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FALL 2006 EA-2A EXAM SOLUTIONS

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Fall 2006 EA-2A Exam Solutions

These solutions use beginning of year amortization payments in setting up the Minimum Funding Standard Account. These solutions were prepared based on the law as in effect at June 30, 2006.

The Pension Protection Act of 2006 was NOT on the syllabus for the 2006 exam. As a result, most of the solutions for the 2006 exam are no longer applicable for 2007 and later.

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!

For 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 amount should never be based on the Alternative MFSA. This amount may be increased by the amount of any "includible employer contribution."
4. The maximum deductible limit is the greater of (1) and (3), but not greater than (2).
5. If the Unfunded Current Liability exceeds the final deductible limit, then the final deductible limit will be the UCL. This UCL limit ignores recent benefit improvements for small plans with highly compensated employees.

Revision History:

September 3, 2019	Corrected solutions for problems 3 and 30
October 17, 2009	Corrected solutions for problems 3 and 30
July 25, 2008	Corrected solutions for problems 1, 5, 10, 11, 12, 13, 15, 18, 19, 26, 27, 28, 39 and 43
November 19, 2007	Corrected solution for problem 16
August 31, 2007	Original solutions

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NOTES on 2006 exam

Revised 07/25/08

The 2006 exam was easier than the pre-2006 exams. This means that you had to get a higher number of points correct to pass in 2006 than on most of the earlier exams:

<u>Exam</u> <u>Year</u>	<u>Pass</u> <u>Mark</u>	<u>Percentage</u> <u>Who passed</u>	
2006	113	58.6	(no, that is not a typo!)
2005	99	43.0	
2004	104	44.6	
2003	102	41.4	
2002	112	44.1	

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Problem 1

Similar to 2005 #11

Revised 07/25/08

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

Age 59 at 01/01/06

Service 25 years

The Unit Credit normal cost is calculated as the present value of the change in the accrued benefit. With a zero percent salary scale, Smith's benefit accrual is $975 = 1.3\%(75,000)$.

With multiple retirement decrements, the normal cost must be calculated as a complicated summation:

$$NC = 975 * \sum_{t=0}^6 v^t p_{59}^{(T)} q_{59+t}^{(r)} ERF_{59+t} \ddot{a}_{59+t}^{(12)}$$

The unreduced benefit is available at retirement ages 64 and above, when the participant has completed 30 years of service. You must calculate the early retirement factor at age 63:

$$ER \text{ factor at } 63 = .92 = [1 - 2(4\%)]$$

The final step is to evaluate the summation shown previously. The only ages you need to calculate are those with retirement decrements:

		(1)	(2)	(3)		(4)	(5)	(6)
t	59+t	v^t	${}_t p_{59}^{(T)}$	$q_{59+t}^{(r)}$	${}_t p_{59+t}^{(T)}$	ERF_{59+t}	$\ddot{a}_{59+t}^{(12)}$	(1)(2)(3)(4)(5)
4	63	.7629	1.000	0.33	0.67	.92	9.72	2.2513
5	64	.7130	0.670	0.50	0.50	1.00	9.48	2.2643
6	65	.6663	0.335	1.00	0.00	1.00	9.24	<u>2.0626</u>
								6.5782

The normal cost equals $975 * 6.5782$, which is 6,414.

Answer is B

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Problem 2 – Page 1

The key to this problem is knowing how to calculate the Aggregate normal cost. You also need to calculate the Full Funding Limitation (FFL) to see if there is a FFL credit in the 2006 Minimum Funding Standard Account (MFSA).

The first step is calculation of the Aggregate PVNC. One trick is coming up with the total PVB. You can use the Entry Age Normal (EAN) results to derive the PVB:

$$\begin{aligned}\text{EAN AL} &= \text{PVB} - \text{PVNC} \\ 450,000 &= \text{PVB} - 10.0 * 25,000 \\ \text{PVB} &= 450,000 + 10.0 * 25,000 \\ &= 700,000\end{aligned}$$

$$\begin{aligned}\text{AGG PVNC} &= \text{PVB} - \text{AAV} - (\text{O/S } \$412 \text{ bases} - \text{CB}) && \text{NOTE: No ARA under Aggregate} \\ &= 700,000 - 451,000 - (0 - 0) \\ &= 249,000\end{aligned}$$

$$\text{PVL} / \text{L} = 10.0 \text{ (given)}$$

$$\begin{aligned}\text{AGG NC} &= \text{PVNC} / (\text{PVL} / \text{L}) \\ &= 249,000 / 10.0 \\ &= 24,900\end{aligned}$$

2006 Minimum Funding Standard Account			
Charges		Credits	
Normal Cost	24,900	Credit Balance	0
		12/31 contribution	x
7% interest	1,743	7% interest	0
Total charges	<u>26,643</u>	Total credits	<u>x</u>

This seems to imply that the minimum contribution is 26,643, but that may be incorrect. You should check the Full Funding Limitation for purposes of 412.

Based on the 12/82 proposed regulation, the Accumulated Funding Deficiency (AFD) based on no contribution and no credit balance must be calculated. If the AFD exceeds the Full Funding Limitation, then there will be a Full Funding Credit in the MFSA for 2006. The AFD equals the total MFSA charges less the amortization credits with interest, or 26,643.

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Problem 2 – Page 2

The final Full Funding Limitation is the greater of the ERISA and RPA FFL values. If the Accumulated Funding Deficiency exceeds the Full Funding Limitation, then there is a credit in the MFSA equal to the excess.

The ERISA Full Funding Limitation is defined as:

$$\begin{aligned}\text{\$412 "ERISA" FFL} &= (1+i) * (\text{EAN NC} + \text{EAN AL}) - (1+i) * [\text{lesser (MVA, AAV)} - \text{CB}] \\ &= 1.07 * (25,000 + 450,000) - 1.07 * (449,000 - 0) \\ &= 27,820\end{aligned}$$

The RPA Full Funding Limitation is defined as follows (NOTE - this uses 12/31 CL)

$$\begin{aligned}\text{\$412 RPA FFL floor} &= 90\% (12/31 \text{ RPA CL}) - [1.07(\text{AAV})] && \text{(if no ben pmts)} \\ 90\% \text{ 12/31 RPA CL} &= 512,100 = 90\% [569,000] \\ 12/31 \text{ asset value} &= 482,570 = (1.07)(451,000) \\ \text{RPA '94 FFL floor} &= 29,530\end{aligned}$$

The §412 FFL credit is defined as the excess of the Accumulated funding deficiency (AFD) based on zero contribution and zero credit balance over the FFL. The AFD equals the previously calculated charges of 26,643. Since the AFD is less than the final FFL of 29,530, there is NO FFL credit in the MFSA for 2006.

The previously calculated minimum of 26,643 is correct.

Answer is B

NOTE:

You could save a tiny bit of work by skipping the calculation of the RPA FFL. Since the AFD is lower than the ERISA FFL, it must also be lower than the final FFL. The reason is that the final FFL is defined as the greater of the ERISA FFL and the RPA FFL.

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

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

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

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

For all of these methods, a corridor must be applied for the final actuarial value of assets. Based on the general conditions for the EA exams, you are not working on a multi-employer plan. The final actuarial value of assets can't be lower than 80% of market value, nor greater than 120% of market value. For a multi-employer plan, there is a wider corridor available.

(15) Smoothed market value without phase-in

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

The actuarial value of assets is calculated using decreasing fractions of each of the prior year's gain or loss. With a four year average, the fractions are 3/4, 2/4 and 1/4:

$$01/06 \text{ AAV} = 01/06 \text{ MVA} - 3/4(2005 \text{ G/L}) - 2/4(2004 \text{ G/L}) - 1/4(2003 \text{ G/L})$$

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

$$01/06 \text{ AAV} = 01/06 \text{ MVA} - 4/5(2005 \text{ G/L}) - 3/5(2004 \text{ G/L}) - 2/5(2003 \text{ G/L}) - 1/5(2002 \text{ G/L})$$

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

(next page)

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Problem 3 – Page 2

Revised 09/03/19

You need to calculate the 2005 G/L item. To do this, you need to calculate the expected market value of assets at 01/01/06.

01/01/06 Asset calculations

$$\begin{aligned} 01/06 \text{ } e\text{MVA} &= (1.07)*(355,000) + (1.035)*(15,000-10,000) && \text{(simple interest)} \\ &= 385,025 \end{aligned}$$

$$\begin{aligned} \text{MVA G/L} &= 01/06 \text{ MVA} - 01/06 \text{ } e\text{MVA} \\ &= 345,000 - 385,025 \\ &= -40,025 && \text{(Loss)} \end{aligned}$$

$$\begin{aligned} 01/06 \text{ AAV} &= 01/06 \text{ MVA} - 4/5(2005 \text{ G/L}) - 3/5(2004 \text{ G/L}) - 2/5(2003 \text{ G/L}) - 1/5(2002 \text{ G/L}) \\ &= 345,000 - (.80)(-40,025) - (.60)(-75,000) - (.40)(-34,000) - (.20)(-45,000) \\ &= 444,620 \end{aligned}$$

$$\begin{aligned} 01/06 \text{ AAV} &= \text{Lesser of } [120\%(\text{MVA}) \text{ and greater of } (\text{AAV or } 80\%(\text{MVA}))] \\ &= \text{Lesser of } [1.20(345,000) \text{ and greater of } (444,620 \text{ or } .80(345,000))] \\ &= 414,000 \end{aligned}$$

Answer is D

NOTES:

1. In the calculation of the AAV above, asset gains are treated as positive numbers, and asset losses are treated as negative numbers. Of course this does not match the signs for the asset gains and losses given in the problem.
2. If you used compound interest to calculate the expected market values, the expected market value at 01/06 and the G/L value for 2005 are slightly different:

$$\begin{aligned} 01/06 \text{ } e\text{MVA} &= 385,022 \\ 2005 \text{ G/L} &= 40,022 \\ 01/06 \text{ AAV} &= 414,000 && \text{(corridor still applies)} \end{aligned}$$

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Problem 4 – Page 1

The key to this problem is recognizing that you should calculate the gain / loss for 2005. The first step is to determine the normal cost and accrued liability for 2006:

01/01/06 past service 25 years (given)

$$01/01/06 \text{ UAL} \quad 400,000 = \text{AL} - \text{AAV}$$

$$01/01/06 \text{ AL} \quad 500,000 = \text{UAL} + \text{AAV}$$

$$01/01/06 \text{ NC} \quad 500,000/25 = 20,000$$

You can calculate the amount of the G/L base by using the actuarial equation of balance. You need to do several calculations using the “old” assumptions (same assumptions as 2005):

OLD ASSUMPTIONS

$$\begin{aligned} \text{Total G/L} &= {}_e\text{UAL}_1 - \text{UAL}_1 \\ {}_e\text{UAL}_1 &= (1+i)(\text{NC}_0 + \text{UAL}_0) - (\text{contribution} + \text{interest}) \\ &= 12/31/05 \text{ O/S 412 bases} - \text{CB} - \text{ARA} \end{aligned}$$

$$\begin{aligned} \text{IAL amort} &= 200,000 / \ddot{a}_{\overline{30}|.07} \\ &= 15,063 \end{aligned}$$

$$\begin{aligned} 12/31 \text{ 412 base} &= 15,063 * \ddot{a}_{\overline{26}|.07} \\ &= 190,599 \end{aligned}$$

$$\begin{aligned} {}_e\text{UAL}_1 &= 12/31/05 \text{ O/S 412 bases} - \text{CB} - \text{ARA} \\ &= 190,599 - 7,000 - 0 \end{aligned}$$

$$\begin{aligned} \text{UAL}_1 &= 300,000 \\ \text{Loss} &= 300,000 - 183,599 \\ &= 116,401 \end{aligned}$$

Now you can calculate the amortizations for the two new bases:

$$\begin{aligned} \text{Loss amort} &= 116,401 / \ddot{a}_{\overline{5}|.07} \\ &= 26,532 \end{aligned}$$

$$\begin{aligned} \text{Assump amort} &= 100,000 / \ddot{a}_{\overline{10}|.07} \\ &= 13,306 \end{aligned}$$

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Problem 4 – Page 2

Now you can set up the MFSA and calculate the 12/31/06 minimum contribution:

2006 Minimum Funding Standard Account			
Charges		Credits	
Normal Cost	20,000	Credit Balance	7,000
IAL amortization	15,063		
Assump amortization	13,306	12/31 minimum	x
Loss amortization	26,532		
7% interest	5,243	7% interest	490
Total charges	80,144	Total credits	x + 7,490

You should at least think about the FFL calculations. Based on the unfunded accrued liability of 400,000 and the asset value of 100,000, the FFL will not apply.

The minimum contribution at 12/31/06 is $72,654 = 80,144 - 7,490$.

Answer is D

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Problem 5 – Page 1

Similar to 2005 #05

The key to this problem is calculating the Full Funding Limitation (FFL) credit in the 2006 Minimum Funding Standard Account (MFSA). The problem has been simplified a bit, since you have the Aggregate cost method, with no amortizations in the MFSA:

2006 Minimum Funding Standard Account			
Charges		Credits	
Normal Cost	40,000	Credit Balance	0
		12/31 contribution	x
7% interest	2,800		
12/31 412(l) AFC	24,000	7% interest	0
Total charges	<u>66,800</u>	Total credits	<u>x</u>

This seems to imply that the minimum contribution is 66,800, but that is incorrect. You should check the Full Funding Limitation for purposes of 412.

Based on the 12/82 proposed regulation, the Accumulated Funding Deficiency (AFD) based on no contribution and no credit balance must be calculated. If the AFD exceeds the Full Funding Limitation, then there will be a Full Funding Credit in the MFSA for 2006. The AFD equals the total MFSA charges less the amortization credits with interest, or 66,800.

