &= 37,247\end{aligned}$$

#### **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 prefunding balance (PB) and the carryover balance (CB). The problem states that both the CB and the PB are equal to zero at 01/01/2012.

Note that the value given for the 01/01/12 funding target does not change under the new assumptions. The reason is that the accrued benefit at 01/01/2012 does not change.

$$\begin{aligned}\text{Funding S/F} &= \text{Funding target} - (\text{AAV} - \text{CB} - \text{PB}) \\ &= 108,720 - (108,720 - 0 - 0) \\ &= 0\end{aligned}$$

Since the 2012 Funding shortfall is zero, all prior shortfall bases were eliminated.

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### Problem 19 – Page 3

#### Minimum Required Contribution

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

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

$$\begin{aligned} 01/2012 \text{ MRC} &= \text{TNC} + \text{Funding target} - (\text{AAV} - \text{CB} - \text{PB}) \\ &= 37,247 + 108,720 - (108,720 - 0 - 0) \\ &= 37,247 \end{aligned}$$

**Answer is C**



## Fall 2011 EA-2A Exam Solutions

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### Problem 20

Similar to 2010 #17
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Smith is highly paid, with compensation near the 401(a)(17) limit. The key point of the question is how the 401(a)(17) limit applies to Smith's pay. The plan document defines the benefit using the highest consecutive 3-year average plan years of pay. The problem asks for Smith's final average pay at 07/01/2012.

You need to figure out how to apply the calendar year 401(a)(17) limits to the pay values for each plan year. The general rule is that the 401(a)(17) limit for a calendar year applies to the plan year that begins in that calendar year.

The problem states that compensation is paid uniformly throughout the year. You need to construct the plan year compensation based on the calendar year pay value given. One minor trick is in the calculation of pay for the final plan year. The problem only gives six months of pay for 2012, so you do not multiply that value by  $\frac{1}{2}$ .

Plan year starts	Applicable 401(a)(17) limit	Plan year compensation	Limited pay
07/01/07	225,000	$232,500 = \frac{1}{2}(245,000+220,000)$	225,000
07/01/08	230,000	$185,000 = \frac{1}{2}(220,000+150,000)$	185,000
07/01/09	245,000	$225,000 = \frac{1}{2}(150,000+300,000)$	225,000
07/01/10	245,000	$195,000 = \frac{1}{2}(300,000+90,000)$	195,000
07/01/11	245,000	$218,000 = \frac{1}{2}(90,000)+173,000$	218,000

You need to check two different values. The average pay based on the first three plan years is 211,667. The average pay based on the last three plan years is 212,667.

**Answer is C**

### NOTES

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

## Fall 2011 EA-2A Exam Solutions

### Problem 21

Revised 10/10/13

The key to this problem is knowing that the amortization period is 15 years for all the minimum funding standard account bases. You actually do NOT need to calculate the outstanding base amounts at 01/01/2012.

Amortization base	Original base	Amortization payment
1-1-2008 Initial AL	2,000,000	$194,269 = 2,000,000 / \ddot{a}_{15 .06}$
1-1-2009 Loss base	150,000	$14,570 = 150,000 / \ddot{a}_{15 .06}$
1-1-2010 Loss / Plan chg base	1,000,000	$97,135 = 1,000,000 / \ddot{a}_{15 .06}$
1-1-2011 Loss base	600,000	$58,281 = 600,000 / \ddot{a}_{15 .06}$
1-1-2012 Gain base	-789,312	$-76,670 = -789,312 / \ddot{a}_{15 .06}$

Now you can set up the MFSA and calculate the 01/01/12 “smallest amount”:

2012 Minimum Funding Standard Account			
Charges		Credits	
Normal Cost	2,000,000	Credit Balance	0
01/2008 IAL amortization	194,269		
01/2009 Loss amortization	14,570		
01/2010 “Loss” amortization	97,135	Gain amortization	76,670
01/2011 Loss amortization	58,281	12/31 minimum	x
6% interest	N/A	6% interest	N/A
Total charges	2,364,255	Total credits	x + 76,670

“The smallest amount that satisfies the minimum funding standard” is equal to the excess of the MFSA charges over the credits at 01/01/2012. This reflects offsetting the credit balance against the minimum contribution.

$$\begin{aligned}
 X &= 2,364,255 - 76,670 \\
 &= 2,287,586
 \end{aligned}$$

**Answer is B**

### NOTE

If you take the time to calculate the O/S 431 bases, you can verify that the equation of balance is satisfied. But this calculation takes valuable time, and there is no reason to do this. Based on the exam conditions, you can safely assume that the accumulated reconciliation account is zero - and that is the only item not given in the problem’s data.

## Fall 2011 EA-2A Exam Solutions

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### Problem 22 – Page 1

Similar to 2010 #46
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Revised 07/25/15

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 is equal to the average market value, but it 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 for 2011. The problem states that the actuary's assumed annual rate of return on assets is 8.50%. 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 7.50%.

Based on the 7.50% assumed return, you can calculate the expected return on assets for 2011. The calculation must allow for the timing of the cash flows during the year. You are told that all the cash flows (except for the 01/01 contribution) occur at mid-year:

<b>Expected return calculation</b>	<b>7.50%</b>
Plan year	<b>2011</b>
Beginning of year values	
Market value at 1-1	34,000,000
Contribution paid 01/01/11	500,000
Middle of year values	
Benefit pmt + expenses	(2,200,000)
Expected return (compound)	2,506,491

## Fall 2011 EA-2A Exam Solutions

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### Problem 22 – Page 2

Revised 07/25/15

Now you can calculate the cash flow adjustment for 2011. This is the sum of the cash flows and the expected return. The asset values at 01/01/11 exclude both of the contributions paid for the 2011 plan year.

#### Adjustment for year

Year	2011
Trust assets at 1-1	34,000,000
Market value at 1-1	34,000,000
Receivable contribution paid 09/01/12	958,886
Benefit payments	(2,000,000)
Expenses	(200,000)
Contribution paid 01/01/11	500,000
Expected return (compound)	<u>2,506,491</u>
Adjustment for year	1,765,377

The 2012 market value excluding receivables was given in the problem as 44,000,000. You must include the discounted value of the 2011 receivable contribution, using the 2011 effective interest rate of 6.5%. The total market value is  $44,958,886 = 44,000,000 + 958,886$ .

Now you can calculate the adjusted market values. 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 01/01/2012:

#### Average market value calculation

Year	2011	2012
Market value at 1-1	34,000,000	44,958,886
Adjustment for 2011	<u>1,765,377</u>	
Adjusted fair market value	35,765,377	44,958,886

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

$$40,362,132 = (35,765,377 + 44,958,886) / 2.$$

This preliminary actuarial asset value of 40,362,132 must be compared to the corridors. The final AAV is equal to the average market value, but it must be limited to be within 10% of the market value.

The bottom of the corridor is 90% of market value, or 40,462,997. The top of the corridor is 110% of market value, or 49,454,774. The final actuarial value of assets is 40,462,997.

**Answer is D**

#### 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  $1/2$ :

$$01/2012 \text{ AAV} = 01/2012 \text{ MVA} - 1/2(2011 \text{ G/L})$$

You need to calculate the value of the G/L for 2011. 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:

$$\begin{aligned} 01/2012 \text{ } e\text{MVA} &= 01/2011 \text{ MVA} + \text{adjustment for 2011} \\ 35,765,377 &= 34,000,000 + 1,765,377 \end{aligned}$$

$$\begin{aligned} 2011 \text{ G/L} &= 01/2012 \text{ MVA} - 01/2012 \text{ } e\text{MVA} \\ &= 44,958,886 - 35,765,377 \\ &= 9,193,509 \quad (\text{Gain}) \end{aligned}$$

$$\begin{aligned} 01/2012 \text{ AAV} &= 01/2012 \text{ MVA} - 1/2(2011 \text{ G/L}) \\ &= 44,958,886 - (1/2)(9,193,509) \\ &= 40,362,132 \end{aligned}$$

This preliminary actuarial asset value of 40,362,132 must be compared to the corridors. The bottom of the corridor is 90% of market value, or 40,462,997. The final actuarial value of assets is 40,462,997.

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

## Fall 2011 EA-2A Exam Solutions

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### Problem 23 – Page 1

Similar to 2010 #31

This is the fourth question asked on 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 01/01/12. Based on 2011 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 2011 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:

$$\begin{aligned}\text{Funding S/F} &= \text{Funding target} - (\text{AAV} - \text{CB} - \text{PB}) \\ &= 36,000,000 - (36,000,000 - 0 - 0) \\ &= \text{zero}\end{aligned}$$

Since the funding shortfall is zero, no new shortfall base is established. In addition, all prior shortfall bases are considered fully amortized.

### **Minimum Required Contribution**

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

Since the funding shortfall is zero, 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):

$$01/2012 \text{ MRC} = \text{TNC} + \text{Funding target} - (\text{AAV} - \text{CB} - \text{PB})$$

### **Target normal cost**

The problem states that there are 125,000 of expected plan-related expenses for 2012. In addition, the plan has mandatory employee contributions of 2% of compensation. The expected employee contributions for the year are  $400,000 = 2\%(20,000,000)$ .

$$\begin{aligned}01/2012 \text{ TNC} &= 2,000,000 + 125,000 \text{ expenses} - 400,000 \text{ employee contributions} \\ &= 1,725,000\end{aligned}$$

$$\begin{aligned}01/2012 \text{ MRC} &= \text{TNC} + \text{Funding target} - (\text{AAV} - \text{CB} - \text{PB}) \\ &= 1,725,000 + 36,000,000 - (36,000,000 - 0 - 0) \\ &= 1,725,000\end{aligned}$$

## Fall 2011 EA-2A Exam Solutions

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### Problem 23 – Page 2

#### Smallest amount

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

$$\begin{aligned}\text{Smallest contr} &= \text{MRC} - \text{CB} - \text{PB} \\ &= 1,725,000 - 0 - 0 \\ &= 1,725,000\end{aligned}$$

**Answer is B**

#### **NOTE**

In a typical valuation calculation, the employee contributions would be interest adjusted based on expected payment dates during the year. But this problem does not give enough information to “fine tune” the adjustment for expected employee contributions.