The final Full Funding Limitation is the greater of the ERISA and RPA FFL values. If the Accumulated Funding Deficiency exceeds the Full Funding Limitation, then there is a credit in the MFSA equal to the excess.

The ERISA Full Funding Limitation is defined as:

$$\begin{aligned}\text{\$412 "ERISA" FFL} &= (1+i) * (\text{EAN NC} + \text{EAN AL}) - (1+i) * [\text{lesser (MVA, AAV)} - \text{CB}] \\ &= 1.07 * (30,000 + 750,000) - 1.07 * (730,000 - 0) \\ &= 53,500\end{aligned}$$

The RPA Full Funding Limitation is defined as (NOTE - this uses 12/31 CL)

$$\begin{aligned}\text{\$412 RPA FFL floor} &= 90\% (12/31 \text{ RPA CL}) - [1.07(\text{AAV})] && \text{(if no ben pmts)} \\ 90\% \text{ 12/31 RPA CL} &= 845,100 = 90\% [939,000] \\ 12/31 \text{ asset value} &= 781,100 = [(1.07)(730,000)] \\ \text{RPA '94 FFL floor} &= 64,000\end{aligned}$$

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Problem 5 – Page 2

Revised 07/25/08

The §412 FFL credit is defined as the excess of the Accumulated funding deficiency (AFD) based on zero contribution and zero credit balance over the FFL. The AFD equals the previously calculated charges of 66,800. Since the AFD of 66,800 exceeds the FFL of 64,000, there is a FFL credit in the MFSA for the excess of 2,800.

With a credit balance of zero, you know that the minimum contribution at 12/31 must equal the FFL of 64,000. You don't need to finalize the MFSA.

Answer is C

Just in case you still want to see the final MFSA for 2006:

2006 Minimum Funding Standard Account			
Charges		Credits	
Normal Cost	40,000	Credit Balance	0
		12/31 contribution	x
7% interest	2,800	12/31 FFL credit	2,800
12/31 412(l) AFC	24,000	7% interest	0
Total charges	<u>66,800</u>	Total credits	<u>x + 2,800</u>

The minimum contribution at 12/31/06 is 66,800 - 2,800, or 64,000.

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Problem 6

The key to this problem is handling the disability decrement correctly in calculating the present value of the future benefits, as well as the temporary annuity for the normal cost.

Age 63 at 01/01/06

Service 34 years

Aggregate PVNC = PVB – AAV – (O/S 412 bases – CB)

Aggregate NC = PVNC / avg (PVE/Earn)

With pre-retirement decrements, the present value of benefits is usually calculated as a complicated summation:

$$PVB = \sum_{t=0}^2 v^t p_{63}^{(T)} q_{63+t}^{(i)} \text{Benefit}_{63+t} \ddot{a}_{63+t}^{(12)}$$

The trick in this problem is that the annuity factor uses different mortality, depending on whether it is for disability at age 64, or for retirement at age 65. With only one decrement at age 64 and at age 65, you don't have to use the complicated summation formula to calculate the PVB.

To keep things simple, first you should calculate the projected benefit at each age:

Age 63: 2%(34)(100,000)

Age 64: 2%(35)(100,000)(1.04) = 72,800

Age 65: 2%(36)(100,000)(1.04)² = 77,875

$$\begin{aligned} PVB &= v^1 {}_1p_{63}^{(T)} (20\%) \text{BEN}_{64}(6.88) + v^2 {}_2p_{63}^{(T)} (100\%) \text{BEN}_{65}(9.24) \\ &= (1.07)^{-1} (100\%) (20\%) (72,800) (6.88) + (1.07)^{-2} (1-20\%) (100\%) (77,875) (9.24) \\ &= 93,619 + 502,798 \\ &= 596,417 \end{aligned}$$

When you calculate the temporary annuity, be careful. It should include the salary scale, and it should allow for the 20% disability decrement at age 64:

$$\begin{aligned} {}^s\ddot{a}_{63:2} &= 1 + (1-20\%)(1.04/1.07) \\ &= 1.7776 \end{aligned}$$

$$\begin{aligned} PVNC &= 596,417 - 150,000 - (0 - 0) \\ &= 446,417 \end{aligned}$$

$$\begin{aligned} AGG \text{ NC} &= 446,417 / 1.7776 \\ &= 251,139 \end{aligned}$$

Answer is B

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Problem 7

The key to this problem is recognizing that you should determine the gain / loss bases for both 2005 and 2006. The first step is to determine the G/L amortization amount for 2005:

$$\begin{aligned}\text{IAL amort} &= 1,200,000 / \ddot{a}_{\overline{30}|.07} \\ &= 90,377 \\ \text{Loss amort} &= 100,000 - 90,377 = 9,623 \quad (\text{for 01/01/05 Loss base})\end{aligned}$$

Now you can use the equation of balance to solve for the 01/01/06 Loss base:

$$\begin{aligned}01-06 \text{ UAL} &= \text{O/S 412 bases} - \text{CB} - \text{ARA} \\ &= 1,800,000 - 400,000 \\ 1,400,000 &= 90,377 * \ddot{a}_{\overline{28}|.07} + 9,623 * \ddot{a}_{\overline{4}|.07} + \text{Loss} - 20,000 - 0 \\ &= 1,173,703 + 34,876 + \text{Loss} - 20,000 \\ \text{Loss} &= 211,421 \\ \text{Loss amort} &= 211,421 / \ddot{a}_{\overline{5}|.07} \\ &= 48,190\end{aligned}$$

Now you can set up the MFSA and calculate the 12/31/06 minimum contribution:

2006 Minimum Funding Standard Account			
Charges		Credits	
Normal Cost	250,000	Credit Balance	20,000
IAL amortization	90,377		
2004 Loss amortization	9,623	12/31 minimum	x
2005 Loss amortization	48,190		
7% interest	27,873	7% interest	1,400
Total charges	426,063	Total credits	x + 21,400

You should at least think about the FFL calculations. Based on the unfunded accrued liability of 1,400,000, the FFL will not apply.

The minimum contribution at 12/31/06 is $404,664 = 426,063 - 21,400$.

Answer is D

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Problem 8

Similar to 2004 #44

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

The deductible limit for the taxable year ending 12/31/06 is based on the valuation for the plan year beginning in that tax year. The 04/01/06 valuation should be used to determine the deductible limit needed for the answer to this problem.

The first step should be to calculate the normal cost plus limit adjustments. The ten year amortization bases include the initial accrued liability. The deductible limit is the normal cost plus limit adjustments brought forward with interest to the earlier of the end of the plan year, or the end of the tax year, which is 12/31/06.

Based on the information given in the problem, the §412 normal cost and PVNC both equal the §404 values. Based on the general exam conditions, you can assume that all prior contributions have been deducted, so the assets and unfunded accrued liability values are the same under both §404 and §412. Based on exam condition #27, the §412 values are given in exam problems.

You should use the §412 equation of balance to solve for the Initial Accrued Liability. The plan was set up in 1997, which is 9 years before 2006. There are 21 years remaining in the amortization base under §412:

$$\begin{aligned}04-06 \text{ UAL} &= \text{O/S } 412 \text{ bases} - \text{CB} - \text{ARA} \\345,000 &= \text{IAL} * (\ddot{a}_{\overline{21}|.07} / \ddot{a}_{\overline{30}|.07}) - 25,000 - 0 \\ \text{IAL} &= 423,731 \\ \text{Limit adjustment} &= 423,731 / \ddot{a}_{\overline{10}|.07} \\ &= 56,383 \\ \text{Deductible limit} &= (50,000 + 56,383) * [1 + (9/12)*.07] \\ &= 111,968\end{aligned}$$

The second step is usually to check the Full Funding Limitation under §404. Since you have no market value of assets, you can't check the Full Funding Limitation. The third step would be to calculate the minimum contribution required under §412. Since the only amortization base is for the IAL, the 412 minimum contribution will be less than 111,968.

You can't calculate the deductible limit based on unfunded current liability. The final deductible limit is 111,968.

Answer is D

On a compound interest basis, the deductible limit is 111,921 which is also in answer range D.

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Problem 9

Similar to 2003 #10

The key to this problem is correctly calculating the amortization of the funding waiver in 2006. You are told there is a funding waiver for 2005. You would set up a waiver base at 01/01/2006, and amortize this over five years.

The funding waiver is equal to the 2005 minimum contribution:

$$\begin{aligned} \text{2005 Waiver} &= 1.08 * (\text{normal cost} + \text{IAL} / \ddot{a}_{\overline{30}|.08}) \\ &= 1.08(100,000 + 600,000 / \ddot{a}_{\overline{30}|.08}) \\ &= 1.08(100,000 + 49,349) \\ &= 161,296 \end{aligned}$$

You are given the Federal mid-term rate as 6.76%. Since the valuation interest rate is greater than 6.76%, you should use the valuation rate of interest of 8% to amortize the G/L base.

$$\begin{aligned} \text{Waiver amort} &= 161,296 / \ddot{a}_{\overline{5}|.08} \\ &= 37,405 \end{aligned}$$

2006 Minimum Funding Standard Account			
Charges		Credits	
Normal Cost	90,000	Credit Balance	0
IAL amortization	49,349	12/31/03 contribution	x
Waiver	37,405		
8% interest	14,140	8% interest	0
Total charges	<u>190,894</u>	Total credits	<u>x</u>

The 12/31/06 minimum contribution is equal to the charges of 190,894.

Answer is E

NOTE:

Normally you would calculate an end of year amortization payment for the waiver. But this is only necessary when the waiver amortization rate is different than the valuation interest rate.

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Problem 10

Revised 07/25/08

The key to this problem is recognizing that you need to derive the value of the credit balance at 12/31/05. You can use the equation of balance under the Entry Age Normal method, prior to the change in cost method.

When you change to the Aggregate method, you can discard all of the 412 amortization bases. The only ones you can't get rid of are for amortization of waiver bases, AMFSA switch-back, and shortfall bases. The plan was set up in 2000, which is 6 years before 2006. There are 24 years remaining in the amortization base under 412:

$$\begin{aligned}\text{EAN UAL} &= \text{EAN AL} - \text{AAV} \\ &= 925,000 - 500,000\end{aligned}$$

$$\begin{aligned}425,000 &= 12/31/05 \text{ O/S } \$412 \text{ bases} - \text{CB} - \text{ARA} \\ &= 500,000 * (\ddot{a}_{24|.07} / \ddot{a}_{30|.07}) + 8,000 * (\ddot{a}_{4|.07} / \ddot{a}_{5|.07}) - \text{CB} - 0\end{aligned}$$

$$\begin{aligned}425,000 &= 462,136 + 6,609 - \text{CB} \\ \text{CB} &= 43,745\end{aligned}$$

$$\begin{aligned}\text{Aggregate PVNC} &= \text{PVB} - \text{AAV} - (\text{O/S } 412 \text{ bases} - \text{CB}) \\ \text{Aggregate NC} &= \text{PVNC} / \text{avg (PVE/Earn)}\end{aligned}$$

$$\begin{aligned}\text{AGG PVNC} &= 1,500,000 - 500,000 - (0 - 43,745) \\ &= 1,043,745\end{aligned}$$

$$\begin{aligned}\text{PVE/E} &= 9,000,000 / 800,000 = 11.25 \\ \text{AGG NC} &= 1,043,745 / 11.25 = 92,777\end{aligned}$$

Now you can set up the MFSA and calculate the 12/31/06 minimum contribution:

2006 Minimum Funding Standard Account			
Charges		Credits	
Normal Cost	92,777	Credit Balance	43,745
		12/31 minimum	x
7% interest	6,494	7% interest	3,062
Total charges	99,271	Total credits	x + 46,807

You should at least think about the FFL calculations. Based on the EAN unfunded accrued liability of 425,000, the FFL will not apply.

The minimum contribution at 12/31/06 is $52,465 = 99,271 - 46,807$.

Answer is D

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Problem 11 - Page 1

Similar to 2004 #33

This problem has a salary scale, and a cost method given as Unit Credit. One key to this problem is knowing that the calculations are done using Projected Unit Credit (PUC).

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

You need to calculate the PUC accrued liability at 01/01/2006. Under PUC, the accrued liability is defined as the present value of the "funding accrued benefit" (FAB):

$$AL = PV(FAB)$$

The 1.412(c)(3)-1 regulations define "funding accrued benefit":

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

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

Retired AL = PV of Early retirement benefit

Active AL = PV of FAB

Retired calculations

Description

01/2006 Age 60

Past service 28

2005 pay (age 59) 85,000

Accrued benefit $1.25\%(28)(\text{Final pay})$
 $1.25\%(28)(85,000) = 29,750$

Early retirement factor @ 59 $1 - (2 \times 4\%) = .92$
 $.92(29,750)$
Early retirement benefit $= 27,370$

Retired AL $27,370 \ddot{a}_{60}^{(12)}$
 $= 330,630$

Active calculations

The plan benefit is based on the final year of pay. The normal retirement age is 62, so you need to project pay to age 61.

$$\text{Projected pay @ 61} = 85,000 \cdot (1.03)^2$$

$$\begin{aligned} \text{Funding Accrued benefit} &= 1.25\%(28)(\text{Final pay}) \\ &= 1.25\%(28)(85,000)(1.03)^2 \\ &= 29,750(1.03)^2 \\ &= 31,562 \end{aligned}$$

$$\begin{aligned} \text{Active AL} &= 31,562(D_{62} / D_{60}) \ddot{a}_{62}^{(12)} \\ &= 31,562(1.07)^{-2}(11.61) \\ &= 320,056 \end{aligned}$$

The loss is 10,574, calculated as 330,630 - 320,056.