## Fall 2011 EA-2A Exam Solutions

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### Problem 24

This is a fairly simple problem on the Form 5500 filing requirements and plan terminations.

#### I. TRUE

In general, as long as a plan has assets, it must file the annual return (Form 5500). As described in Section 1 of the Form 5500 instructions, most pension plans must file:

*“All pension benefit plans covered by ERISA must file an annual return/report except as provided in this section. The return / report must be filed whether or not the plan is “tax-qualified,” benefits no longer accrue, contributions were not made this plan year, or contributions are no longer made. Pension benefit plans required to file include both defined benefit plans and defined contribution plans.”*

Then Section 1 of the instructions includes a list of pension benefit plans that must file, followed by a list of pension benefit plans that should not file the Form 5500.

#### II. FALSE

Even though a plan is terminated, it still must file Form 5500 and the Schedule B for the final year. This is described in Section 3 of the Form 5500 instructions as the Final Return / Report:

*“If all assets under the plan (including insurance/annuity contracts) have been distributed to the participants and beneficiaries or legally transferred to the control of another plan, and when all liabilities for which benefits may be paid under a welfare benefit plan have been satisfied, check the final return/report box in Part I, line B at the top of the Form 5500. If a trustee is appointed for a terminated defined benefit plan pursuant to ERISA section 4042, the last plan year for which a return/report must be filed is the year in which the trustee is appointed.”*

#### III. TRUE

This makes sense. If a plan termination does not occur, then the plan still has assets. As described in item I, then you are required to file the Form 5500 (as well as the Schedule SB).

Only items I and III are true.

**Answer is C**



## Fall 2011 EA-2A Exam Solutions

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### Problem 25

Similar to 2010 #9

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 need to calculate the AFTAP at 01/01/2012 to see if it satisfies IRC 436(d):

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

$$\begin{aligned}\text{AFTAP} &= \frac{0 + 3,079,450 - 80,000 - 150,000}{0 + 3,850,000} \\ &= 74.0\%\end{aligned}$$

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).

Set up a quick calculation to see if eliminating both balances would get the AFTAP to 80%:

$$\begin{aligned}\text{AFTAP} &= \frac{3,079,450 - X}{3,850,000} \\ &= 80.0\%\end{aligned}$$

$$\begin{aligned}X &= 3,079,450 - 80\%(3,850,000) \\ &= -550\end{aligned}$$

The negative result means that you can not get the AFTAP to 80%, even if you eliminate both balances. Under IRC 430(f)(3), there is no deemed reduction, so the value of X is zero.

**Answer is A**

## Fall 2011 EA-2A Exam Solutions

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### Problem 26 – Page 1

Revised 08/22/13

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

### 01/01/12 valuation calculations

The plan benefit is based on the final 5-year average pay. The normal retirement age is 65 by default. You have decrements at both age 62 and 65, so you need to project pay to those ages.

01/2012 Age	41
Past service	4
2011 pay (age 40)	44,000

$$\begin{aligned}\text{Projected pay @ 64} &= 44,000 * (1.025)^{24} \\ &= 79,584\end{aligned}$$

$$\begin{aligned}\text{Final average pay @ 65} &= 79,584 * (\ddot{a}_{\overline{5}|2.5\%} / 5) \\ &= 75,795\end{aligned}$$

$$\begin{aligned}\text{Final average pay @ 62} &= 75,795 * (1.025)^{-3} \\ &= 70,384\end{aligned}$$

Funding Accrued benefit - ARA 65	$1.0\%(4)(FAE5)_{65}$
$\Delta$ Funding Accrued benefit - ARA 65	$1.0\%(1)(FAE5)_{65}$
	$1.0\%(75,795)$
	$= 757.95$

## Fall 2011 EA-2A Exam Solutions

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### Problem 26 – Page 2

Revised 08/22/13

This participant will have 21 additional years of service when they attain age 62. With 25 years of service at age 62, the participant will be eligible for the Enhanced early retirement benefit. That means the early retirement benefit at age 62 will be unreduced.

$$\begin{aligned}\text{Funding Accrued benefit - ARA 62} & 1.0\%(4)(\text{FAE5})_{62} \\ \Delta\text{Funding Accrued benefit - ARA 62} & 1.0\%(1)(\text{FAE5})_{62} \\ & 1.0\%(70,384) \\ & = 703.84\end{aligned}$$

The PUC NC could be calculated as a summation:

$$\text{NC} = {}_{21}p_{41}^{(T)} \sum_{t=0}^3 v^t {}_t p_{62}^{(T)} q_{62+t}^{(r)} (\Delta\text{FAB})_{62+t} \ddot{a}_{62+t}^{(12)}$$

With decrements at only two ages, the expression is easy to evaluate. One minor trick to the question is that you should only use the commutation functions to calculate the annuity values at age 62 and age 65.

The commutation functions typically include both interest and mortality. Based on 2011 exam condition 15, there are no pre-retirement decrements. The present values should use interest-only discounting prior to benefit commencement age.

$$\begin{aligned}\ddot{a}_{62}^{(12)} &= N_{62}^{(12)} / D_{62} \\ &= 2,079,449 / 210,916 \\ &= 9.8591\end{aligned}$$

$$\begin{aligned}\ddot{a}_{65}^{(12)} &= N_{65}^{(12)} / D_{65} \\ &= 1,517,247 / 163,979 \\ &= 9.2527\end{aligned}$$

$$\begin{aligned}01/01/12 \text{ PUC NC} &= v^{21}(1.0)(50\%)(703.84)\ddot{a}_{62}^{(12)} + v^{21}(1-50\%)(757.95)(v^3)\ddot{a}_{65}^{(12)} \\ &= (1.075)^{-21}(.50)(703.84)(9.8591) + (1.075)^{-24}(.50)(757.95)(9.2527) \\ &= 760 + 618 \\ &= 1,378\end{aligned}$$

**Answer is C**

## Fall 2011 EA-2A Exam Solutions

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### Problem 27 – Page 1

Similar to 2010#22

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. You don’t have enough information to calculate the shortfall amortization installment in this problem, so you should ignore the minimum contribution.

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

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

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

$$\begin{aligned}\text{Cushion amount} &= 50\%(\text{FT}) + \Delta\text{FT due to pay increases} \\ &= .5(24,000,000) + (26,000,000 - 24,000,000) \\ &= 14,000,000\end{aligned}$$

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 2011 exam condition 42.

Target normal cost	700,000
+ Funding target	24,000,000
+ Cushion amount	14,000,000
Sub-total	38,700,000
Less unreduced AAV	17,000,000
Deductible limit	21,700,000

## Fall 2011 EA-2A Exam Solutions

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### Problem 27 – 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	1,000,000
+ At-Risk Funding target	27,000,000
Sub-total	28,000,000
Less unreduced AAV	17,000,000
Deductible limit	11,000,000

The alternative definition does not produce a higher value for the deductible limit. The final deductible limit is 21,700,000.

**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 2011 EA-2A Exam Solutions

### Problem 28 – Page 1

In general, the Top Heavy (T-H) determination date is the last day of the preceding plan year. An exception to this is the first plan year, when the determination date is the last day of the first plan year. To determine if the defined benefit plan is T-H for the 2012 plan year, the determination date would be December 31, 2011.

Based on questions T-24 and T-25 of the 1.416 regulation, the present value of accrued benefits for the DB plan (or account balance for the DC plan) is calculated as of the valuation date in the 12 month period ending on the determination date. This problem states that the DB plan valuation date is 12/31. This is convenient, since it matches the 12/31 date used for the profit sharing plan.

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

This problem is a bit unusual - it requires you to calculate both the accrued benefit, as well as the present value of benefits for the DB plan.

	Date of Birth	Age at 12/31/12	Service at 12/31/12	DB Plan accrued ben	PV factor	PV of accd ben
Smith	12/31/1964	48	8	14,400	2.31	33,264
Jones	12/31/1969	43	4	7,200	1.59	11,448
Brown	12/31/1958	54	3	5,400	3.65	19,710
Green	12/31/1971	41	3	5,400	1.37	7,398
Black	12/31/1974	38	3	5,400	1.10	5,940
Total						77,760

	PV of accrued ben	Key ees PV of DB accrued ben	12/31/11 PS plan acct balance	12/31/12 PS plan acct balance	Key ees PS plan acct balance
Smith	33,264	33,264	20,500	21,730	21,730
Jones	11,448	11,448	10,000	10,600	10,600
Brown	19,710		15,000	15,900	
Green	7,398		8,000	8,480	
Black	5,940		3,000	3,180	
Total	77,760	44,712	56,500	59,890	32,330

One minor trick is that the problem gives you the profit sharing balance at 12/31/11. The values at 12/31/12 have been increased to reflect the 6% return during 2011.

## Fall 2011 EA-2A Exam Solutions

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### Problem 28 – Page 2

The problem states that X will be the maximum contribution for Smith so that the plan is not Top Heavy for 2012. It also qualifies this by saying “Considering only top-heavy requirements”, so you don’t need to even think about maximum deduction issues for the profit sharing plan.