Answer is B

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Problem 12 - Page 1

Similar to 2001 #24

The Shortfall regulation at 1.412(c)(1)-2(h)(1) states the experience gain / loss must be amortized based on §412(b)(2)(B)(iv) or §412(b)(3)(B)(ii). Then in 1.412(c)(1)-2(h)(2), for plans that use the Shortfall modification to their funding method, it says there is a different set of amortization years for the experience gain / loss.

The experience G/L amortization years in 1.412(c)(1)-2(h)(2) match those in 1.412(c)(1)-2(g)(2) for the amortization of the Shortfall G/L:

- The first year is the earlier of
 - 5th year following the plan year in which the Shortfall G/L arose, or
 - 1st year after expiration of the collective bargaining agreement in effect at the end of the plan year in which the Shortfall G/L arose
- The last year is the 15th year following the year the Shortfall G/L arose

The Shortfall G/L base is entered into the minimum funding standard account, and increases each year with interest until the amortization begins. At the point when payments should begin they are determined based on the outstanding balance. Based on the prior definitions, the base will be amortized over a period between 11 and 15 years.

The key aspect of this problem is the annual collective bargaining agreements (CBA) that expire on December 31 of each year. The IRC regulations at 1.412(c)(1)-2(g)(2)(i) state that a CBA that expires on the last day of the year is deemed renewed on the last day of the year for the same number of years as the succeeding CBA.

The effect of this provision with annual CBA is to delay for one year the amortization of both experience and shortfall gains and losses. The 2005 CBA expires 12/31/2005, so it is treated as if it expires on 12/31/2006 for purposes of determining amortization periods.

Neither the Shortfall G/L nor the experience G/L for 2005 would be amortized in 2006. The solution to the problem is made shorter, since you can skip the calculation of both the experience G/L and the Shortfall G/L for 2005.

Here are the steps for calculating the Shortfall G/L under the shortfall method:

1. Calculate the annual computation charge. This is the normal cost, plus amortization charges, less amortization credits, under the MFSA. This includes interest to the end of the year. This calculation ignores the credit balance.
2. The Shortfall G/L equals the annual computation charge, multiplied by $\{[(\text{actual hours worked}) / (\text{estimated hours worked})] - 1.0\}$. If the result is positive, it is a shortfall gain.

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Problem 12 - Page 2

The first step is calculation of the total actual and estimated hours worked during 2005. You are told that each participant is assumed to work 1,800 hours per year. The actual contribution for 2005 is 210,000, which is based on \$10 per hour:

$$\text{Actual hours worked in 2005:} \quad 21,000 = \$210,000 / \$10$$

$$\text{Estimated hours worked in 2005:} \quad 19,800 = 1,800 * 11$$

$$\begin{aligned} \text{Annual computation charge} &= 1.07 * (\text{NC} + \text{IAL} / \ddot{a}_{30|.07}) \\ &= 1.07 * (75,000 + 750,000 / \ddot{a}_{30|.07}) \\ &= 140,690 \end{aligned}$$

$$\begin{aligned} \text{Shortfall Gain} &= 140,690 * [(21,000 / 19,800) - 1.0] \\ &= 8,527 \end{aligned}$$

Answer is D

NOTE:

The original answer key showed answer range C. To produce answer range C, it appears that the experience G/L for 2005 was used to determine the Shortfall G/L for 2006. The exact same error was made in the Shortfall G/L question on the 2001 exam (and the one before that!).

The first step is calculation of the total actual and estimated hours worked during 2004. You are told that each participant is assumed to work 1,800 hours per year. The actual contribution for 2004 is 180,000, which is based on \$10 per hour:

$$\text{Actual hours worked in 2004:} \quad 18,000 = \$180,000 / \$10$$

$$\text{Estimated hours worked in 2004:} \quad 18,000 = 1,800 * 10$$

Since the estimated hours worked were equal to the actual hours worked in 2004, there was no shortfall G/L in 2004. Now you can calculate the expected UAL to determine the experience G/L base that is established at 1/1/2005:

$$\begin{aligned} {}_e\text{UAL}_1 &= (1+i)(\text{NC}_0 + \text{UAL}_0) - (\text{contribution} + \text{interest}) \\ &= (1.07) * (50,000 + 750,000) - 180,000 \\ &= 676,000 \end{aligned}$$

$$\text{LOSS} = 515,000 - 676,000$$

$$\text{GAIN} = 161,000$$

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Problem 12 - Page 3

Revised 07/25/08

This is the correct calculation of the experience gain base. Based on 1.412(c)(1)-2(g)(2)(i), the annual CBA that expires at 12/31/2005 is treated as if it is renewed for 12 months, and thus has an expiration date at 12/31/2006.

The experience gain base should be increased with interest during 2006, and amortized starting 1/1/2007. Here is the result if it is incorrectly amortized over 5 years, and incorrectly starting 1/1/2006:

$$\begin{aligned}\text{Annual computation charge} &= 1.07*(NC + IAL / \ddot{a}_{\overline{30}|.07} - \text{Gain} / \ddot{a}_{\overline{5}|.07}) \\ &= 1.07*(75,000 + 750,000 / \ddot{a}_{\overline{30}|.07} - 161,000 / \ddot{a}_{\overline{5}|.07}) \\ &= 101,423\end{aligned}$$

$$\begin{aligned}\text{Shortfall Gain} &= 101,423*[(21,000 / 19,800) - 1.0] \\ &= 6,147\end{aligned}$$

But that value falls in answer range B. It appears that the solution for the original answer key amortized the gain over 15 years, and incorrectly starting 1/1/2006:

$$\begin{aligned}\text{Annual computation charge} &= 1.07*(NC + IAL / \ddot{a}_{\overline{30}|.07} - \text{Gain} / \ddot{a}_{\overline{15}|.07}) \\ &= 1.07*(75,000 + 750,000 / \ddot{a}_{\overline{30}|.07} - 161,000 / \ddot{a}_{\overline{15}|.07}) \\ &= 123,013\end{aligned}$$

$$\begin{aligned}\text{Shortfall Gain} &= 123,013*[(21,000 / 19,800) - 1.0] \\ &= 7,455\end{aligned}$$

Incorrect answer is C

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Problem 13

Similar to 1984 #18

Revised 07/25/08

Yes, that's correct - they actually tested this concept in 1984! The key to this problem is correctly handling the 2006 contribution.

Under the Frozen Initial Liability cost method, the normal cost is defined as

$$\text{FIL NC} = \frac{\text{PVB} - \text{AAV} - \text{UAL}}{\text{Average annuity}}$$

In this problem, you need to derive values for the AAV and the UAL at 12/31/06. You are told that the assets earned 3.5% during 2006. One key point of the problem is that you should not use the 2006 contribution for any purpose, regardless of the payment date. The reason is that it is considered a future plan year contribution, and should not affect the determination of the 2006 normal cost.

$$\begin{aligned} 12/31/06 \text{ AAV} &= 1.035(45,000) \\ &= 46,575 \end{aligned}$$

Under FIL, the actual UAL is defined as always equal to the expected UAL. If there is one year between valuation dates, the formula is the usual definition:

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

In the prior formula, the factor $(1+i)$ represents one full year of interest at the valuation rate. The contribution plus interest is calculated with interest at the valuation rate up to the next valuation date. Based on having two years between the valuation dates, the comparable formula is this

$${}_e\text{UAL}_1 = (1+i)^2(\text{NC}_0 + \text{UAL}_0) - (\text{contribution} + \text{interest})$$

The key is that the contribution plus interest is still calculated with interest at the valuation rate up to the next valuation date:

$$\begin{aligned} {}_e\text{UAL}_1 &= (1.07)^2(25,000 + 150,000) - 1.07(45,000) \\ &= 152,208 \end{aligned}$$

$$\begin{aligned} \text{FIL PVNC} &= \text{PVB} - \text{AAV} - \text{UAL} \\ &= 300,000 - 46,575 - 152,208 \\ &= 101,218 \end{aligned}$$

$$\begin{aligned} \text{PVE/E} &= 2,850,000 / 240,000 \\ &= 11.875 \end{aligned}$$

$$\begin{aligned} 12/31 \text{ NC} &= 101,218 / 11.875 \\ &= 8,524 \end{aligned}$$

Answer is D

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Problem 14

The key to this problem is handling the accumulated reconciliation account (and the funding deficiency) correctly in the actuarial equation of balance. You need to determine the Initial accrued liability, and then you can complete the MFSA.

$$\begin{aligned} \text{UAL} &= \text{AL} - \text{AAV} \\ &= 260,000 - 200,000 \\ &= 60,000 \end{aligned}$$

$$\begin{aligned} \text{UAL} &= \text{IAL} * (\ddot{a}_{\overline{27}|.07} / \ddot{a}_{\overline{30}|.07}) - 0 + 5,000 - 4,500 \\ 60,000 &= \text{IAL} * (\ddot{a}_{\overline{27}|.07} / \ddot{a}_{\overline{30}|.07}) + 500 \end{aligned}$$

You need the amortization payment for the Initial accrued liability in the MFSA, so don't bother solving for the Initial accrued liability:

$$\begin{aligned} \text{IAL} / \ddot{a}_{\overline{30}|.07} &= 59,500 / \ddot{a}_{\overline{27}|.07} \\ &= 4,639 \end{aligned}$$

Now you can set up the MFSA and calculate the 12/31/06 minimum contribution:

2006 Minimum Funding Standard Account			
Charges		Credits	
Debit balance	5,000	Credit Balance	0
Normal Cost	54,000		
IAL amortization	4,639	12/31 minimum	x
7% interest	4,455		
12/31 412(m) qtrly	1,850	7% interest	0
Total charges	69,944	Total credits	x

You should at least think about the FFL calculations. Based on the EAN unfunded accrued liability of 60,000 and the normal cost of 54,000, the FFL will not apply.

The minimum contribution at 12/31/06 is 69,944.

Answer is B

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Problem 15 – Page 1

Similar to 2005 #25

The key to this problem is calculating the accrued liability and normal cost under the Entry Age Normal (EAN) method. The problem asks for the Full Funding Limitation credit in the MFSA.

Under the Aggregate method, the present value of normal costs (PVNC) is defined as the present value of benefits less the assets less the outstanding §412 bases (reduced by the credit balance). The Aggregate normal cost is calculated by dividing the PVNC by the average temporary annuity from current age to the assumed retirement age. In this problem, the plan benefit is not based on pay, so the temporary annuity is an interest-only calculation.

<u>Description</u>	<u>Calculation</u>
01/2006 Age	50
Past service	8
Entry age	42
Total service	23

$$\begin{aligned}\text{Projected benefit} & 12(23)(65) \\ & = 17,940\end{aligned}$$

$$\begin{aligned}\text{PV future benefits at 50} & 17,940(D_{65} / D_{50}) \ddot{a}_{65}^{(12)} \\ & 17,940(1.07)^{-15}(10.0) \\ & = 65,023\end{aligned}$$

Now you can calculate the Aggregate PVNC:

$$\begin{aligned}\text{\$412 PVNC} & = \text{PVB} - \text{AAV} - (\text{O/S } \$412 \text{ bases} - \text{CB}) & \text{NOTE: No ARA under Aggregate} \\ & = 65,023 - 40,000 - (0 - 0) \\ & = 25,023\end{aligned}$$

Now you need to calculate the average temporary annuity, which can then be used to calculate the normal cost. You can simplify this to a certain annuity at a single interest rate:

$$\ddot{a}_{50:15} = \ddot{a}_{15|.07} = 9.7455$$

In general, you calculate the average annuity by dividing the present value of future lifetime by the number of participants. Since you only have one participant, the average temporary annuity is equal to 9.7455:

$$\begin{aligned}\text{\$412 NC} & = \text{PVNC} / (\text{PVL}/L) \\ & = 25,023 / 9.7455 \\ & = 2,568\end{aligned}$$

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Revised 07/25/08

Since this plan uses an aggregate type cost method, the ERISA FFL must be calculated using the entry age normal cost and accrued liability. You have to do a separate Entry Age Normal valuation to generate the ERISA FFL.

In general, the Entry Age Normal Cost (EANC) is defined as the present value of benefits at entry age, divided by a temporary annuity at entry age. If the benefit is defined based on pay, the EANC is calculated as a level percentage of salary, and the temporary annuity will include a salary scale.

The plan formula accrues benefits for all years of service, so you use the participant's age at hire as EA in these formulas:

$$\text{Level \$ EANC: } PVB_{EA} / \ddot{a}_{EA:RA-EA}$$

<u>Description</u>	<u>Calculation</u>
Entry age	42
Projected benefit	17,940 (previously calculated for Aggregate)
PV future benefits at 42	$17,940(D_{65} / D_{42}) \ddot{a}_{65}^{(12)}$ $17,940(1.07)^{-23}(10.0)$ $= 37,844$

The next step is calculation of the EA normal cost and accrued liability.

$$\ddot{a}_{42:23} = \ddot{a}_{23|.07}$$
$$= 12.0612$$

$$\begin{aligned} EANC_{42} &= 37,844 / 12.0612 \\ &= 3,138 \end{aligned}$$

Next, you can use the typical prospective formula for the accrued liability:

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

$$\begin{aligned} PV(EANC) &= EANC(\ddot{a}_{50:15}) \\ &= 3,138(9.7455) \quad (\text{previously calculated for Aggregate}) \\ &= 30,578 \end{aligned}$$

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$$\begin{aligned}\text{EAN AL} &= 65,023 - 30,578 \\ &= 34,445\end{aligned}$$

Finally, you have enough information to calculate the FFL values. The ERISA Full Funding Limitation is defined as:

$$\begin{aligned}\text{\$412 "ERISA" FFL} &= (1+i) * (\text{EAN NC} + \text{EAN AL}) - (1+i) * [\text{lesser (MVA, AAV)} - \text{CB}] \\ &= 1.07 * (3,138 + 34,445) - 1.07 * (38,000 - 0) \\ &= \text{Zero}\end{aligned}$$

The RPA Full Funding Limitation is defined as (NOTE - this uses 12/31 CL)

$$\begin{aligned}\text{\$412 RPA FFL floor} &= 90\% (12/31 \text{ RPA CL}) - [1.07(\text{AAV})] && \text{(if no ben pmts)} \\ 90\% \text{ 12/31 RPA CL} &= 45,000 = 90\% [50,000] \\ 12/31 \text{ asset value} &= 42,800 = [(1.07)(40,000)] \\ \text{RPA '94 FFL floor} &= 2,200\end{aligned}$$

The §412 FFL credit is defined as the excess of the Accumulated funding deficiency (AFD) based on zero contribution and zero credit balance over the FFL.