You need to derive the value of X so that the plan’s Top Heavy ratio is exactly equal to 60%:

$$\begin{aligned} 60.0\% &= (\text{Key employees PVAB} + \text{account balances}) \\ &\quad / (\text{Total employees PVAB} + \text{account balances}) \\ &= (44,712 + 32,330 + X) / (77,760 + 59,890 + X) \end{aligned}$$

$$60.0\%(77,760 + 59,890 + X) = (44,712 + 32,330 + X)$$

$$\begin{aligned} 82,590 + .6X &= 77,042 + 1.0X \\ 5,548 &= .4X \end{aligned}$$

$$X = 13,870$$

**Answer is E**

### NOTES:

1. This problem is a bit simplified, since you don’t have to figure out who the key employees are. One of three definitions must be satisfied for an employee to be a key employee. They would have to satisfy at least one of these definitions within the 12 month period ending on the determination date:
  - (i) Officer with 2011 compensation > 160,000 (2011 value)
  - (ii) Someone with more than 5% of the stock ownership
  - (iii) Someone with more than 1% of the stock ownership with pay > 150,000
2. In IRC 416(i), there is a limit on the number of officers counted as key employees. No more than 50 employees (or, if less, the greater of 3 employees or 10% of all employees) shall be treated as officers. This limit has never been tested on prior EA exams.

## Fall 2011 EA-2A Exam Solutions

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### Problem 29

This is a simple question on the effect of the IRC 436(d) restriction related to accelerated payments. If a plan's AFTAP is under 60%, then they are subject to restrictions. In general, no accelerated payments may be made.

The plan can make payments to participants if they do not exceed the benefit amount payable as a straight life annuity. That is exactly what is described in this problem.

**Answer is A**



### Problem 30 – Page 1

Revised 07/09/13

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.

In this problem, you are given most of the valuation results under two sets of assumptions. You are given the FIL normal cost under the old assumptions. You must determine the normal cost under the new assumptions.

The problem states that the benefits are pay related. You must calculate the average temporary annuity including a salary scale. The missing piece of information is the total compensation. You need to do several calculations under the old assumptions to calculate that value.

#### Old Assumptions

In general, the UAL is brought forward each year using the formula for the expected UAL. In this problem, you are not given any prior year valuation results, but you are given the value of the UAL.

$$\text{UAL} = 1,500,000$$

$$\begin{aligned}\text{FIL PVNC} &= \text{PVB} - \text{AAV} - \text{UAL} \\ &= 7,700,000 - 3,400,000 - 1,500,000 \\ &= 2,800,000\end{aligned}$$

$$\text{PVE/E} = 43,400,000 / (\text{total comp})$$

The trick to this question is that you are given the normal cost under the old assumptions. You can use that information to calculate the value of the temporary annuity (PVE/E).

$$\begin{aligned}\text{FIL NC} &= \text{FIL PVNC} / (\text{PVE/E}) \\ 165,000 &= 2,800,000 / (\text{PVE/E}) \\ \text{PVE/E} &= 16.9697\end{aligned}$$

$$\begin{aligned}\text{PVE/E} &= 43,400,000 / (\text{total comp}) \\ \text{Total comp} &= 43,400,000 / 16.9697 \\ &= 2,557,500\end{aligned}$$

## Fall 2011 EA-2A Exam Solutions

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### Problem 30 – Page 2

#### New Assumptions

When you have a plan amendment, or a change in assumptions, you must make an adjustment to the UAL - this is the amount of the new MFSA amortization base. It is equal to the change in the accrued liability under the Entry Normal method.

$$\begin{aligned}\text{New UAL} &= \text{Old UAL} + \Delta \text{EAN AL} \\ &= 1,500,000 + (6,100,000 - 5,300,000) \\ &= 2,300,000\end{aligned}$$

$$\begin{aligned}\text{New PVNC} &= \text{new PVB} - \text{AAV} - \text{new UAL} \\ &= 8,900,000 - 3,400,000 - 2,300,000 \\ &= 3,200,000\end{aligned}$$

$$\begin{aligned}\text{PVE/E} &= \text{new PVE} / (\text{total comp}) \\ &= 41,000,000 / 2,557,500 \\ &= 16.0313\end{aligned}$$

$$\begin{aligned}\text{FIL NC} &= \text{PVNC} / (\text{PVE/E}) \\ &= 3,200,000 / 16.0313 \\ &= 199,610\end{aligned}$$

**Answer is B**

## Fall 2011 EA-2A Exam Solutions

### Problem 31 – Page 1

Similar to 2008 #13

The key to this problem is knowing how to calculate the funding target using segment interest rates. This question simply asks for the difference between two funding target values. One value is calculated as an active employee, and another is calculated as a retired employee.

Retired FT = PV of Early retirement benefit

Active FT = PV of accrued benefit

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

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

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

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

### Funding Target

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

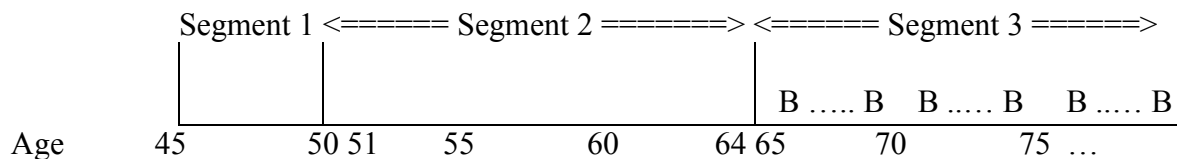
01/01/2012 Age 45

Past service 9

2011 pay (age 44) 120,000

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

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



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### Problem 31 – Page 2

The third segment rate is used to value all benefit payments at and after age 65. Both the accrued benefit and the early retirement benefit are calculated based on the final pay at 01/01/2012:

$$\begin{aligned}\text{Accrued benefit} & \quad 2.0\%(9)(\text{Final pay}) \\ & \quad 2.0\%(9)(120,000) = 21,600\end{aligned}$$

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

$$\begin{aligned}\text{Active}_{45} \text{ FT} &= 21,600 * {}_{20|}\ddot{a}_{45 \text{ seg}_3}^{(12)} \\ &= 21,600 * (v^{20} {}_{20}p_{45}) \ddot{a}_{65 \text{ seg}_3}^{(12)}\end{aligned}$$

Now you need to express these annuities in terms of commutation functions. One important aspect of the problem is that the pre-retirement mortality and post-retirement mortality are not the same (based on 2011 exam condition 15). This means you must use interest-only discounting prior to benefit commencement age.

$$\begin{aligned}{}_{20|}\ddot{a}_{45 \text{ seg}_3}^{(12)} &= (v^{20} {}_{20}p_{45}) \ddot{a}_{65 \text{ seg}_3}^{(12)} && \text{all at segment 3 rate} \\ &= (1.07)^{-20} * (N_{65}^{(12)} / D_{65}) && \text{all at segment 3 rate}\end{aligned}$$

$$\begin{aligned}\text{Active}_{45} \text{ FT} &= 21,600(1.07)^{-20} * (\underline{38,046}) \\ & \quad \underline{4,926} \\ &= 21,600(.2584)(7.7235) \\ &= 43,111\end{aligned}$$

### Retired calculations

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

$$\text{Early retirement factor @ 45} \quad 1 - 2.5\%(65-45) = .50$$

$$\text{Early retirement benefit} \quad .50(21,600) = 10,800$$

Since benefits are assumed to start immediately, the PVB is calculated using all three segment rates. The first segment covers benefit payments from age 45 up to age 49 (5 years). The second segment covers benefit payments from age 50 up to age 64 (15 years). The third segment rate is used to value benefit payments at and after age 65.

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### Problem 31 – Page 3

Revised 10/15/12

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

$$\begin{aligned}\text{Retiree}_{45} \text{ FT} &= 10,800 * [ \ddot{a}_{45:\overline{5}| \text{seg}_1}^{(12)} + {}_5|\ddot{a}_{45:\overline{15}| \text{seg}_2}^{(12)} + {}_{20}|\ddot{a}_{45 \text{ seg}_3}^{(12)} ] \\ &= 10,800 * [ \ddot{a}_{45:\overline{5}| \text{seg}_1}^{(12)} + (v^5 {}_5p_{45}) \ddot{a}_{50:\overline{15}| \text{seg}_2}^{(12)} + (v^{20} {}_{20}p_{45}) \ddot{a}_{65 \text{ seg}_3}^{(12)} ]\end{aligned}$$

Now you need to express these annuities in terms of commutation functions. Since benefits commence at age 45, you can use the commutation functions all the way back to age 45:

$$\ddot{a}_{45:\overline{5}| \text{seg}_1}^{(12)} = (N_{45}^{(12)} - N_{50}^{(12)}) / D_{45} \quad \text{all at segment 1 rate}$$

$$\begin{aligned}{}_5|\ddot{a}_{45:\overline{15}| \text{seg}_2}^{(12)} &= (v^5 {}_5p_{45}) \ddot{a}_{50:\overline{15}| \text{seg}_2}^{(12)} && \text{all at segment 2 rate} \\ &= (D_{50} / D_{45}) * (N_{50}^{(12)} - N_{65}^{(12)}) / D_{50} && \text{all at segment 2 rate} \\ &= (N_{50}^{(12)} - N_{65}^{(12)}) / D_{45} && \text{all at segment 2 rate}\end{aligned}$$

$$\begin{aligned}{}_{20}|\ddot{a}_{45 \text{ seg}_3}^{(12)} &= (v^{20} {}_{20}p_{45}) \ddot{a}_{65 \text{ seg}_3}^{(12)} && \text{all at segment 3 rate} \\ &= (D_{65} / D_{45}) * (N_{65}^{(12)} / D_{65}) && \text{all at segment 3 rate} \\ &= N_{65}^{(12)} / D_{45} && \text{all at segment 3 rate}\end{aligned}$$

$$\begin{aligned}\text{Retiree}_{45} \text{ FT} &= 10,800 [ \frac{(984,873 - 691,251)}{66,478} + \frac{(356,431 - 81,453)}{39,470} + \frac{38,046}{23,549} ] \\ &= 10,800 [ 4.4168 + 6.9668 + 1.6156 ] \\ &= 140,391\end{aligned}$$

### Gain / Loss calculation

The gain or loss on retirement is the difference between the funding target calculated as a retiree and the Funding target calculated as an active employee. Unlike the 2008 exam problem, this problem actually asked for the difference in the funding target values, instead of the G/L on retirement.

$$\begin{aligned}\Delta \text{FT} &= 140,391 - 43,111 \\ &= 97,280\end{aligned}$$

**Answer is A**

## Fall 2011 EA-2A Exam Solutions

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### Problem 32

The key point of this question is how the 415 compensation rules apply to Smith's pay. Smith apparently had a break in service for 2007 and 2008. The question is how to calculate the high 3-year average compensation, since the break in service is in between the two highest years of compensation.

There is a tiny detail in the regulation at 1.415(b)-1(a)(5)(iii) that addresses this:

*“(iii) Break in service.*

*In the case of a participant who has had a severance from employment with an employer that maintains the plan and who is subsequently rehired by the employer, the period of the participant’s high-3 years of service is calculated by excluding all years for which the participant performs no services for and receives no compensation from the employer maintaining the plan (referred to as the break period), and by treating the year of service immediately prior to and the year of service immediately after the break period as if such years of service were consecutive”*

The result is that you ignore the years 2007 and 2008 completely. You treat the three years 2005, 2006 and 2009 as if they are consecutive years. Smith's high 3-year average compensation under IRC 415 is 113,333:

$$113,333 = (106,000 + 116,000 + 118,000) / 3$$

**Answer is E**

### NOTE

This is the first question that tested this detail of the 415 regulation.

## Fall 2011 EA-2A Exam Solutions

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### Problem 33

Similar to EA-2B 2004 #38

Revised 12/18/13

In general, the Top Heavy (T-H) determination date is the last day of the preceding plan year. An exception to this is the first plan year, when the determination date is the last day of the first plan year. To determine if the defined contribution plan is T-H for the plan year starting January 1, 2012, the determination date would be December 31, 2011.

Both plans are part of a required 416 aggregation group, since they both include at least one key employee. You must combine the two plans to determine the T-H status. If the entire aggregation group is T-H, then each of the plans would also be T-H for the year. Question T-27 of the 1.416-1 regulation requires you to use determination dates that fall within the same calendar year (2011). The 2011 determination date for the defined benefit plan is September 30, 2011.

Based on questions T-24 and T-25, the present value of accrued benefits for the DB plan (or account balance for the DC plan) is calculated as of the valuation date in the 12 month period ending on the determination date. For the DB plan, you would use the valuation results at the October 1, 2010 valuation date. For the DC plan, you would use the results at December 31, 2011.

Once you have identified the valuation dates for both plans, you can do the T-H determination.

	DB Plan	DC Plan	Sum
2011 Determination date	09/30/11	12/31/11	
Valuation date within prior 12 months	10/01/10	12/31/11	
Key employees	200,000	130,000	330,000
Non-key employees	100,000	60,000	160,000

The Top heavy ratio is

$$67.35\% = 330 / (330+160)$$

**Answer is D**

Due to the payment of the minimum at 12/31/2011, you have an unpaid minimum required contribution (MRC) for 2011. Since the 12/31/2012 contribution paid is less than 2012 MRC, you also have an unpaid MRC for 2012.

The question asks for the excise tax on the unpaid minimum required contribution for 2012. The key point of the question is that the unpaid MRC for the 2012 plan year includes any unpaid minimums for all prior years. Other points of the problem are:

- What is the interest adjustment to the unpaid contribution to reflect the payment date?
- How do you calculate the amount subject to excise tax?

### **2011 unpaid minimum**

The 2011 contribution of 150,000 is paid at 12/31/11. You should compare the discounted value (using the 2011 effective interest rate of 7%) against the MRC at 01/01/11. In addition, you should assume the plan sponsor elects to apply the carryover balance (CB) and the prefunding balance (PB) towards the MRC. This is based on 2011 exam conditions 27 and 28.

$$\begin{aligned}\text{PV of contrib} &= 150,000 \times (1.07)^{-1} \\ &= 140,187\end{aligned}$$

01/2011

$$\begin{aligned}\text{Unpaid MRC} &= \text{MRC} - \text{CB} - \text{PB} - (\text{PV of contrib}) \\ &= 150,000 - 2,500 - 1,000 - 140,187 \\ &= 6,313\end{aligned}$$

The 2012 contribution of 40,000 is paid at 12/31/12, which is two years later. Part of this contribution must be applied to eliminate the unpaid MRC for 2011. Under the proposed regulation on IRC 4971, you must use the 2011 effective interest rate of 7% to adjust the contribution for the two year period.

01/01/2012

$$\text{Unpaid MRC} = 6,313 \times 1.07$$

12/31/2012

$$\begin{aligned}\text{Unpaid MRC} &= 6,313 \times (1.07)^2 \\ &= 7,228\end{aligned}$$

### **2012 unpaid minimum**

After eliminating the unpaid MRC, the remaining contribution is 32,772 (= 40,000 - 7,228) at 12/31/12. You should compare the discounted value (using the 2012 effective interest rate of 6%) against the MRC at 01/01/12.



### Problem 34 – Page 2

Revised 10/29/13

$$\begin{aligned}\text{PV of contrib} &= 32,772 \times (1.06)^{-1} \\ &= 30,917\end{aligned}$$

01/2012

$$\begin{aligned}\text{Unpaid MRC} &= \text{MRC} - \text{CB} - \text{PB} - (\text{PV of contrib}) \\ &= 50,000 - 0 - 0 - 30,917 \\ &= 19,083\end{aligned}$$

The unpaid minimum for 2012 is 19,083. The excise tax is 10% of this amount, or 1,908.

**Answer is C**

### NOTES

1. IRC 4971 defines the amount of the excise tax. But it does not have a clear definition of the precise date used to determine the unpaid minimum required contribution. The April 15, 2008 proposed regulation on IRC 4971 defines the unpaid minimum contribution as determined at the valuation date.

2. Here is the rule from the proposed regulation regarding the interest adjustment of the unpaid MRC

54.4971(c)-1(d)(2)(i)(A)

*“The correction of an unpaid minimum required contribution under a single employer plan for a plan year requires the contribution, to or under the plan, of the amount that, when discounted to the valuation date for the plan year for which the unpaid minimum required contribution is due at the appropriate rate of interest, equals or exceeds the unpaid minimum required contribution.*

*For this purpose, the appropriate rate of interest is the plan’s effective interest rate for the plan year for which the unpaid minimum required contribution is due except to the extent that the payments are subject to additional interest as provided under section 430(j)(3) or (4).”*

3. The calculations in this problem follow example 2 in the proposed regulation at 54.4971(c)-1(f).
4. You will get the wrong answer range if you do not adjust the 2011 unpaid MRC with interest to the 01/01/2012 calculation date.

## Fall 2011 EA-2A Exam Solutions

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### Problem 35

Similar to 2009 #35

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

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

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

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

$$\begin{aligned}\text{AGG PVNC} &= \text{PVB} - \text{AAV} - (\text{O/S 431 bases} - \text{CB}) \\ &= 50,000,000 - 40,000,000 - (1,500,000 - 2,250,000) \\ &= 10,750,000\end{aligned}$$

$$\begin{aligned}\text{PVE/E} &= 175,000,000 / 21,000,000 \\ &= 8.3333\end{aligned}$$

$$\begin{aligned}\text{AGG NC} &= 10,750,000 / 8.3333 \\ &= 1,290,000\end{aligned}$$

**Answer is B**

## Fall 2011 EA-2A Exam Solutions

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### Problem 36 – Page 1

This is the first question asked on the use of the full yield curve for IRC 430 minimum funding calculations. This results in a fair amount of messy arithmetic for calculating the shortfall amortization installments.

The problem asks for the prefunding balance (PB) at 01/01/13. The problem states that the plan sponsor used the PB to satisfy the 2012 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:

$$\begin{aligned}\text{Funding S/F} &= \text{Funding target} - (\text{AAV} - \text{CB} - \text{PB}) \\ &= 7,000,000 - (7,000,000 - 0 - 500,000) \\ &= 500,000\end{aligned}$$

### 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:

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

The problem tells you that the actuarial valuation is performed using the full yield curve instead of using the three segment rates. That means that the calculation of the shortfall amortizations must also use the full yield curve. See the final regulation at 1.430(h)(2)-1(e)(4).

This problem gives you the 2011 shortfall amortization installment as 200,000. It also gives you the 2012 yield curve values. You need to use these to determine the 6-year amortization factor. Then you can calculate the new shortfall base.