Under the Aggregate method, there are usually no charges except the normal cost. The AFD is 2,748, which equals 1.07 times the Aggregate normal cost of 2,568. Since this exceeds the FFL of 2,200, there is a FFL credit in the MFSA for the excess of 548.

Answer is C

The problem asked for the FFL credit. Here is what the MFSA looks like for 2006:

2006 Minimum Funding Standard Account			
Charges		Credits	
Normal Cost	2,568	Credit Balance	0
		12/31/ FFL credit	548
		12/31 minimum	x
7% interest	180	7% interest	0
Total charges	<u>2,748</u>	Total credits	<u>x + 548</u>

§404(a)(7)(A) of the IRC defines the overall deduction limitation for combinations of DB and DC plans. The limit is the greater of 25% of compensation, or the amount paid to the DB plans, not to exceed the minimum contribution requirement for the DB plan under §412. If the actual deduction for a year was based on the unfunded current liability, the deduction limitation would be no less than that amount.

DC PLAN

First you should calculate the deductible limit for the DC plan (easier than the DB plan). The profit sharing plan has a separate deduction limitation of 25% of gross compensation. The maximum amount that could be contributed to the profit sharing plan is 25% of (1,075,000), which gives 268,750.

The employer contribution to the DC plan is the sum of the employer match and the discretionary contribution, for a total of 87,500 (= 37,500 + 50,000). Neither of the employee contributions is considered as an employer contribution for the 404 deduction limitations.

DB PLAN

There are several steps to follow to determine the deductible limit:

1. The normal cost plus limit adjustments is equal to 225,000
2. The 404 FFL is equal to the greater of the ERISA FFL and the RPA FFL, or 300,000. Since that exceeds the normal cost plus limit adjustments, the 404 FFL does not apply.
3. The absolute minimum amount under the MFSA is 200,000.
4. The maximum deductible limit is the greater of (1) and (3), but not greater than (2). This is equal to the normal cost plus limit adjustments of 225,000.
5. The Unfunded Current Liability of 250,000 exceeds the deductible limit in step 4. The final deductible limit is 250,000.

Since the employer contribution was only 240,000, the actual deduction for 2006 was 240,000.

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Problem 16 – Page 2

OVERALL DB/DC

The overall deduction limitation is defined as the greater of 25% of taxable compensation, or the minimum contribution requirement for the DB plan. However, if the actual deduction for the DB plan is based on the unfunded current liability, then the overall deduction limitation is defined as the greater of 25% of taxable compensation, and the DB plan deduction based on unfunded current liability.

DB/DC 25% of pay limit	= 268,750	(previously calculated for the DC plan)
DB plan minimum	= 200,000	
DB plan unfunded current liability	= 250,000	
DB plan deduction	= 240,000	

The overall DB/DC plan deduction limit is 268,750. The employer has contributed 240,000 to the DB plan, and 87,500 to the DC plan. The total contribution of 327,500 exceeds the deductible limit by 58,750.

Answer is A

NOTE:

If you are curious, there is one more item to consider - what is the amount of the excise tax? Under 4972(c)(6), there is an excise tax exemption equal to the lesser of the DC contribution, or 6% of pay.

6% of pay is equal to $64,500 = .06(1,075,000)$. The result is that the entire non-deductible contribution is exempt, and there is no excise tax. That is probably why the question did not ask for the amount of the excise tax.

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Problem 17

This problem has a salary scale, and a cost method given as Unit Credit. One key to this problem is knowing that the calculations are done using Projected Unit Credit (PUC).

You need to calculate the PUC normal cost at 01/01/2006. Under PUC, the accrued liability is defined as the present value of the “funding accrued benefit” (FAB). The normal cost is defined as the present value of the change in the FAB:

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

The 1.412(c)(3)-1 regulations define "funding accrued benefit":

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

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

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

The plan benefit is based on the final year of pay. The normal retirement age is 65 (by default), so you need to project pay to age 64.

Description

01/2006 Age 54

2005 pay (age 53) 50,000

$$\text{Projected pay @ 64} = 76,973 = 50,000 \cdot (1.04)^{11}$$

$$\begin{aligned} \Delta(\text{Funding Accrued benefit}) &= 2\% \cdot (\text{Final pay}) \\ &= 2\% \cdot 76,973 \\ &= 1,539 \end{aligned}$$

$$\begin{aligned} \text{PUC NC} &= 1,539(D_{65} / D_{54}) \ddot{a}_{65}^{(12)} \\ \text{Old 8\% assumptions} &= 1,539(1.08)^{-11}(9.35) \\ &= 6,173 \end{aligned}$$

$$\begin{aligned} \text{New 7\% assumptions} &= 1,539(1.07)^{-11}(10.06) \\ &= 7,358 \end{aligned}$$

The change in the PUC normal cost is $1,184 = 7,358 - 6,173$.

Answer is D

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Problem 18

Revised 07/25/08

This is a straightforward exam problem, as long as you know the amortization periods for the MFSA bases:

Amortization base	Amortization payment	Remaining Years 01/01/06	Outstanding base at 01/01/06
Initial AL	Assumed zero		
1-1-2004 Loss base	70,000	3 = 5-(2006-2004)	$196,561 = 70,000 * \ddot{a}_{\overline{3} .07}$
1-1-2005 Assm chg base	-5,000	9 = 10-(2006-2005)	$-34,856 = -5,000 * \ddot{a}_{\overline{9} .07}$
1-1-2005 Loss base	35,000	4 = 5-(2006-2005)	$126,851 = 35,000 * \ddot{a}_{\overline{4} .07}$
1-1-2006 Loss base	16,000	5 = 5-(2006-2006)	$70,195 = 16,000 * \ddot{a}_{\overline{5} .07}$
Total O/S bases			358,751

$$\begin{aligned}\text{UAL} &= (\text{O/S } \$412 \text{ bases}) - \text{CB} - \text{ARA} \\ \text{ARA} &= (\text{O/S } \$412 \text{ bases}) - \text{CB} - \text{UAL} \\ &= 358,751 - 35,000 - (750,000 - 450,000) \\ &= 23,751\end{aligned}$$

Answer is B

NOTE:

The only confusing part is that the IAL base is apparently zero. This could occur if there was a method change, and the original cost method was Aggregate, Individual Aggregate, or Individual Level Premium. This could also occur if the plan did not grant past service credit for benefit accrual before the effective date.

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Problem 19 - Page 1

Similar to 2004 #06

Revised 07/25/08

The key to this problem is the derivation of the average temporary annuity used for the normal cost calculation at 01/01/2006. You must also set up both the expected (and actual) balance sheets at 01/01/06.

Item	Actual 01/01/05	Expected 01/01/06
PVE / E	$\frac{PVNC}{NC} = \frac{2,000,000}{182,000} = 10.9890$ <p>(next page shows derivation)</p>	$\frac{(1.07)(10.9890-1.0)}{p_x(1.04)} = 10.2772$

The key point of the problem is the formula used for the PVE/E ratio at 01/01/06. The derivation of this formula is shown on the next page.

You need to write formulas for the values in the expected balance sheet. You must allow for the difference between the salary scale of 4% and the actual compensation increases of 3%. When you adjust the liability to reflect the actual salary increase, you should only apply the adjustment to the actives liability (not the inactives).

The minimum contribution for 2005, payable at 12/31/05, is the normal cost increased with 7% interest. You need to be careful when setting up the actual asset value at 01/01/06. The assets at 01/01/05 should be brought forward with the actual investment return of 2%, but the 2005 contribution paid at 12/31/05 does not change.

Item	Actual 01/01/05	Expected 01/01/06	Actual 01/01/06
PVB	9,000,000	$(1.07)(9,000,000)$	$\frac{(1.03)(1.07)(3,000,000)}{(1.04)} + (1.07)(6,000,000)$ $= 9,599,135$
AAV	7,000,000	$(1.07)(7,000,000)$ $+ (1.07)(182,000)$	$(1.02)(7,000,000)$ $+ (1.07)(182,000)$ $= 7,334,740$
PVNC	2,000,000	$(1.07)(2,000,000)$ $- (1.07)(182,000)$	$9,599,135 - 7,334,740$ $= 2,264,394$
PVE / E		= 10.2772	Same
NC	182,000 (given)	$1.04 * 182,000$	$2,264,394 / 10.2772$ $= 220,333$

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Problem 19 - Page 2

The 2006 normal cost is 220,333.

Answer is D

NOTE:

Here is the derivation of the expected PVE/E formula:

$${}_ePVE_1 = (1+i)(PVE_0 - EARN_0)$$

$${}_eEARN_1 = p_x(1+s)(EARN_0)$$

$$\begin{aligned}\frac{{}_ePVE_1}{{}_eEARN_1} &= \frac{(1+i) * (PVE_0 - EARN_0)}{p_x(1+s) * (EARN_0)} \\ &= \frac{(1+i) * (PVE_0/EARN_0 - 1.0)}{p_x(1+s)}\end{aligned}$$

The calculation of the expected PVE/E assumes that the value of p_x is 1.0 at all ages (no pre-retirement decrements). This assumption is based on exam condition #19.

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Problem 20

The problem asks for the accumulated reconciliation account (ARA) balance at 01/01/07. In the absence of any waiver base amortization, you would use this formula to calculate the ARA at 01/01/07:

$$01/07 \text{ ARA} = 1.07(01/06 \text{ ARA}) + [\$412(l) \text{ charge} + \$412(m) \text{ charge}] \text{ for 2006}$$

Based on the general conditions, the §412(d) item for waivers is equal to zero. You are told that 412(l) AFC for 2006 is equal to 1,000. Based on the answer ranges, there is a large ARA at 01/01/06.

$$\begin{aligned} 01/06 \text{ UAL} &= (\text{O/S } \$412 \text{ bases}) - \text{CB} - \text{ARA} \\ 01/06 \text{ ARA} &= (\text{O/S } \$412 \text{ bases}) - \text{CB} - \text{UAL} \\ &= 500,000 - 2,000 - (1,000,000 - 550,000) \\ &= 48,000 \end{aligned}$$

$$\begin{aligned} 01/07 \text{ ARA} &= 1.07(01/06 \text{ ARA}) + [\$412(l) \text{ charge} + \$412(m) \text{ charge}] \text{ for 2006} \\ &= 1.07(48,000) + 1,000 \\ &= 52,360 \end{aligned}$$

Answer is D

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Problem 21

The key point of this problem is whether you know the amortization periods for multiemployer plans. These plans were not subject to the requirements of OBRA '87, so the amortization periods reflect the pre-OBRA '87 rules.

The assumption change base will be amortized over 30 years instead of 10 years. The G/L base will be amortized over 15 years. A shortcut is to combine all three G/L bases together, since they are all amortized over 15 years. You can also combine the assumption change base with the IAL, since those bases are both amortized over 30 years.

$$\begin{aligned}\text{"IAL" amort} &= (300,000 + 500,000) / \ddot{a}_{\overline{30}|.07} \\ &= 60,252\end{aligned}$$

$$\begin{aligned}\text{G/L amort} &= (200,000 + 150,000 - 50,000) / \ddot{a}_{\overline{15}|.07} \\ &= 30,784\end{aligned}$$

Now you can set up the MFSA and calculate the 12/31/06 minimum contribution:

2006 Minimum Funding Standard Account			
Charges		Credits	
Normal Cost	600,000	Credit Balance	120,000
"IAL" amort	60,252	12/31 contribution	828,000
G/L amort	30,784		
7% interest	48,373	7% interest	8,400
Total charges	<u>739,409</u>	Total credits	<u>956,400</u>

Since you don't have any asset values, you must ignore the FFL calculations. The credit balance at 12/31/06 is $216,992 = 956,400 - 739,409$.

Answer is D

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Problem 22 - Page 1

Similar to 2004 #40

This problem gives you the values needed to calculate the Deficit Reduction Contribution (DRC) and the §412(l) additional funding charge (AFC). The key to this problem is calculating the §412(l) charge.

The first step is calculation of the Gateway test, to see if the plan is subject to §412(l). If this value is 90% or more, then you are done with this problem (not likely to happen).

$$\begin{aligned}\text{Gateway \%} &= (\text{AAV} - 0) / (\text{CL at highest permissible rate}) \\ &= 800,000 / 1,100,000 \\ &= 72.73\%\end{aligned}$$

The §412(l) AFC equals the Unpredictable Contingent Event amount plus the excess, if any, of the DRC over the §412(b) normal cost plus all amortization charges and credits. The DRC is defined as the sum of the unfunded old liability amount (UOLA), the unfunded new liability amount (UNLA), and current liability normal cost.

The unfunded current liability is defined as the excess of the current liability over the actuarial asset value, reduced by the credit balance. The definition also specifies that any debit balance should be treated as zero for this purpose.

$$\begin{aligned}\text{UCL} &= \text{CL} - (\text{AAV} - \text{CB}) \\ &= 1,200,000 - (800,000 - 50,000) \\ &= 450,000\end{aligned}$$

The unfunded new liability (UNL) is usually calculated as the excess of the unfunded current liability (UCL) over the remaining portion of the unfunded old liability (UOL) plus any unpredictable contingent event liability (UCEL).