## Fall 2011 EA-2A Exam Solutions

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### Problem 36 – Page 2

You need to calculate the amortization factor using the full yield curve interest rates for the first six years:

$$5.4476 = 1 + (1.010)^{-1} + (1.025)^{-2} + (1.035)^{-3} + (1.045)^{-4} + (1.055)^{-5}$$

$$\begin{aligned}\text{S/F Amort base} &= 1.0 \times 7,000,000 - (7,000,000 - 0 - 500,000) - (\text{PV of PY Amortizations}) \\ &= 500,000 - 200,000(5.4476) \\ &= -589,510\end{aligned}$$

You must calculate the shortfall amortization installment for 2012. You need to calculate the amortization factor using the full yield curve interest rates for the first seven years:

$$6.1329 = 5.4476 + (1.065)^{-6}$$

$$\begin{aligned}\text{S/F amort} &= -589,510 / 6.1329 \\ &= -96,123\end{aligned}$$

$$\begin{aligned}\text{S/F charge} &= 200,000 - 96,123 \\ &= 103,877\end{aligned}$$

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

### Minimum Required Contribution

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

$$\begin{aligned}\text{MRC} &= \text{TNC} + \text{Shortfall amort charge} + \text{Waiver amort charge} \\ &= 160,000 + 103,877 + 0 \\ &= 263,877\end{aligned}$$

### 2013 prefunding balance

The prefunding balance of 500,000 satisfies the minimum funding standard for 2012. The remaining PB must be brought forward to 01/01/2013 with the asset rate of return:

$$\begin{aligned}\text{01/2012 PB} &= \text{PB} - \text{MRC} \\ &= 500,000 - 263,877 = 236,123\end{aligned}$$

$$\begin{aligned}\text{01/2013 PB} &= (\text{2012 PB})(1 + \text{asset return}) \\ &= 236,123(1.075) \\ &= 253,832\end{aligned}$$

**Answer is C**

## Fall 2011 EA-2A Exam Solutions

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### Problem 37

This is a simple question on when the IRC 436 restrictions take effect. In IRC 436(g), it states that plans are exempt from most of the restrictions for the first five years. The one restriction that still applies is 436(d), which covers accelerated benefit payments (such as lump sums).

This plan's certified AFTAP for 2011 is 65%. At April 1, 2012, the presumed AFTAP is below 60%. Most plans would be subject to the IRC 436(e) restriction, which would freeze benefit accruals.

But that is not true for this plan, since the effective date is 01/01/2008. Most of the IRC 436 restrictions do not apply until 01/01/2013.

**Answer is B**

## Fall 2011 EA-2A Exam Solutions

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### Problem 38 – Page 1

Similar to 2010 #31

The problem asks for the prefunding balance (PB) at 01/01/13. The problem states that the plan sponsor elects to apply both the CB and the 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:

$$\begin{aligned}\text{Funding S/F} &= \text{Funding target} - (\text{AAV} - \text{CB} - \text{PB}) \\ &= 1,000,000 - (1,100,000 - 40,000 - 140,000) \\ &= 80,000\end{aligned}$$

### **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 similar to the previously calculated Funding shortfall:

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

### **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:

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

This problem gives you the 2011 shortfall amortization installment as 25,000. It also gives you the 6-year amortization factor, so you can calculate the new shortfall base:

$$\begin{aligned}\text{S/F Amort base} &= 1.0 * 1,000,000 - (1,100,000 - 40,000 - 140,000) - (\text{PV of PY Amortizations}) \\ &= 80,000 - 25,000(5.2932) \\ &= -52,330\end{aligned}$$

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

$$\begin{aligned}\text{S/F amort} &= -52,330 / 5.9982 \\ &= -8,724\end{aligned}$$

## Fall 2011 EA-2A Exam Solutions

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### Problem 38 – Page 2

$$\begin{aligned}\text{S/F charge} &= 25,000 - 8,724 \\ &= 16,276\end{aligned}$$

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

### Minimum Required Contribution

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

$$\begin{aligned}\text{MRC} &= \text{TNC} + \text{Shortfall amort charge} + \text{Waiver amort charge} \\ &= 40,000 + 16,276 + 0 \\ &= 56,276\end{aligned}$$

### 2013 prefunding balance

The sum of the CB and PB satisfies the minimum funding standard for 2012. The remaining PB must be brought forward to 01/01/2013 with the asset rate of return:

$$\begin{aligned}01/2012 \text{ PB} &= \text{CB} + \text{PB} - \text{MRC} \\ &= 140,000 \text{ PB} - (56,276 \text{ MRC} - 40,000 \text{ CB}) \\ &= 123,724\end{aligned}$$

$$\begin{aligned}01/2013 \text{ PB} &= (2012 \text{ PB})(1 + \text{asset return}) \\ &= 123,724(1.015) \\ &= 125,580\end{aligned}$$

**Answer is D**

### NOTE

The 01/01/12 CB must be eliminated completely before the plan sponsor can make any election with respect to the 01/01/12 PB.

**Problem 39 – Page 1****Revised 09/09/13**

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?**

To calculate the required quarterly contribution for 2013, you must first determine that the plan is subject to the quarterly contribution requirements. In IRC 430(j)(3), it states that plans with a funding shortfall for the preceding plan year are subject to the quarterly contribution requirements. Since the problem states there is a funding shortfall at 01/01/2012, the plan is subject to the quarterly contribution requirement for 2013.

**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 2012 and 2013. The required annual payment (RAP) is the lesser of the 2012 MRC (1,000,000) or 90% of the 2013 MRC (1,080,000). The resulting RAP is 1,000,000. The 2013 required quarterly installment is 25% of the RAP, which is 250,000.

**Calculate 09/15/2014 required contribution**

The problem gives you several contributions at different dates. Some of the required quarterly installments are paid on a timely basis, and some are not.

<b><u>Due date</u></b>	<b><u>Required Installment</u></b>	<b><u>Amount Available</u></b>	<b><u>OVER (UNDER)</u></b>
04/15/2013	250,000	250,000	0
07/15/2013	250,000	0	(250,000)
08/10/2013		250,000	0
10/15/2013	250,000	0	(250,000)
11/10/2013		350,000	100,000
01/15/2014	250,000	250,000	0
09/15/2014		X	0



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### Problem 39 – Page 2

Revised 09/09/13

There is a contribution of 150,000 at 01/15/2014. When you add the 100,000 overpayment at 11/01/2013, you have exactly 250,000 available to satisfy the required quarterly installment at 01/15/2014.

To determine the value of X, you need to discount all of the contributions paid back to 01/01/2013. The difference between the discounted values and the 1,200,000 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 2013 plan year contributions are normally discounted back to the valuation date using the 2013 effective interest rate (EIR). During any time period for which there is an underpayment of the required quarterly installments, the interest rate used for discounting is increased by 5%. The problem gives you the number of days so you can count the period of underpayment based on the exact number of days:

<u>Due date</u>	<u>Required Installment</u>	<u>Amount Available</u>	<u>OVER (UNDER)</u>	<u>Days</u>	<u>Present value</u>
04/15/2013	250,000	250,000	0	104	$250,000(1.06)^{-104/365}$
07/15/2013	250,000	0	(250,000)	195	
08/10/2013		250,000	0	221	$250,000(1.06)^{-195/365}(1.11)^{-26/365}$
10/15/2013	250,000	0	(250,000)	287	
11/10/2013		350,000	100,000	313	$250,000(1.06)^{-287/365}(1.11)^{-26/365} +$ $100,000(1.06)^{-313/365}$
01/15/2014	250,000	150,000	0	379	$150,000(1.06)^{-379/365}$
09/15/2014		X	0	622	$X(1.06)^{-622/365}$

The tricky part of this calculation is the present value of the underpayments. The 07/15/13 underpayment is eliminated by the contribution at 08/10/13. The period of underpayment is 26 days (221 - 195). The first underpayment must be discounted for the period of underpayment (26 days) using the penalty rate (11.0% = 5.0% + 6.0%). It must be discounted for the rest of the period back to 01/01/13 (195 days) at the effective rate of 6.0%.

The 10/15/13 underpayment is eliminated by the contribution at 11/10/13. The period of underpayment is 26 days (313 - 287). The second underpayment must be discounted for the period of underpayment (26 days) using the penalty rate (11.0% = 5.0% + 6.0%). It must be discounted for the rest of the period back to 01/01/13 (287 days) at the effective rate of 6.0%.

The present value of the 11/10/13 contribution must be calculated as two separate pieces. The first 250,000 of the contribution is discounted using the penalty rate, since it satisfies the required quarterly installment. The remaining 100,000 of the 11/10/13 contribution is discounted using only the EIR of 6.0%. The 01/15/14 and 09/15/14 contributions are also discounted using only the EIR.

## Problem 39 – Page 3

Revised 10/18/16

Here is the calculation of the present value of the contributions for 2013, which is equal to the MRC of 1,200,000:

$$\begin{aligned}
 1,200,000 &= 245,884 + 240,543 + (237,036 + 95,126) + 141,194 + .9055X \\
 X &= (1,200,000 - 959,783) / .9055 \\
 &= 265,294
 \end{aligned}$$

**Answer is E**

## NOTES

- Based on the rule in the 09/09/2015 final regulation at 1.430(j)-1(c)(3)(ii), you can increase the 11/10/2013 overpayment with interest to the due date for the next required installment. This increases the amount available at 01/15/2014, but it does not change the final answer:

<u>Due date</u>	<u>Required Installment</u>	<u>Amount Available</u>	<u>OVER (UNDER)</u>
04/15/2013	250,000	250,000	0
07/15/2013	250,000	0	(250,000)
08/10/2013		250,000	0
10/15/2013	250,000	0	(250,000)
11/10/2013		350,000	100,000
01/15/2014	250,000	251,059	0
09/15/2014		X	0

$$101,059 = 100,000 * (1.06)^{66/365}$$

$$251,059 = 250,000 + 101,059$$

- In the 10/15/2009 regulations, there is a special rule about the relationship between two dates:
  - The due date for a required quarterly installment, and
  - 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 interest different rate to adjust for the time period from the quarterly installment due date up to the plan sponsor's date of election. Instead of using the effective rate of interest, you use the effective rate plus 5% (the penalty rate). This is counter-intuitive, to say the least. See the example in the regulation at 1.430(f)-1(d)(1).

### Problem 40

Revised 10/22/12

This is a simple question on the effect of the IRC 436(d) restriction related to accelerated payments. In the 1.436 regulation, it clarifies that plans which do not offer an optional form which includes accelerated payments (such as lump sums) are not subject to the 436(d) restrictions. As such, there would never be a deemed reduction in the carryover (or prefunding) balance to force the AFTAP to be at least 80%.

**Answer is A**

### NOTES

1. Based on 2011 exam condition 47, this plan is not maintained under a collective bargaining agreement (CBA). This is important, because CBA plans are subject to the deemed reduction rule for all of the IC 436 restrictions. For the default case of a non-CBA plan, the deemed reduction rule only applies for the 436(d) restriction related to accelerated payments.
2. Assume this was a CBA plan, and the plan sponsor wanted to amend the plan to increase benefits. Depending on the specifics of the problem, it would be necessary to reduce the carryover balance to zero in order to get the AFTAP up to 80% to satisfy IRC 436(c). The current value is 70%:

$$\begin{aligned}\text{AFTAP} &= \frac{\text{NHAP} + \text{AAV} - \text{CB} - \text{PB}}{\text{NHAP} + \text{Funding Target (non At-Risk)}} \\ \text{AFTAP} &= \frac{0 + 90,000,000 - 10,000,000 - 10,000,000}{0 + 100,000,000} \\ &= 70.0\%\end{aligned}$$

## Fall 2011 EA-2A Exam Solutions

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### Problem 41 – Page 1

Similar to 2008 #42

This problem asks for the shortfall amortization installment attributed to the 2012 shortfall amortization base. The key idea is that the plan has been At-Risk for most years since 2008.

2011 exam condition 43 defines terms related to At-Risk plans:

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

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

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

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

The plan has previously been determined to be in At-Risk status for 2010 through 2012, so both of the additional load factors should be applied for 2012:

Funding target using 430(i)(1)(B) assump	660,000,000
4% load	24,000,000 = 4%*600,000,000
Per participant load	14,000,000 = 700*20,000
At-Risk Funding target	698,000,000

### At-Risk plan - Weighting factors

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

Consecutive years plan has been in at-risk status	Percent of item based on 430(i) rules	Percent of item ignoring 430(i) rules
1	20%	80%
2	40%	60%
3	60%	40%
4	80%	20%
5	100%	zero

## Fall 2011 EA-2A Exam Solutions

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### Problem 41 – Page 2

The plan has previously been determined to be in At-Risk status for 2010 through 2012, for three consecutive years. The “Final” At-Risk value will equal the sum of 60% times the At-Risk value (which includes loads) and (1-60%) times the non-At-Risk value:

$$\begin{aligned}\text{Funding Target} &= 60\%*(698,000,000) + 40%*(600,000,000) \\ &= 658,800,000\end{aligned}$$

### Funding Shortfall

The next step is calculation of the funding shortfall. The problem states that there are no funding balances at 01/01/12:

$$\begin{aligned}\text{Funding S/F} &= \text{Funding target} - (\text{AAV} - \text{CB} - \text{PB}) \\ &= 658,800,000 - (430,000,000 - 0 - 0) \\ &= 228,800,000\end{aligned}$$

### 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:

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

Instead of giving you the prior years' shortfall amortization installments, this problem gives you the present value of the prior shortfall amortizations:

$$\begin{aligned}&= 1.0*658,800,000 - (430,000,000 - 0 - 0) - (\text{PV of PY Amortizations}) \\ &= 228,800,000 - 29,000,000 \\ &= 199,800,000\end{aligned}$$

## Fall 2011 EA-2A Exam Solutions

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### Problem 41 – Page 3

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

$$\begin{aligned}\text{S/F amort} &= 199,800,000 / 5.9982 \\ &= 33,309,993\end{aligned}$$

**Answer is B**

## Fall 2011 EA-2A Exam Solutions

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### Problem 42 – Page 1

Revised 07/31/13

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 asks for the "smallest amount" at 12/31/2012. Based on exam condition 31, the "smallest amount" reflects offsetting the funding standard account credit balance (CB) against the minimum contribution.

### FIL Cost method definitions

$$\begin{aligned}\text{UAL} &= {}_e\text{UAL} \\ &= \text{O/S 431 bases} - \text{CB} - \text{ARA}\end{aligned}$$

$$\text{FIL PVNC} = \text{PVB} - \text{AAV} - \text{UAL}$$

$$\text{PVE/E} = \text{PVE} / (\text{total comp})$$

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

### 2012 Balance equation

In general, the UAL is brought forward each year using the formula for the expected UAL. In this problem, you have no prior year valuation results. You must use the actuarial balance equation to determine the UAL.

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

There is a plan amendment at 01/01/12. The problem gives you the values of the Entry Age Normal accrued liability before and after the plan amendment. The difference in these values is the amount of the new plan amendment base at 01/01/12:

$$\begin{aligned}\text{Plan chg base} &= 46,000,000 - 41,000,000 \\ &= 5,000,000\end{aligned}$$

$$\begin{aligned}\text{O/S 431 bases} &= 5,000,000 + 25,000,000 * (\ddot{a}_{\overline{3}|.07} / \ddot{a}_{\overline{30}|.07}) \\ &= 10,287,105\end{aligned}$$

$$\begin{aligned}\text{UAL} &= 10,287,105 - 1,000,000 - 0 \\ &= 9,287,105\end{aligned}$$

Since the effective date is 01/01/1985, the amortization period for the IAL is 30 years.

## Fall 2011 EA-2A Exam Solutions

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### Problem 42 – Page 2

#### 2012 valuation

$$\begin{aligned}\text{FIL PVNC} &= \text{PVB} - \text{AAV} - \text{UAL} \\ &= 50,000,000 - 40,000,000 - 9,287,105 \\ &= 712,895\end{aligned}$$

$$\begin{aligned}\text{PVE/E} &= \text{PVE} / (\text{total comp}) \\ &= 150,000,000 / 20,000,000 \\ &= 7.50\end{aligned}$$

$$\begin{aligned}\text{FIL NC} &= \text{PVNC} / (\text{PVE/E}) \\ &= 712,895 / 7.50 \\ &= 95,053\end{aligned}$$

You only need to do a few amortization calculations to set up the MFSA for 2012.

$$\begin{aligned}\text{IAL amort} &= 25,000,000 / \ddot{a}_{\overline{30}|.07} \\ &= 1,882,860\end{aligned}$$

$$\begin{aligned}\text{Plan amort} &= 5,000,000 / \ddot{a}_{\overline{15}|.07} \\ &= 513,059\end{aligned}$$

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

#### **2012 Minimum Funding Standard Account**

<b>Charges</b>		<b>Credits</b>	
Normal Cost	95,053	Credit Balance	1,000,000
IAL amortization	1,882,860		
Plan chg amortization	513,059	12/31 minimum	x
7% interest	174,368	7% interest	70,000
Total charges	<u>2,665,340</u>	Total credits	<u>x + 1,070,000</u>

The “smallest amount” at 12/31/12 is  $1,595,340 = 2,665,340 - 1,070,000$ . This includes interest to 12/31, and reflects offsetting the credit balance against the minimum contribution.

**Answer is B**



## Fall 2011 EA-2A Exam Solutions

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### Problem 43

This problem is a simple one on excise tax definitions.

X is equal to 20%. - see IRC 4980. This is the reduced excise tax on a reversion when there is a qualified replacement plan.

Y is equal to 10%. - see IRC 4971(f). This is the excise tax on a liquidity shortfall under 430(j). If the liquidity shortfall is not corrected, the IRS has authority to increase the excise tax to 100%.

Z is equal to 5%. - see IRC 4971(a). This is the excise tax on the accumulated funding deficiency for a multiemployer plan. If the deficiency is not corrected, the IRS has authority to increase the excise tax to 100%.

The correct ordering of these items is  $Z < Y < X$ .

**Answer is E**

#### NOTE

The first part of the question asks about the excise tax on reversions - which is not part of the EA-2A exam syllabus. This would be a valid question on the EA-2B exam, but it was thrown out as a **defective question for EA-2A**.

## Fall 2011 EA-2A Exam Solutions

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### Problem 44

Revised 11/01/17

This is a simple question on the calculation of the AFTAP under IRC 436. The point of the question is that the problem gives you both the non-At-Risk funding target, as well as the funding target under the At-Risk assumptions.

A secondary point of the problem is that there were annuity purchases in the prior two plan years. The calculation of the AFTAP adds back the non-HCE annuity purchases in the prior two plan years (NHAP) to both the numerator and the denominator:

$$\begin{aligned}\text{AFTAP} &= \frac{\text{NHAP} + \text{AAV} - \text{CB} - \text{PB}}{\text{NHAP} + \text{Funding Target (non At-Risk)}} \\ \text{AFTAP} &= \frac{8,000 + 155,000 - 5,000 - 3,000}{8,000 + 180,000} \\ &= 155,000 / 188,000 \\ &= 82.44\%\end{aligned}$$

**Answer is C**

### NOTE

Based on 2011 exam condition 47, this plan is not maintained under a collective bargaining agreement (CBA). This is important, because CBA plans are subject to the deemed reduction rule for all of the IC 436 restrictions. For the default case of a non-CBA plan, the deemed reduction rule only applies for the 436(d) restriction related to accelerated payments.