Since this is a plan established after OBRA '87, the UOL is zero. The entire unfunded current liability will be considered as unfunded new liability. In this problem, you are told nothing about unpredictable contingent events. You must assume there are none.

$$\begin{aligned}\text{UNL} &= \text{UCL} - \text{UOL} - \text{UCEL} \\ &= 450,000 - 0 - 0 \text{ (assumed)} \\ &= 450,000\end{aligned}$$

The UNLA is defined as the unfunded new liability times the applicable percentage, which is 30% - 40% (FCL% - 60%). In this problem, you are given this formula for the applicable percentage.

When the FCL% is less than 60%, the applicable percentage for the UNLA is capped at 30%. When calculating the FCL%, any debit balance is treated as a zero CB. Based on the Schedule B instructions, the FCL% should be rounded to the nearest .01%.

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Problem 22 - Page 2

$$\begin{aligned}\text{FCL\%} &= (\text{AAV} - \text{CB}) / \text{CL} \\ &= (800,000 - 50,000) / 1,200,000 \\ &= 62.50\%\end{aligned}$$

$$\begin{aligned}\text{APP\%} &= .30 - .40 [.6250 - .60] \\ &= 29.00\%\end{aligned}$$

$$\begin{aligned}\text{UNLA} &= 450,000 * .2900 \\ &= 130,500\end{aligned}$$

$$\begin{aligned}\text{DRC} &= \text{UOLA} + \text{UNLA} + \text{CLNC} \\ \text{DRC} &= 0 + 130,500 + 80,000 \\ &= 210,500\end{aligned}$$

You must subtract the §412 normal cost plus all amortization charges from the DRC to calculate the additional §412(l) charge. Then you must bring the §412(l) charge forward to the end of the year with interest at the current liability rate.

$$\begin{aligned}01/01/06 \text{ §412(l) charge} &= 210,500 - (90,000 + 70,000) \\ &= 50,500\end{aligned}$$

$$\begin{aligned}12/31/06 \text{ §412(l) charge} &= 50,500 * 1.0475 \\ &= 52,899\end{aligned}$$

With less than 150 plan participants, you must pro-rate the §412(l) AFC. The pro-rata is based on the highest number of plan participants on any day in the prior plan year. You are given the highest participant count for the 2005 plan year as 130.

$$\begin{aligned}12/31/06 \text{ §412(l) AFC} &= 52,899 * [2\% * (130-100)] \\ &= 52,899 * .60 \\ &= 31,739\end{aligned}$$

(next page)

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Problem 22 - Page 3

Now you can set up the minimum funding standard account to determine the minimum contribution.

2006 Minimum Funding Standard Account			
Charges		Credits	
Normal Cost	90,000	Credit Balance	50,000
Net amortizations	70,000	12/31 minimum	x
7% interest	11,200	7% interest	3,500
12/31 412(m)	10,000		
12/31 412(l) AFC	31,739		
Total charges	<u>212,939</u>	Total credits	<u>53,500 + x</u>

With no Unit Credit accrued liability, you must ignore the Full Funding Limitation. The minimum contribution at 12/31/06 is $159,439 = 212,939 - 53,500$.

Answer is D

NOTE:

Based on Revenue Ruling 96-21, this end of year §412(l) charge should be limited to the end of year UCL. For the sake of speed in working problems, you can simply look at the UCL at the start of the year and see that it will not be anywhere near the magnitude of the §412(l) charge. In general, the end of year UCL should never be less than the AFC.

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Problem 23

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

$$\begin{aligned}01/01/06 \text{ UAL} &= \text{O/S 412 bases} - \text{CB} - \text{ARA} \\&= 1,250,000 + 450,000 - 40,000 - 0 \\&= 1,660,000\end{aligned}$$

$$\begin{aligned}\text{PVNC} &= \text{PVFB} - \text{AAV} - \text{UAL} \\&= 3,500,000 - 1,500,000 - 1,660,000 \\&= 340,000\end{aligned}$$

$$\begin{aligned}\text{PVE/E} &= 6,500,000 / 500,000 \\&= 13.0\end{aligned}$$

$$\begin{aligned}\text{NC} &= 340,000 / 13.0 \\&= 26,154\end{aligned}$$

Now you need to determine the amortizations for the 412 bases. At 01/01/06, there are 20 years left in the amortization of the IAL:

$$\begin{aligned}\text{IAL amort} &= 1,250,000 / \ddot{a}_{20|.07} \\&= 110,272\end{aligned}$$

$$\begin{aligned}\text{Plan amort} &= 450,000 / \ddot{a}_{30|.07} \\&= 33,891\end{aligned}$$

Now you can set up the MFSA and calculate the 12/31/06 minimum contribution:

2006 Minimum Funding Standard Account			
Charges		Credits	
Normal Cost	26,154	Credit Balance	40,000
IAL amortization	110,272		
Plan amortization	33,891	12/31 minimum	x
7% interest	11,922	7% interest	2,800
Total charges	182,239	Total credits	x + 42,800

Since you have no Entry Age Normal valuation results, you can ignore the FFL calculation. The minimum contribution at 12/31/06 is $139,440 = 182,239 - 42,800$.

Answer is C

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Problem 24

This is a straightforward exam problem, as long as you know the amortization periods for the MFSA bases. The key to the problem is handling the funding deficiency and the accumulated reconciliation account in the actuarial equation of balance.

Amortization base	Amortization payment	Remaining Years 01/01/06	Outstanding base at 01/01/06
Initial AL	20,000	$28 = 30 - (2006 - 2004)$	$259,734 = 20,000 * \ddot{a}_{\overline{28} .07}$
1-1-2005 Gain base	-30,000	$4 = 5 - (2006 - 2005)$	$-108,729 = -30,000 * \ddot{a}_{\overline{4} .07}$
1-1-2006 Loss base	10,000	$5 = 5 - (2006 - 2006)$	$43,872 = 10,000 * \ddot{a}_{\overline{5} .07}$
Total O/S bases			194,877

$$\begin{aligned} \text{UAL} &= \text{AL} - \text{AAV} \\ &= \text{AL} - 200,000 \end{aligned}$$

$$\begin{aligned} \text{UAL} &= (\text{O/S } \$412 \text{ bases}) - \text{CB} + \text{DB} - \text{ARA} \\ \text{AL} &= 194,877 - 0 + 25,000 - 5,000 + 200,000 \\ &= 414,877 \end{aligned}$$

Answer is D

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Problem 25

One key to this problem is knowledge of the gain / loss formulas. The total gain / loss is defined as the difference between the expected and actual unfunded accrued liability. The investment gain / loss is defined as the difference between the expected and actual actuarial value of assets:

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

$${}_e\text{AAV}_1 = (1+i)(\text{AAV}_0) - (\text{actual benefit payments} + \text{interest}) + (\text{contributions} + \text{interest})$$

You can't directly calculate the asset G/L, since you don't know the amount of the 2005 contribution. Since you have the credit balance at both 01/01/05 and 12/31/05, you can derive the value of the contribution plus interest for 2005.

I'll assume that the 2005 contribution was paid at the end of the year. You will get the same expected value of assets whether you assume the contribution is paid at the beginning of the year, or the end of the year.

Now set up the MFSA and solve for the 12/31 contribution:

2005 Minimum Funding Standard Account			
Charges		Credits	
Normal Cost	30,000	Credit Balance	10,000
		Net amortization	10,000
		12/31 contribution	x
7% interest	2,100	7% interest	1,400
Total charges	32,100	Total credits	x + 21,400

Based on the 30,000 normal cost and the 30,000 UAL, the Full Funding Limitation will not apply.

$$01/01/06 \text{ CB} = 5000$$

$$5000 = (x + 21,400) - 32,100$$

$$x = 15,700$$

$$\begin{aligned} {}_e\text{AAV}_1 &= (1+i)(\text{AAV}_0) - (\text{actual benefit payments} + \text{interest}) + (\text{contributions} + \text{interest}) \\ &= 1.07(120,000) - [1 + (6/12)(.07)](20,000) + 15,700 \\ &= 123,400 \end{aligned}$$

$$\begin{aligned} \text{Inv loss} &= {}_e\text{AAV}_1 - \text{AAV}_1 \\ &= 123,400 - 130,000 \end{aligned}$$

$$\text{Gain} = 6,600$$

Answer is B

NOTE

The expected asset value was determined using simple interest. If you use compound interest, the gain is 6,588. This result is also in answer range B.

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Problem 26 – Page 1

Similar to 2001 #03

Revised 07/25/08

The key point to this problem is the calculation of the liquidity shortfall. Since the 2005 412(l) AFC is non-zero, you know that the 2005 FCL% is less than 100%. That means the plan is subject to the quarterly contribution requirement for 2006.

To calculate the required quarterly contribution for 2006, you must first calculate the required annual payment (RAP). This is the lesser of last year's minimum required contribution or 90% of this year's. These numbers are both interest adjusted to the first day of this plan year, and they both would not reflect any credit balance.

You are given the normal cost and 412 amortizations for 2005 and 2006. This data is a bit easier to work with than earlier quarterly contribution problems that give you the minimum contribution (which reflects offsetting the credit balance).

One confusing aspect is that you are given the 412(l) AFC for both years, as of 12/31. These values have already been adjusted to 12/31 using the current liability interest rate for the year, which you are not given. With no information on the current liability interest rate, I'll use the valuation interest rate to discount the 2006 412(l) AFC back to 01/01/06:

$$\begin{aligned} &12/31/05 \text{ "MFSA excluding CB"} \\ &(\$412 \text{ NC} + \$412 \text{ amort} - 0) * 1.07 + 412(l) \text{ AFC} \\ &= 207,000 \quad = 100,000 * 1.07 + 100,000 \end{aligned}$$

$$\begin{aligned} &01/01/06 \text{ "MFSA excluding CB"} \\ &(\$412 \text{ NC} + \$412 \text{ amort} - 0) + [412(l) \text{ AFC} / (1+i)] \\ &= 232,150 \quad = 120,000 + 120,000 / 1.07 \end{aligned}$$

$$\text{Lesser of 2005 or 90\% of 2006} = \text{Lesser of } (207,000 \text{ or } .90 * 232,150) = 207,000$$

The required quarterly installment is based on the applicable percentage multiplied by the RAP, which is $25\%(207,000) = 51,750$.

In the absence of the liquidity shortfall, the answer would be 51,750. If you had a credit balance at 12/31/05, you could use it like an employer contribution for a required quarterly installment. This is only allowed if the contribution that creates the credit balance is actually in the trust fund at the installment date.

Since the problem states that the minimum contribution was paid for both 2004 and 2005, the credit balance at 01/01/06 is zero.

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Problem 26 - Page 2

You have to calculate the amount of the liquidity shortfall. If it were greater than the 51,750, then the required payment at 04/15/2006 would equal the liquidity shortfall. This is based on the definition of the "required installment" in §412(m)(5)(A), which is actually a bit more precise:

"IN GENERAL. --A plan to which this paragraph applies shall be treated as failing to pay the full amount of any required installment to the extent that the value of the liquid assets paid in such installment is less than the liquidity shortfall (whether or not such liquidity shortfall exceeds the amount of such installment required to be paid but for this paragraph)."

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

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

Adjusted disbursements equal all disbursements from plan less the FCL% times the sum of annuity purchases, lump sums, and other accelerated payments. The FCL% is calculated without reducing the actuarial asset value by the credit balance. In this problem, you are simply given the value of the FCL% as 60%.

$$\begin{aligned}\text{All Disbursements} &= 70,000 + 50,000 \\ &= 120,000 \\ \text{Accelerated Pmts} &= 70,000 \\ \\ \text{Base amount} &= 3 * (120,000 - 60.0\%(70,000)) \\ &= 234,000 \\ \\ \text{Liquid assets} &= 160,000 \quad (\text{given}) \\ \text{Liquidity Shortfall} &= 234,000 - 160,000 \\ &= 74,000\end{aligned}$$

The required installment at 04/15/2006 is the greater of the quarterly requirement of 51,750 and the liquidity shortfall of 74,000.

Answer is E

NOTE

The cap on the liquidity shortfall is the amount to increase the FCL% to 100%. This is given as 300,000. This has no impact, since it is much greater than the liquidity shortfall.

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Problem 27 – Page 1

Revised 07/25/08

The key to this problem is to remember to calculate the Full Funding Limitation. You are given the Entry Age Normal valuation results and the market value of assets, as well as the current liability.

The deductible limit is defined as the normal cost plus limit adjustments brought forward with interest to the earlier of the end of the plan year, or the end of the tax year. You need to determine values for both the normal cost and the limit adjustments.

With the FIL cost method, you assume there is an initial Accrued Liability base. You need to use the 412 actuarial equation of balance to solve for the amount of the IAL:

$$\begin{aligned} 01/01/06 \text{ UAL} &= \text{O/S 412 bases} - \text{CB} - \text{ARA} \\ 100,000 &= \text{IAL} * (\ddot{a}_{24|.07} / \ddot{a}_{30|.07}) - 0 - 0 \end{aligned}$$

$$\text{IAL} = 108,193$$

$$\begin{aligned} \text{PVNC} &= \text{PVFB} - \text{AAV} - \text{UAL} \\ &= 1,500,000 - 340,000 - 100,000 \\ &= 1,060,000 \end{aligned}$$

$$\begin{aligned} \text{PVE/E} &= 1,000,000 / 85,000 \\ &= 11.7647 \end{aligned}$$

$$\begin{aligned} \text{NC} &= 1,060,000 / 11.7647 \\ &= 90,100 \end{aligned}$$

$$\begin{aligned} \text{Deductible limit} &= 1.07 * (90,100 + 108,193 \div \ddot{a}_{10|.07}) \\ &= 111,811 \end{aligned}$$

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

$$\begin{aligned} \text{\$404 "ERISA" FFL} &= (1+i) * (\text{EANC} + \text{EAN AL}) - (1+i) * (\text{lesser MVA, AAV}) \\ &= 1.07 * (40,000 + 350,000 - 300,000) \\ &= 96,300 \end{aligned}$$

$$\begin{aligned} \text{\$404 "RPA 94" FFL} &= .90 (12/31 \text{ CL}) - (1+i) * (\text{AAV}) && \text{(if no benefit payments)} \\ &= .90 * (515,000) - 1.07 * (340,000) \\ &= 99,700 \end{aligned}$$

The final 404 FFL is the greater of the two values, or 99,700. The 404 FFL does apply, and it reduces the deductible limit to 99,700.