If this was a CBA plan, and the AFTAP was below 80%, then it would be necessary to reduce the carryover (and prefunding) balances in order to get the AFTAP up to 80%.

## Fall 2011 EA-2A Exam Solutions

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### Problem 45 – Page 1

Similar to 2010 #46
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Revised 07/25/15

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 is equal to the average market value, but it 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 three years. 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 for 2011. The problem states that the actuary's assumed annual rate of return on assets is 6.75%. 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. This limitation has no impact on the solution to this problem.

Based on the 6.75% assumed return, you can calculate the expected return on assets for both 2010 and 2011. The calculation must allow for the timing of the cash flows during the year. You are told that all the cash flows occur at mid-year:

<b>Expected return calculation</b>	<b>6.75%</b>	<b>6.75%</b>
<b>Plan year</b>	<b>2010</b>	<b>2011</b>
Beginning of year values		
Market value at 1-1	330,000	270,000
Middle of year values		
Contribution paid 07/01	44,000	6,000
Benefit pmt + expenses	<u>(27,000)</u>	<u>(30,000)</u>
Expected return (compound)	22,839	17,428

## Fall 2011 EA-2A Exam Solutions

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### Problem 45 – Page 2

Now you can calculate the cash flow adjustment for both 2010 and 2011. This is the sum of the cash flows and the expected return:

#### Adjustment for year

Year	2010	2011
Trust assets at 1-1	330,000	270,000
Market value at 1-1	330,000	270,000
Receivable contribution	-	-
Benefit payments	(27,000)	(30,000)
Expenses	-	-
Contribution paid 07/01	44,000	6,000
Expected return (compound)	<u>22,839</u>	<u>17,428</u>
Adjustment for year	39,839	(6,572)

The 2012 market value excluding receivables was given in the problem as 290,000. Now you can calculate the adjusted market values. 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 01/01/2012:

#### Average market value calculation

Year	2010	2011	2012
Market value at 1-1	330,000	270,000	290,000
Adjustment for 2010	39,839		
Adjustment for 2011	<u>(6,572)</u>	<u>(6,572)</u>	
Adjusted fair market value	363,268	263,428	290,000

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

$$305,565 = (363,268 + 263,428 + 290,000) / 3.$$

This preliminary actuarial asset value of 305,565 must be compared to the corridors. The final AAV is equal to the average market value, but it must be limited to be within 10% of the market value. The bottom of the corridor is 90% of market value, or 261,000. The top of the corridor is 110% of market value, or 319,000.

The asset corridor has no effect in this problem. The final actuarial value of assets is 305,565.

**Answer is D**

**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 3 years. With a 3 year average, the fractions are  $2/3$  and  $1/3$ :

$$01/2012 \text{ AAV} = 01/2012 \text{ MVA} - (2/3)(2011 \text{ G/L}) - (1/3)(2010 \text{ G/L})$$

You need to calculate the value of the G/L for both 2010 and 2011. 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:

$$\begin{aligned} 01/2012 \text{ } e\text{MVA} &= 01/2011 \text{ MVA} + \text{adjustment for 2011} \\ 263,428 &= 270,000 + (6,572) \end{aligned}$$

$$\begin{aligned} 2011 \text{ G/L} &= 01/2012 \text{ MVA} - 01/2012 \text{ } e\text{MVA} \\ &= 290,000 - 263,428 \\ &= 26,572 \quad (\text{Gain}) \end{aligned}$$

$$\begin{aligned} 01/2011 \text{ } e\text{MVA} &= 01/2010 \text{ MVA} + \text{adjustment for 2010} \\ 369,839 &= 330,000 + 39,839 \end{aligned}$$

$$\begin{aligned} 2010 \text{ G/L} &= 01/2011 \text{ MVA} - 01/2011 \text{ } e\text{MVA} \\ &= 270,000 - 369,839 \\ &= (99,839) \quad (\text{Loss}) \end{aligned}$$

$$\begin{aligned} 01/2012 \text{ AAV} &= 01/2012 \text{ MVA} - (2/3)(2011 \text{ G/L}) - (1/3)(2010 \text{ G/L}) \\ &= 290,000 - (2/3)(26,572) - (1/3)(-99,839) \\ &= 305,565 \end{aligned}$$

## Fall 2011 EA-2A Exam Solutions

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### Problem 45 – Page 4

This preliminary actuarial asset value of 305,565 must be compared to the corridors. The bottom of the corridor is 90% of market value, or 261,000. The top of the corridor is 110% of market value, or 319,000.

The final actuarial value of assets is 305,565. This is identical to the earlier result calculated using the method in Notice 2009-22.

## Fall 2011 EA-2A Exam Solutions

### Problem 46 – Page 1

Similar to 2007 #43

Revised 08/22/13

The key to this problem is knowing the gain / loss formulas, as well as how to value Joint and Survivor benefits.

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

Since Smith and Jones are both retired, their NC is zero, and the AL is the same as their PVB. You need to calculate the expected accrued liability at 01/01/2012.

Data as of	01/01/11
Smith's age	65
Smith's spouse's age	65
Jones' age	65
Jones' spouse's age	65

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

- Smith and Jones both have the same benefit amount
- Smith and Jones both have the same form of benefit payment
- Benefits are payable annually (not monthly)
- Everyone is the same age

$$\begin{aligned}AL_0 &= 20,000 \{ \ddot{a}_{65} + (100\%)[\ddot{a}_{65} - \ddot{a}_{65:65}] \} \{2\} \\ &= 40,000 \{ (N_{65} / D_{65}) + (N_{65} / D_{65}) - (N_{65:65} / D_{65:65}) \} \\ &= 40,000 \{ 2 * (339,200 / 31,600) - (272,000 / 29,400) \} \\ &= 40,000 \{ 2 * 10.7342 - 9.2517 \} \\ &= 488,666\end{aligned}$$

$$\begin{aligned}{}_eAL_1 &= (1.07) \{ AL_0 - 2(20,000) \} \\ &= 480,073\end{aligned}$$

You need to calculate the gain when Jones and Jones' spouse both survive, and Smith survives, but Smith's spouse dies. In this case, the actual accrued liability at 01/01/2012 is a life annuity payable to Smith:

$$\begin{aligned}AL_1 &= 20,000 \ddot{a}_{66} + 20,000 \{ \ddot{a}_{66} + (100\%)[\ddot{a}_{66} - \ddot{a}_{66:66}] \} \\ &= 20,000(N_{66} / D_{66}) + 20,000 \{ (N_{66} / D_{66}) + (N_{66} / D_{66}) - (N_{66:66} / D_{66:66}) \} \\ &= 20,000 \{ 3 * (307,600 / 29,200) - (242,600 / 27,000) \} \\ &= 20,000 \{ 3 * 10.5342 - 8.9852 \} \\ &= 452,351\end{aligned}$$

## Fall 2011 EA-2A Exam Solutions

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### Problem 46 – Page 2

$$\begin{aligned}\text{Gain} &= {}_e\text{AL}_1 - \text{AL}_1 \\ &= 480,073 - 452,351 \\ &= 27,722\end{aligned}$$

**Answer is A**

#### NOTE

This definitely seems a bit too short for a 5 point question. Without a few of those simplifying items, it would be worth 5 points.



## Fall 2011 EA-2A Exam Solutions

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### Problem 47

Revised 07/09/13

This is the second 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 carryover balance (CB) at the beginning of the year must be increased with interest based on the plan’s rate of return on assets.

#### Excess contribution

The problem asks for the prefunding balance at 01/01/12. The problem states that the plan sponsor elects to offset 10,000 of the CB against the 2011 minimum contribution under IRC 430.

You can calculate the amount of the excess contribution at 01/01/2011. 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 2011 plan year:

$$\begin{aligned}\text{PV of contrib} &= 16,000 \times (1.04)^{-1} \\ &= 15,385\end{aligned}$$

$$\begin{aligned}\text{Addition to} \\ \text{2012 PB} &= 15,385 - (10,000 \text{ MRC} - 10,000 \text{ CB}) \\ &= 5,385 \text{ excess contribution} + 10,000 \text{ CB applied}\end{aligned}$$

If there was no CB used, then the 01/2012 PB equals the sum of the 01/2011 PB (brought forward using the rate of return on assets for the 2011 plan year) plus the excess contribution (brought forward with the effective rate of interest for the 2011 plan year). But the calculation is not actually done that way in this problem.

The portion of the prefunding balance that is attributed to the sponsor’s use of the carryover balance (CB) at the beginning of the year must be increased with interest based on the 2011 rate of return on assets.

$$\begin{aligned}\text{01/2012 PB} &= 1.04(5,385 \text{ excess contribution}) + 1.085(10,000 \text{ CB} + 1,000 \text{ PB}) \\ &= 17,535\end{aligned}$$

**Answer is D**

#### **NOTE**

As expected, you get the wrong answer range if you only use the 2011 effective interest rate or if you only use the 2011 rate of return on assets.

## Fall 2011 EA-2A Exam Solutions

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### Problem 48 – Page 1

There one key idea to this problem, which is calculation of the plan lump sum value. The problem states that Smith terminated on 12/31/2008. They elect to receive a lump sum on April 1, 2012.

The plan lump sum should be calculated based on the plan assumptions for actuarial equivalence. In this problem, the plan actuarial equivalence assumptions are the same as those for the minimum lump sum under 417(e)(3). This calculation is based on a modified set of segment rates, as defined in 417(e)(3)(D).

At 04/01/12	Smith
Current age	65
12/31/08 service	3 years

### Plan benefit

One key point of this problem is that the participant's pay is far above the 401(a)(17) limit. Since they terminated in 2008, you need to determine the 3-year final average pay at 12/31/08:

Year	2006	2007	2008
Pay	480,000	480,000	480,000
401(a)(17) limit	220,000	225,000	230,000
Limited pay	220,000	225,000	230,000

The participant's 3-year final average pay at 12/31/08 is 225,000. Next, calculate the participant's accrued benefit:

$$\begin{aligned}\text{Accrued benefit} &= 3(3.29\%)(225,000) \\ &= 22,208\end{aligned}$$

### Plan lump sum

Now you can calculate the lump sum based on the plan's assumptions for actuarial equivalence. This calculation uses the modified segment interest rates under 417(e). This problem simplifies the calculation, since it does not give you any segment rate information. Instead, it gives you some lump sum factors, and you have to decide the correct factor to use.

The plan defines the lookback month as the month preceding the first day of the stability period. The plan defines the stability period as the calendar quarter. Since Smith is getting a lump sum on 04/01/12, the stability period is the second quarter of 2012. The lookback month is March 2012. The correct lump sum factor is 13.05 (based on March 2012).

### Problem 48 – Page 2

Revised 10/18/16

$$\begin{aligned}\text{Age 65 LS} &= 22,208(13.05) \\ &= 289,808\end{aligned}$$

**Answer is B**

### NOTES

1. The plan year begins on April 1, so it is not 100% clear how to apply the calendar year 401(a)(17) limits to the \$40,000 per month pay. There is a tiny detail in the regulation at 1.401(a)(17)-1(b)(3)(ii) that addresses this:

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

The participant retires at 12/31, so their 36 month average pay is based on three 12 month periods which begin on 01/01. Each of the 12 month periods is subject to the 401(a)(17) limit for the corresponding calendar year.

2. One thing you may have asked - what about the 415 limits? Smith's IRC 415 compensation limit is much larger than the plan benefit:

$$\begin{aligned}\$415 \text{ comp limit} &= 225,000 * (3/10) \\ &= 67,500\end{aligned}$$

The 415 dollar limit is probably larger than the plan benefit, since it uses an accrual rate of 10% per year of participation service. Since the problem does not give you the plan effective date, you can not calculate the 415 dollar limit.

## Fall 2011 EA-2A Exam Solutions

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### Problem 49

This is a fairly simple problem on definitions of deductible limits under IRC 404(o).

#### I. FALSE

This is false because the plan has less than 101 participants. Under IRC 404(o)(4), it says that plans with less than 101 participants can not include the liability for benefit increases within the prior two years for highly compensated employees in the calculation of the cushion amount under IRC 404(o)(3).

#### II. TRUE

This is true, since the plan amendment became effective during 2012. In general, the funding target and target normal cost must reflect benefits that become effective during the year.

The only trick to this question is if you incorrectly read the valuation year as 2011. Even though the plan was amended in 2011, the 2011 valuation did not reflect the plan amendment.

#### III. FALSE

In general, the carryover balance (CB) and prefunding balance (PB) have no effect on the calculation of the asset value for the deductible limit. In IRC 404(o)(2)(A)(ii), it refers to the assets determined under IRC 430(g)(3). That subsection only describes the allowable rules for determining the actuarial value of assets. The description of the reduction of assets by both the CB and PB is in IRC 430(f)(4).

Only item II is true.

**Answer is C**

## Fall 2011 EA-2A Exam Solutions

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### Problem 50 – Page 1

The key point of this question is that you must know numerous definitions related to the quarterly contribution requirement and the liquidity shortfall. 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. Can you use the carryover balance to satisfy the quarterly contribution requirement?
4. What is the impact of the liquidity shortfall?
5. How do you discount the payments made back to the valuation date?

#### **Subject to the quarterly contribution requirement?**

To calculate the required quarterly contribution for 2012, you must first determine that the plan is subject to the quarterly contribution requirements. In IRC 430(j)(3), it states that plans with a funding shortfall for the preceding plan year are subject to the quarterly contribution requirements.

The problem states the funding target attainment percentage (FTAP) at 01/01/2011 is 76%:

$$\text{2011 FTAP} = \frac{(\text{AAV} - \text{CB} - \text{PB})}{\text{Non At-Risk FT}} = 76\%$$

$$\text{Non A-R FT} = (\text{AAV} - \text{CB} - \text{PB}) / 76\%$$

$$\text{2011 Shortfall} = \text{FT} - (\text{AAV} - \text{CB} - \text{PB})$$

It should be clear that the 2011 funding shortfall is greater than zero. As a result, the plan is subject to the quarterly contribution requirement 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 (85,000) or 90% of the 2012 MRC (150,000). The resulting RAP is 85,000. The 2012 required quarterly installment is 25% of the RAP, which is 21,250.

## Fall 2011 EA-2A Exam Solutions

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### Problem 50 – Page 2

#### Effect of carryover balance

The plan has a carryover balance of 38,000 at 01/01/2012. It may be possible to use that to satisfy the required quarterly installments.

You have to read the question carefully. It states that “no funding balances were applied or contributions were made before 07/15/2012”.

#### Liquidity Requirement

The best way to think of the effect of the liquidity requirement is that it can increase the amount of a required quarterly installment. Since the liquidity requirement exceeds the quarterly installment, the 04/15/12 required installment increases to 115,000.

In the regulation at 1.430(j)-1(d)(1)(ii), the liquidity shortfall is limited to the amount which, when added to prior installments paid for the year, would increase the FTAP to 100%. The problem gives you this amount as 100,000.

The result is that the 03/31/12 liquidity shortfall is capped at 100,000. This results in a required installment at 04/15/12 of 100,000. The difference of 78,750 (100,000 - 21,250) is called the liquidity increment. This will be used to determine the interest penalty, and for discounting the contributions back to the valuation date.

#### Required Quarterly Installments

The problem states that the plan sponsor paid the necessary contributions at 07/15/02. Only the required quarterly installment for 07/15/02 is paid on a timely basis:

<u>Due date</u>	<u>Required Installment</u>	<u>Amount Available</u>	<u>Liquidity Requirement</u>	<u>OVER (UNDER)</u>
03/31/2012		0	100,000	
04/15/2012	100,000	0		(100,000)
07/15/2012	21,250	121,250		

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%.

This sounds similar to the other quarterly contribution question on this exam, but there is an extra twist. In the regulation at 1.430(j)-1(d)(2)(i), it has some tricky rules. Regardless of the actual date of payment of a contribution, the liquidity increment is treated as unpaid until the close of the NEXT quarter (after the date of the liquidity requirement). But the interest adjustment to the valuation date reflects the actual date of payment of the contribution.

What that means is that you need to consider the contribution of 121,250 in three separate pieces. There are two contributions at that date of 21,250, which satisfy the required quarterly installments. One is late for three months, and the other is paid timely. Both of these contributions are discounted back to the valuation date with 6.5 months of interest.

There is also a contribution of 78,750 for the liquidity requirement at 03/31/12. To apply the penalty interest rate, you treat it as paid at 06/30/12 (the end of the next quarter following the liquidity requirement date). This contribution is discounted back to the valuation date with 6.5 months of interest, since it is actually paid at 07/15/12. But it is considered as late for 2.5 months (from 04/15 to 06/30).

<u>Due date</u>	<u>Required Installment</u>	<u>Amount Available</u>	<u>OVER (UNDER)</u>	<u>Present value</u>
04/15/2012	100,000	0	(100,000)	
07/15/2012	21,250	21,250		$21,250(1.06)^{-6.5/12}$
07/15/2012		21,250		$21,250(1.06)^{-3.5/12}(1.11)^{-3.0/12}$
07/15/2012		78,750		$78,750(1.06)^{-4.0/12}(1.11)^{-2.5/12}$

$$116,518 = 20,590 + 20,354 + 75,574$$

**Answer is C**

### NOTES

1. The answer above is based on the proposed regulations. Under the final regulation released 09/09/2015, the late payment of 78,750 at 07/15/2012 is treated quite differently. At 06/30/2012, the 78,750 is no longer treated as unpaid.

The 2012 MRC is increased to reflect the penalty interest on the 78,750, assuming a payment date of 06/30/2012. The increase in MRC is 731, which is calculated as the difference between two present values. One calculation has no penalty interest, and the other assumes the payment is 3.5 months late:

$$731 = 76,489 - 75,758 = 78,750(1.06)^{-6.0/12} - 78,750(1.06)^{-3.5/12}(1.11)^{-2.5/12}$$

For the answer to the exam question, the present value of the 78,750 would reflect the payment date of 07/15/2012 but no penalty interest:

$$\begin{aligned} 76,303 &= 78,750(1.06)^{-6.5/12} \\ 117,247 &= 20,590 + 20,354 + 76,303 \end{aligned}$$

As of 06/30/2012, the liquidity shortfall will be recalculated. The 78,750 contribution can be used to satisfy the 06/30/2012 liquidity shortfall. If any excess contribution remains, it can be used to satisfy the 10/15/2012 required installment.

**NOTES - continued**

2. In the analysis of the 2011 shortfall versus the 2011 FTAP, it does not matter whether the plan is in At-Risk status. If the plan is in At-Risk status, the 2011 shortfall would be greater. Based on 2011 exam condition 42, the plan is not in At-Risk status - so you don't need to waste any time thinking about this on the exam.
3. If you overlooked the statement that "no funding balances were applied", then you would try to analyze the 2011 "funding ratio". But you can not determine whether the 2011 "funding ratio" is below 80%. This means that you have to rely on 2011 exam condition 27, which will result in the wrong answer to this question.