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Problem 27 – Page 2

Since the 404 FFL applies, you can skip the calculation of the minimum contribution. It can not increase the deductible limit.

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

You need to follow the same logic as used above for the §404 FFL:

$$\begin{aligned}\text{\$404 "RPA 94" UCL} &= 1.00 (12/31 \text{ CL}) - (1+i) * (\text{AAV}) + \text{NDC} && \text{(if no benefit payments)} \\ &= 515,000 - 1.07 * (340,000) \\ &= 151,200\end{aligned}$$

The 404 UCL produces the final result for the deductible limit, since it exceeds the previously calculated value of 99,700.

Answer is D

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Problem 28 – Page 1

The key to this problem is carefully reflecting the participant counts at both 01/01/05 and 01/01/06. You also need to be careful to handle the actives separately from the non-actives.

You should use the non-investment G/L formulas:

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

$$01/06 {}_e\text{AL}_1 = (1+i) * (\text{NC}_0 + \text{AL}_0) - (\text{actual benefit payments} + \text{interest})$$

Under the Unit Credit cost method, the accrued liability is defined as the present value of the accrued benefit. The normal cost is defined as the present value of the change in the accrued benefit:

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

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

First, do the prior year calculations for the active participants. Then add in the values for the inactive participants to calculate the expected accrued liability. Finally, do the current year calculations for the active participants, and add in the values for the inactive participants.

01/01/05 valuation

	GROUP 1	GROUP 2
01/01/05 Age	50	45
Past service	20	15
Δ Accrued Benefit	$120 = 12(10)$	$120 = 12(10)$
UC NC = PV of ΔAB	$120 (D_{65} / D_{50}) \ddot{a}_{65}^{(12)}$	$120 (D_{65} / D_{45}) \ddot{a}_{65}^{(12)}$
	$= 120(1.07)^{-15}(9.24)$	$= 120(1.07)^{-20}(9.24)$
	$= 401.88$	$= 286.53$
Participant count	100	100
Total NC	40,188	28,653
Accrued Liability	$20 * (\text{UC NC})$	$15 * (\text{UC NC})$
Total AL	803,760	429,802

$$\text{Total NC} = 68,842 = 40,188 + 28,653$$

$$\text{Total AL} = 1,983,562 = 803,760 + 429,802 + 750,000$$

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Problem 28 – Page 2

Revised 07/25/08

01/01/06 valuation

$$\begin{aligned}
 01/06 {}_eAL_1 &= (1+i)*(NC_0 + AL_0) - (\text{actual benefit payments} + \text{interest}) \\
 &= 1.07(68,842 + 1,983,562) - 50,000 \\
 &= 2,146,073
 \end{aligned}$$

With no pre-retirement decrements, you can calculate this year's accrued liability for a single participant (who survives) based on last year's valuation results:

$$\begin{aligned}
 01/06 AL_1 &= (D_{x-1}/D_x)*(NC_0 + AL_0) && \text{(no benefit payments for active participants)} \\
 &= [(1+i)/p_x]*(NC_0 + AL_0) \\
 &= (1+i)*(NC_0 + AL_0)
 \end{aligned}$$

	GROUP 1	GROUP 2
01/05 Participant count	100	100
01/05 Accrued Liability	803,760	429,802
01/06 Participant count	90	80
01/06 Accrued Liability	$(1.07)*(90/100)(40,188+803,760)$ = 812,722	$(1.07)*(80/100)(28,653+429,802)$ = 392,437

$$\text{Total AL} = 2,005,159 = 812,722 + 392,437 + 800,000$$

$$\begin{aligned}
 \text{Non-inv Gain} &= {}_eAL_1 - AL_1 \\
 &= 2,146,073 - 2,005,159 \\
 &= 140,914
 \end{aligned}$$

Answer is C

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Problem 29 – Page 1

This is a straightforward exam problem, as long as you know the amortization periods for the MFSA bases. The key to the problem is that you must use the actuarial equation of balance to derive the G/L base at 01/01/06. You need to compare the actual versus expected UAL using the old 8% interest assumption.

Since this is a frozen plan, the Unit Credit normal cost is zero. Don't forget to set up the new assumption change base at 01/01/06.

$$G/L = {}_eU\bar{A}L_1 - U\bar{A}L_1$$

$$\begin{aligned} {}_eU\bar{A}L_1 &= (1+i)(NC_0 + U\bar{A}L_0) - (\text{contribution} + \text{interest}) \\ &= 12/31/05 \text{ O/S } \$412 \text{ bases} - CB - ARA \\ &= 147,000 + 2,600 + 5,500 + 1,100 + \text{LOSS} - 5,000 - 0 \\ &= 151,200 + \text{LOSS} \end{aligned}$$

$$\begin{aligned} U\bar{A}L &= AL - AAV \\ &= 510,000 - 375,000 \quad (\text{old 8\% interest assumption}) \\ &= 135,000 \end{aligned}$$

$$\begin{aligned} \text{Gain} &= 151,200 - 135,000 \\ &= 16,200 \end{aligned}$$

$$\begin{aligned} \text{Assm} &= 550,000 - 510,000 \\ &= 40,000 \end{aligned}$$

Now you need to re-amortize the outstanding 412 bases using the new 7% interest rate.

Amortization base	Remaining Years 01/01/06	Outstanding 8% base	7% amortization
1-1-1995 Initial AL	30 - (2006-1995) = 19	147,000	$147,000 / \ddot{a}_{19 .07} = 13,292$
1-1-2003 Loss base	5 - (2006-2003) = 2	2,600	$2,600 / \ddot{a}_{2 .07} = 1,344$
1-1-2004 Loss base	5 - (2006-2004) = 3	5,500	$5,500 / \ddot{a}_{3 .07} = 1,959$
1-1-2005 Loss base	5 - (2006-2005) = 4	1,100	$1,100 / \ddot{a}_{4 .07} = 304$
1-1-2006 Gain base	5	-16,200	$-16,200 / \ddot{a}_{5 .07} = -3,693$
1-1-2006 Assump base	10	40,000	$40,000 / \ddot{a}_{10 .07} = 5,323$

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Problem 29 – Page 2

Now you can set up the MFSA and calculate the 12/31/06 minimum contribution:

2006 Minimum Funding Standard Account			
Charges		Credits	
Normal Cost	0	Credit Balance	5,000
IAL amortization	13,292		
Loss amortization	1,344	12/31 minimum	x
Loss amortization	1,959		
Loss amortization	304	Gain amortization	3,693
Assm amortization	5,323		
7% interest	1,556	7% interest	608
Total charges	23,778	Total credits	x + 9,301

Based on the UAL of 175,000, you can ignore the FFL calculation. The minimum contribution at 12/31/06 is $14,475 = 23,778 - 9,301$.

Answer is C

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

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

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

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

For all of these methods, a corridor must be applied for the final actuarial value of assets. Based on the general conditions for the EA exams, you are not working on a multi-employer plan. The final actuarial value of assets can't be lower than 80% of market value, nor greater than 120% of market value. For a multi-employer plan, there is a wider corridor available.

(15) Smoothed market value without phase-in

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

The actuarial value of assets is calculated using decreasing fractions of each of the prior year's gain or loss. With a four year average, the fractions are 3/4, 2/4 and 1/4:

$$01/06 \text{ AAV} = 01/06 \text{ MVA} - 3/4(2005 \text{ G/L}) - 2/4(2004 \text{ G/L}) - 1/4(2003 \text{ G/L})$$

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

$$01/06 \text{ AAV} = 01/06 \text{ MVA} - 4/5(2005 \text{ G/L}) - 3/5(2004 \text{ G/L}) - 2/5(2003 \text{ G/L}) - 1/5(2002 \text{ G/L})$$

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

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Problem 30 – Page 2

Revised 09/03/19

You need to calculate the 2005 G/L item. To do this, you need to calculate the expected market value of assets at 01/01/06.

01/01/06 Asset calculations

$$\begin{aligned} 01/06 \text{ } _e\text{MVA} &= (1.07) * (2,750,000) - 50,000 \\ &= 2,892,500 \end{aligned}$$

$$\begin{aligned} \text{MVA G/L} &= 01/06 \text{ MVA} - 01/06 \text{ } _e\text{MVA} \\ &= 2,900,000 - 2,892,500 \\ &= 7,500 \quad (\text{Gain}) \end{aligned}$$

$$\begin{aligned} 01/06 \text{ AAV} &= 01/06 \text{ MVA} - 3/4(2005 \text{ G/L}) - 2/4(2004 \text{ G/L}) - 1/4(2003 \text{ G/L}) \\ &= 2,900,000 - (.75)(7,500) - (.50)(25,000) - (.25)(-50,000) \\ &= 2,894,375 \end{aligned}$$

$$\begin{aligned} 01/06 \text{ AAV} &= \text{Lesser of } [120\%(\text{MVA}) \text{ and greater of } (\text{AAV or } 80\%(\text{MVA}))] \\ &= \text{Lesser of } [1.20(2,900,000) \text{ and greater of } (2,894,375 \text{ or } .80(2,900,000))] \\ &= 2,894,375 \end{aligned}$$

$$\begin{aligned} _e\text{AAV}_1 &= (1+i)(\text{AAV}_0) - (\text{actual benefit payments} + \text{interest}) + (\text{contributions} + \text{interest}) \\ &= (1.07) * (2,775,000) - 50,000 + 0 \\ &= 2,919,250 \end{aligned}$$

$$\begin{aligned} \text{Inv loss} &= _e\text{AAV}_1 - \text{AAV}_1 \\ &= 2,919,250 - 2,894,375 \\ &= 24,875 \end{aligned}$$

Answer is E

NOTE

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

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Problem 31 – Page 1

Similar to 2005 #11

The retirement gain / loss calculation is simply the difference between two accrued liability values, one as an active employee, and one as a retired employee. The Unit Credit accrued liability is defined as the present value of the actual accrued benefit.

Retired AL = PV of Early retirement benefit

Active AL = PV of AB

The key to this problem is handling the multiple retirement decrements correctly in calculating the Accrued liability as an active employee.

Age 61 at 01/01/06

Service 28 years

$$\begin{aligned}\text{Accd ben} &= 12 * 50 * 28 \\ &= 16,800\end{aligned}$$

Retired AL

$$\text{PVB} = (\text{ER Ben}) * \ddot{a}_{61}^{(12)}$$

$$\begin{aligned}\text{ER Ben} &= 16,800 * [1 - 4(5\%)] \\ &= 13,440\end{aligned}$$

$$\begin{aligned}\text{PVB} &= 13,440 * 11.41 \\ &= 153,350\end{aligned}$$

Active AL

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

$$\text{PVB} = \sum_{t=0}^1 v_t p_{61}^{(T)} q_{61+t}^{(r)} (\text{ER Ben})_{61+t} \ddot{a}_{61+t}^{(12)}$$

You must calculate the reduced benefit available at age 62 (calculated age 61 above):

$$\text{ER ben at 62} \quad 14,280 = 16,800[1 - 3(5\%)]$$

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Problem 31 – Page 2

Now you can evaluate the summation shown previously:

		(1)	(2)	(3)		(4)	(5)	(6)
t	$61+t$	v^t	${}_t p_{61}^{(T)}$	${}_t q_{61+t}^{(r)}$	${}_t p_{61+t}^{(T)}$	ERB_{61+t}	$\ddot{a}_{61+t}^{(12)}$	$(1)(2)(3)(4)(5)$
0	61	1.000	1.000	0.50	0.50	13,440	11.41	76,675
1	62	.9346	0.500	1.00	0.00	14,280	11.23	<u>74,937</u>
								151,612

The loss upon early retirement is $1,739 = 153,350 - 151,612$.

Answer is B

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Problem 32 – Page 1

Similar to 2005 #10

You are told to calculate the deductible limit using the Fresh Start approach. You need to calculate the amount of the unfunded accrued liability (UAL) to calculate the limit adjustments.

The key point of this problem is whether you know how to calculate items under §404 when you have a contribution that has not yet been deducted. The method of calculation of the FFL when you have a non-deducted contribution is outlined in Revenue Ruling 82-125.

Based on the default exam conditions, the AAV given in problems is the appropriate value for minimum funding calculations. This is consistent with the description of the assets in the problem.

If a contribution has been paid to the trust for a prior plan year, it is considered as part of the §412 assets, regardless of whether or not it has been deducted. If a contribution has been paid to the trust for the current plan year, it should NOT be considered as part of the §412 assets for the current plan year valuation.

If a contribution has been paid to the trust for a prior plan year, it is considered as part of the §404 assets only if it has been deducted for a prior tax year. If a contribution has been paid to the trust for the current plan year, it can be considered as part of the §404 assets for the current tax year, as long as it has been deducted for a prior tax year.

Here is the relationship between the §404 asset definition and the §412 asset definition:

$$\begin{aligned}\text{\$404 AAV} &= \text{AAV} - \text{NDC} \\ &= 14,500 - 1,500 \\ &= 13,000\end{aligned}$$

The deductible limit is defined as the normal cost plus limit adjustments brought forward with interest to the earlier of the end of the plan year, or the end of the tax year. Under Fresh Start, the limit adjustments equal a 10 year amortization of the UAL:

$$\text{\$412 UAL} = \text{AL} - \text{AAV}$$

$$\begin{aligned}\text{\$404 UAL} &= \text{AL} - \text{\$404 AAV} \\ &= 23,000 - 13,000 \\ &= 10,000\end{aligned}$$

$$\begin{aligned}\text{Deductible limit} &= 1.07 * (1,000 + 10,000 \div \overline{s}_{10|0.07}) \\ &= 2,494\end{aligned}$$

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Problem 32 – Page 2

The second step is usually to check the Full Funding Limitation under §404. The examples in Revenue Ruling 82-125 show how to calculate the Full Funding Limitation when you have a non-deductible contribution in the assets. The NDC should not get any interest credit:

$$\text{\$404 ERISA FFL} = (1+i)(\text{NC}+\text{AL}) - (1+i)[\text{lesser of MV, AAV}] + \text{NDC}$$

Based on the size of the UAL, it should be clear that the FFL will not reduce the deductible limit of 2,494.

Now you usually check the §412 minimum contribution to see if it is greater. Since you have no credit balance, you must skip the minimum contribution calculation.

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

You need to follow the same logic as used above for the §404 FFL. You should not credit any interest on the NDC, which produces a slightly lower deductible limit.

$$\begin{aligned}\text{\$404 "RPA 94" UCL} &= 1.00 (12/31 \text{ CL}) - (1+i)*(\text{AAV}) + \text{NDC} && \text{(if no benefit payments)} \\ &= 27,500 - 1.07*(14,500) + 1,500 \\ &= 13,485\end{aligned}$$

The 404 UCL produces the final result for the deductible limit, since it exceeds the previously calculated value of 2,494.

Answer is C

NOTE

Note that the end of year asset value (if any) should be used in calculating the RPA '94 UCL (and RPA '94FFL). The reason is that any benefit payments during the year should be reflected at the valuation rate in the assets.

They presumably are included in the end of year asset value. They would be accumulated at the current liability interest rate in the end of year current liability value.

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Problem 33

Similar to 2004 #12

The key to this problem is calculating the normal cost under the Entry Age Normal method. In general, the Entry Age Normal Cost (EANC) is defined as the present value of benefits at entry age, divided by a temporary annuity at entry age. Since the plan benefits are based on pay, the EANC is calculated as a level percentage of salary, and the temporary annuity will include a salary scale.

You should assume that the plan formula accrues benefits for all years of service, so you use the participant's age at hire as EA in these formulas:

Level % EANC: $PVB_{EA} / s\ddot{a}_{EA:RA-EA}$ at entry age - adjust later ages by salary scale

Age 62 at 01/01/06

Entry age 61

This problem simplifies the calculations, since you are given the projected monthly benefit at 65.

$$\begin{aligned} PVB \text{ at } 61 &= (1,200 * 12)(D_{65} / D_{61}) \ddot{a}_{65}^{(12)} \\ &= 14,400(1.07)^{-4}(9.42) \\ &= 103,485 \end{aligned}$$

The next step is calculation of the EA normal cost and accrued liability.

Level % EANC: $PVB_{EA} / s\ddot{a}_{61:4}$ EANC at entry age - adjust later ages by salary scale

$$\begin{aligned} s\ddot{a}_{61:4} &= \ddot{a}_{4|j} \text{ where } 1+j = (1.07 / 1.04), \quad j = 2.88\% \\ &= 3.8349 \end{aligned}$$

$$\begin{aligned} EANC_{61} &= 103,485 / 3.8349 \\ &= 26,985 \end{aligned}$$

$$\begin{aligned} EANC_{62} &= 26,985 * (1.04)^1 \\ &= 28,065 \end{aligned}$$

Answer is B

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Problem 34

The final Full Funding Limitation is the greater of the ERISA and RPA FFL values. The ERISA Full Funding Limitation is defined as:

$$\begin{aligned}\text{\$412 "ERISA" FFL} &= (1+i) * (\text{UC NC} + \text{UC AL}) - (1+i) * [\text{lesser (MVA, AAV)} - \text{CB}] \\ &= 1.07 * (25,000 + 1,000,000) - 1.07 * (900,000 - 0) \\ &= 133,750\end{aligned}$$

The RPA Full Funding Limitation is defined as follows

(NOTE - this uses 12/31 CL)

$$\begin{aligned}\text{\$412 RPA FFL floor} &= 90\% (12/31 \text{ RPA CL}) - [1.07(\text{AAV})] && \text{(if no ben pmts)} \\ 90\% \text{ 12/31 RPA CL} &= 1,173,420 = 90\% [1,303,800] \\ 12/31 \text{ asset value} &= 963,000 = (1.07)(900,000) \\ \text{RPA '94 FFL floor} &= 210,420\end{aligned}$$

The §412 FFL is the greater of the two values, or 210,420.

Answer is D

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Problem 35 – Page 1

This problem has a salary scale, and a cost method given as Unit Credit. One key to this problem is knowing that the calculations are done using Projected Unit Credit (PUC).

You need to calculate the PUC normal cost at 01/01/2006. Under PUC, the accrued liability is defined as the present value of the “funding accrued benefit” (FAB). The normal cost is defined as the present value of the change in the FAB:

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

The 1.412(c)(3)-1 regulations define "funding accrued benefit":

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

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

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

The plan benefit is based on the three year final average pay. The normal retirement age is 65 (by default), so you need to project pay to age 64.

Description

01/2006 Age 60

01/2006 Service 20

2005 pay (age 59) 35,000

$$\begin{aligned}\text{Projected pay @ 64} &= 35,000 \times (1.03)^5 \\ &= 40,575\end{aligned}$$

$$\begin{aligned}\text{Projected FAE3} &= 40,575 \times \left(\ddot{a}_{\overline{3}|0.03} / 3 \right) \\ &= 39,404\end{aligned}$$

You need to be careful in determining the change in the funding accrued benefit. As often happens on PUC exam problems, there are two accrual rates in the benefit formula. Since the participant has 20 years of service, they are accruing benefits at the 4% rate:

$$\begin{aligned}\Delta(\text{Funding Accrued benefit}) &= 4\% \times (\text{Projected FAE3}) \\ &= 4\% \times 39,404 \\ &= 1,576\end{aligned}$$

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Problem 35 – Page 2

PUC NC

$$\begin{aligned} & 1,576(D_{65} / D_{60}) \ddot{a}_{65}^{(12)} \\ &= 1,576(1.07)^{-5}(9.70) \\ &= 10,901 \end{aligned}$$

Answer is E

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Problem 36

You need to use the actuarial equation of balance to solve for the IAL. Then you can determine the minimum contribution.

$$\begin{aligned}01/01/06 \text{ UAL} &= \text{O/S 412 bases} - \text{CB} - \text{ARA} \\ &= \text{PVB} - \text{PVNC} - \text{AAV}\end{aligned}$$

$$\begin{aligned}\text{PVNC} &= \text{NC} * (\text{avg PVE/E}) \\ &= 100,000 * (2,000,000 / 250,000) \\ &= 800,000\end{aligned}$$

$$\begin{aligned}\text{UAL} &= 1,800,000 - 800,000 - 500,000 \\ &= 500,000\end{aligned}$$

$$\begin{aligned}01/01/06 \text{ UAL} &= \text{O/S 412 bases} - \text{CB} - \text{ARA} \\ 500,000 &= (\text{IAL} / \ddot{a}_{\overline{30}|.07}) * \ddot{a}_{\overline{18}|.07} - 25,000 - 0\end{aligned}$$

You really want to calculate the IAL amortization payment instead of the value of the IAL:

$$\begin{aligned}\text{IAL} / \ddot{a}_{\overline{30}|.07} &= 525,000 / \ddot{a}_{\overline{18}|.07} \\ &= 48,777\end{aligned}$$

Now you can set up the MFSA and calculate the 12/31/06 minimum contribution:

2006 Minimum Funding Standard Account

Charges		Credits	
Normal Cost	100,000	Credit Balance	25,000
IAL amortization	48,777	12/31 minimum	x
7% interest	10,414	7% interest	1,750
Total charges	<u>159,191</u>	Total credits	<u>x + 26,750</u>

Since you have no Entry Age Normal valuation results, you can ignore the FFL calculation. The minimum contribution at 12/31/06 is $132,442 = 159,191 - 26,750$.

Answer is D

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Problem 37

Similar to 2005 #18

The key to this problem is knowing how to handle the change in the interest rate under §412. You have to determine the outstanding amount of several §412 bases at 7.5%, and re-determine the amortization of all the bases at the new 7% interest rate.

Another point of this problem is whether you know the amortization periods for multiemployer plans. These plans were not subject to the requirements of OBRA '87, so the amortization periods reflect the pre-OBRA '87 rules. The assumption change base will be amortized over 30 years instead of 10 years. The G/L bases will be amortized over 15 years.

Amortization base	Remaining years	7.5% Outstanding base	New Amortization Amount at 7.0%
01/01/2004 IAL base	28 = 30-(2006-2004)	$2,426,069 = 195,000 * \ddot{a}_{\overline{28} .075}$	$2,426,069 / \ddot{a}_{\overline{28} .07} = 186,812$
01/01/2005 Assum base	29 = 30-(2006-2005)	$377,201 = 30,000 * \ddot{a}_{\overline{29} .075}$	$377,201 / \ddot{a}_{\overline{29} .07} = 28,713$
01/01/2005 Gain base	14 = 15-(2006-2005)	$-547,550 = -60,000 * \ddot{a}_{\overline{14} .075}$	$-547,550 / \ddot{a}_{\overline{14} .07} = -58,514$
01/01/2006 Loss base	15	$100,000 = 10,538 * \ddot{a}_{\overline{15} .075}$	$100,000 / \ddot{a}_{\overline{15} .07} = 10,261$
01/01/2006 Assum base	30	200,000	$200,000 / \ddot{a}_{\overline{30} .07} = 15,063$
Total		$\Sigma = 175,538$	$\Sigma = 182,335$

You must be VERY careful here. Besides the ridiculous amount of arithmetic, you must calculate the amortization of the 2005 Loss base at the old 7.5% interest rate.

The increase in the 01/01/06 minimum due to the interest change is the sum of the increase in the normal cost, and the increase in the amortization payments:

$$\begin{aligned}\Delta \text{ Amort} &= 182,335 - 175,538 \\ &= 6,797\end{aligned}$$

$$\Delta \text{ NC} = 30,000 \quad (\text{given})$$

$$\Delta \text{ 01/06 Min} = 36,797$$

Answer is C

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Problem 38 – Page 1

Similar to 2002 #17

The key to this problem is calculation of the required quarterly installment, and the amount of the underpayment.

To calculate the required quarterly contribution for 2006, you must first calculate the required annual payment (RAP). This is the lesser of last year's minimum required contribution or 90% of this year's. These numbers are both interest adjusted to the first day of this plan year, and they both would not reflect any credit balance.

Since the 2005 412(l) AFC is non-zero, you know that the 2005 FCL% is less than 100%. That means the plan is subject to the quarterly contribution requirement for 2006.

You are given the normal cost for 2005 and 2006, both as of the valuation date. Since this plan uses the Aggregate funding method, the 412 amortization payments are equal to zero.

$$\begin{aligned} &12/31/05 \text{ "MFSA excluding CB"} \\ &(\$412 \text{ NC} + \$412 \text{ amort} - 0) * 1.07 + 412(l) \text{ AFC} \\ &= 317,500 \quad = 250,000 * 1.07 + 50,000 \end{aligned}$$

$$\begin{aligned} &01/01/06 \text{ "MFSA excluding CB"} \\ &(\$412 \text{ NC} + \$412 \text{ amort} - 0) \\ &= 280,000 \end{aligned}$$

$$\text{Lesser of 2005 or 90\% of 2006} = .90 * 280,000 = 252,000$$

The required quarterly installment is based on the applicable percentage multiplied by the RAP, which is $25\%(252,000) = 63,000$.

You must determine the credit balance at 12/31/05. Comparing the 12/31/05 minimum of 317,500 to the contribution of 350,000, there is a credit balance of 32,500 at 12/31/05.

You may use this credit balance like an employer contribution for a required quarterly installment, but only if the contribution that creates the credit balance is actually in the trust fund at the installment date. The problem states that the contribution was paid by 12/31/05.

Date	Required	Amount Available	Overpayment (Underpayment)
01/01/06		32,500	32,500
04/15/06	63,000	$32,500 * [1 + (.07) * (3.5/12)]$ $= 33,163$	$33,163 - 63,000$ $= (29,836)$

The employer would have to contribute at least 29,836 at 04/15/06 to meet the required quarterly installment.

Answer is A

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Problem 38 – Page 2

If you use compound interest, the result is slightly different. The amount available is 33,148, and the underpayment at 04/15/06 is 29,852. This result is also in answer range A.

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Problem 39 – Page 1

The key to this problem is determination of the outstanding ten year amortization bases (TYAB) each year. This question has not been tested on the enrollment exam for about 15 years!

The rules are outlined in the regulation at 1.404(a)-14(h):

1. Determine the net contribution towards all 404 bases. If there are no non-deducted contributions, this equals (Contribution + interest) - (Normal cost + interest).
2. Allocate the net contribution towards all bases to each base using the original amount of the $TYAB / \ddot{a}_{10|.07}$

You must keep track of the separate outstanding TYAB each year. The deductible limit is calculated each year as $(1+i)(\text{Normal cost} + \text{Limit adjustments})$. You can pay this amount at any date during the year (see 1.404(a)-14(h)).

The Limit Adjustment is defined as lesser of two items:

- The outstanding TYAB, or
- The original $TYAB / \ddot{a}_{10|.07}$

The first step is determination of the contribution towards the bases:

$$\begin{aligned}\text{Contribution} + \text{interest} &= 20,000 \\ \text{Normal cost} + \text{interest} &= \underline{-10,700} \\ \text{Contribution to bases} &= 9,300\end{aligned}$$

The second step is calculation of the outstanding 404 amortization bases at the end of the year. This is simply the write down of the ${}_{\epsilon}UAL$ for 2006:

$$\begin{aligned}{}_{\epsilon}UAL_1 &= (1+i)(NC_0 + UAL_0) - (\text{contribution} + \text{interest}) \\ &= (1.07)*(10,000 + 100,000) - 20,000 \\ &= 97,700\end{aligned}$$

The third step is to determine the outstanding amount of each base. You need to allocate the contribution towards the bases to each individual base. Based on the information given, it appears that the limit adjustment for each base is equal to the 10 year amortization, since it is less than the outstanding amount of the base.

Problem 39 – Page 2**Revised 07/25/08**

Base description	Total	IAL base	Assump base
01/01 Outstanding base	100,000	150,000	-50,000
10 year amortization	15,000	30,000	-15,000
Allocation to each base	9,300	18,600	-9,300
(1.07)*(Outstanding base)	107,000	160,500	-53,500
12/31 outstanding base	97,700	141,900	-44,200

The absolute value of the assumption change base is 44,200.

Answer is D**NOTES:**

1. The contribution toward the bases of 9,300 was allocated to each base by multiplying each 10 year amortization amount by the ratio $(9,300 / 15,000)$. The outstanding base at 12/31 is the 01/01 base brought up with one year's interest, reduced by the allocated contribution toward the base.
2. The total 404 base at 12/31/06 is 97,700. This matches the value of the expected UAL that we calculated earlier. This verifies that the total is correct.

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Problem 40

The key to this problem is knowing the formulas for the non-investment G/L:

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

In this problem, the liability gain is caused by the death of Smith. You need to calculate the accrued liability at 01/01/06, and use that to calculate the expected accrued liability at 01/01/07.

Description	<u>Smith</u>
01/2006 Age	65
Past service	30
Annual benefit	$500(30) = 15,000$
PVB at 65	$15,000 * \ddot{a}_{65}$

The problem gives you the value of \ddot{a}_{66} , but not the value of \ddot{a}_{65} . You have to use a basic life contingencies formula to value the annuity:

$$\ddot{a}_{65} = 1 + v^1 p_{65} \ddot{a}_{66}$$

If you use this in the formula for the expected accrued liability, it works nicely. The key is that you have an annual benefit instead of a monthly benefit:

$$\begin{aligned}{}_eAL_1 &= 15,000[(1+i)*(0 NC + \{1 + v^1 p_{65} \ddot{a}_{66}\}) - (1+i)] \\ &= 15,000[(1+i) + p_{65} \ddot{a}_{66} - (1+i)] \\ &= 15,000[(1-q_{65}) \ddot{a}_{66}] \\ &= 15,000[.9847 * 9.46] \\ &= 139,729\end{aligned}$$

$$\text{Non-inv G/L} = {}_eAL_1 - AL_1$$

$$AL_1 = \text{zero}$$

$$\text{Non-inv G/L} = 139,729$$

Answer is C

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Problem 41 – Page 1

Similar to 2002 #17

The key to this problem is calculation of the required quarterly installment, and the amount of the underpayment.

To calculate the required quarterly contribution for 2006, you must first calculate the required annual payment (RAP). This is the lesser of last year's minimum required contribution or 90% of this year's. These numbers are both interest adjusted to the first day of this plan year, and they both would not reflect any credit balance.

In this problem, you must assume that the plan is subject to the quarterly contribution requirement for 2006. You are given the minimum contributions for both 2005 and 2006, both at the end of the plan year.

The plan starts off with a zero credit balance at 01/01/05. Comparing the 12/31/05 minimum of 750,000 to the contribution of 1,000,000, there is a credit balance of 250,000 at 12/31/05.

12/31/05 "MFSA excluding CB"

$$(\$412 \text{ NC} + \$412 \text{ amort} - 0) * 1.07 = 12/31/05 \text{ minimum} + (1.07) * (01/01/05 \text{ CB}) \\ = 750,000$$

01/01/06 "MFSA excluding CB"

$$(\$412 \text{ NC} + \$412 \text{ amort} - 0) = 12/31/06 \text{ minimum} / (1.07) + 01/01/06 \text{ CB} \\ = 775,701 = 562,500 / 1.07 + 250,000$$

$$\text{Lesser of 2005 or 90\% of 2006} = .90 * 775,701 = 698,131$$

The required quarterly installment is based on the applicable percentage multiplied by the RAP, which is $25\%(698,131) = 174,533$.

You may use the 01/01/06 credit balance like an employer contribution for a required quarterly installment, but only if the contribution that creates the credit balance is actually in the trust fund at the installment date. The problem states that the contribution was paid at 03/15/06.

Date	Required	Amount Available	Overpayment (Underpayment)
01/01/06		250,000	250,000
04/15/06	174,533	$250,000 * [1 + (.07) * (3.5/12)]$ $= 255,104$	$255,104 - 174,533$ $= 80,571$
07/15/06	174,533	$80,571 * [1 + (.07) * (3.0/12)]$ $= 81,981$	$81,981 - 174,533$ $= (92,551)$

The employer would have to contribute at least 92,551 at 07/15/06 to meet the required quarterly installment.

Answer is B

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Problem 41 – Page 2

If you use compound interest, the result is slightly different. The underpayment at 07/15/06 is 92,711. This result is also in answer range B.

Date	Required	Amount Available	Overpayment (Underpayment)
01/01/06		250,000	250,000
04/15/06	174,533	$250,000 * (1.07)^{3.5/12}$ = 254,982	254,982 - 174,533 = 80,450
07/15/06	174,533	$80,450 * (1.07)^{3.0/12}$ = 81,822	81,822 - 174,533 = (92,711)

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Problem 42 – Page 1

The key to this problem is knowing the details of the normal cost calculation for each of the cost methods.

I. FALSE

You are told the additional 2005 contribution at 01/01/06 does not create a negative unfunded liability under FIL. You can analyze the value of the FIL PVNC to see the impact of that contribution, which I'll represent by C:

Before additional contribution:

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

After additional contribution:

$$\text{FIL UAL} = {}_e\text{UAL}_1$$

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

$$\text{UAL}_A = \text{UAL}_B - C$$

$$\text{AAV}_A = \text{AAV}_B + C$$

$$\begin{aligned}\text{FIL PVNC}_A &= \text{PVB} - \text{UAL}_A - \text{AAV}_A \\ &= \text{PVB} - \text{UAL}_B - \text{AAV}_B \\ &= \text{FIL PVNC}_B\end{aligned}$$

II. TRUE

Under the FIL cost method, any investment G/L affects the assets, but not the UAL. As a result, it will affect the FIL PVNC, and also the FIL NC.

III. FALSE

This one is a little tricky. If there were no MFSA, then it is true that the amount of contribution in 2005 will affect the normal cost in 2006 under the Aggregate cost method. In order for the normal cost to remain level as a percentage of pay, the 12/31 contribution must equal the Aggregate method normal cost plus interest.

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Problem 42 – Page 2

But the existence of the MFSA means that any excess contribution will create a credit balance. You can analyze the value of the AGG PVNC to see the impact of the extra 2005 contribution at 01/01/06, which I'll represent by C:

Before additional contribution:

$$\text{AGG PVNC}_B = \text{PVB} - \text{AAV}_B - (\text{O/S 412 bases}_B - \text{CB}_B)$$

After additional contribution:

$$\text{AAV}_A = \text{AAV}_B + C$$

$$\text{CB}_A = \text{CB}_B + C$$

$$\begin{aligned}\text{AGG PVNC}_A &= \text{PVB} - \text{AAV}_A - (\text{O/S 412 bases}_A - \text{CB}_A) \\ &= \text{PVB} - (\text{AAV}_B + C) - (\text{O/S 412 bases}_B - (\text{CB}_B + C)) \\ &= \text{AGG PVNC}_B\end{aligned}$$

Only II is true

Answer is C

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Problem 43 – Page 1

Similar to 2004 #27

Revised 07/25/08

The key to this problem is calculating the normal cost under the Individual Level Premium method. In general, the Individual Level Premium (ILP) Normal Cost is defined as the sum of multiple layers. A new layer is established each time the plan benefit changes, and it funds the change in the present value of future benefits prospectively over future service:

$$\Delta \text{ ILP NC} = \text{PV}(\Delta \text{ Proj Benefit}) / \ddot{a}_{\overline{X:RA-X}|} \quad \text{level \$ normal cost}$$

Since there are two plan changes, there are two separate layers of normal cost. With no salary scale, the problem is not as messy as some past ILP problems.

Birth date 01/01/1955 Age 45 at hire
Hire date 01/01/2000 Total Service 20

The key point of the problem is that the first layer of ILP normal cost is established at the later of age at hire, or age at plan inception:

Effective date 01/01/2005 Age 50 at plan inception

Normal cost calculation date

	01/01/05	01/01/06
Age	50	51
Plan Benefit	\$50	\$50+X
Projected benefit	$12(50)(20)$	$12(50+X)(20)$
Δ Projected benefit	$12(50)(20)^{\ddagger}$	$12(X)(20)$
PV (Δ Proj Benefit)	$12,000v^{(65-50)}\ddot{a}_{65}^{(12)}$	$240Xv^{(65-51)}\ddot{a}_{65}^{(12)}$
Δ Normal cost	$12,000v^{15}\ddot{a}_{65}^{(12)} / \ddot{a}_{15 .07}$ $= 12,000\ddot{a}_{65}^{(12)} / \ddot{s}_{15 .07}$	$240Xv^{14}\ddot{a}_{65}^{(12)} / \ddot{a}_{14 .07}$ $= 240X\ddot{a}_{65}^{(12)} / \ddot{s}_{14 .07}$
Δ Normal cost	4,405	$240X(9.87)/24.1290$
Total normal cost	4,405	$98.1722X + 4,405$
12/31 minimum	$4,405(1.07)$ $= 4,713$	$(98.1722X + 4,405)1.07$ $= 105.0443X + 4,713$

One point of the problem is that the change in benefits in 2006 does not affect the UAL, and does not create a 412 amortization base. This is a feature of the ILP cost method, where all benefit changes are funded prospectively over future service.

[‡] NOTE: Some students don't like this identification of the initial normal cost layer. I consider that their benefit increases from zero to 12,000 when they enter the plan.

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Problem 43 – Page 2

You are told that X is chosen so the 12/31/06 minimum is 125% of the 12/31/05 minimum:

$$105.0443X + 4,713 = 1.25(4,713)$$

$$105.0443X = .25(4,713)$$

$$X = 11.22$$

Answer is C

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Problem 44 – Page 1

Similar to 2004 #08

This problem has a salary scale, and a cost method given as Unit Credit. One key to this problem is knowing that the calculations are done using Projected Unit Credit (PUC).

Another key to this problem is carefully handling the change in actuarial assumptions. You must calculate the accrued liability and normal cost under the old and new assumptions.

You need to calculate the PUC accrued liability at 01/01/2006. Under PUC, the accrued liability is defined as the present value of the “funding accrued benefit” (FAB):

$$AL = PV(FAB)$$

The 1.412(c)(3)-1 regulations define "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.

Description

Birth Date	01/01/66
01/2006 Age	40
Hire Date	01/01/96
Past service	10

The participant was hired at 01/01/96, which is also the effective date of the plan. Since they are the only participant, the Initial Accrued Liability is zero. Since there have never been any gains or losses, there are no old 412 amortization bases. There is only one base at 01/01/06, which is for the change in actuarial assumptions.

01/01/2006 Valuation - 7% interest and 3% salary scale

The plan benefit is based on the final year of pay. The normal retirement age is 65, so you need to project pay to age 64.

2005 compensation	= 100,000	age 39 pay
Projected pay @ 64	= 100,000*(1.03) ²⁵	
	= 209,378	

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Problem 44 – Page 2

$$\begin{aligned}\text{Funding Accrued benefit} & 1.0\%(10)(\text{Final pay}) \\ & 1.0\%(10)(209,378) \\ & = 20,938\end{aligned}$$

$$\begin{aligned}\text{PUC AL at 7\%} & 20,938*(D_{40} / D_{65}) \ddot{a}_{65}^{(12)} \\ & 20,938(1.07)^{-25}(10.00) \\ & = 38,578\end{aligned}$$

01/01/2006 Valuation - 6% interest and 2.5% salary scale

The plan benefit is based on the final year of pay. The normal retirement age is 65, so you need to project pay to age 64.

$$\begin{aligned}\text{2005 compensation} & = 100,000 & \text{age 39 pay} \\ \text{Projected pay @ 64} & = 100,000*(1.025)^{25} \\ & = 185,394\end{aligned}$$

$$\begin{aligned}\text{Funding Accrued benefit} & 1.0\%(10)(\text{Final pay}) \\ & 1.0\%(10)(185,394) \\ & = 18,539\end{aligned}$$

$$\begin{aligned}\text{PUC AL at 6\%} & 18,539*(D_{40} / D_{65}) \ddot{a}_{65}^{(12)} \\ & 18,539(1.06)^{-25}(11.00) \\ & = 47,516\end{aligned}$$

$$\begin{aligned}\Delta(\text{Funding Accrued benefit}) & 1.25\%(\text{Final pay}) \\ & 1.25\%(185,394) \\ & = 2,317\end{aligned}$$

$$\begin{aligned}\text{PUC NC at 6\%} & 2,317*(D_{40} / D_{65}) \ddot{a}_{65}^{(12)} \\ & (2,317/18,539)*47,516 \\ & = 5,940\end{aligned}$$

You can't use the typical trick of calculating the normal cost by dividing the accrued liability by past service. The reason is that the benefit rate is not uniform for all years of service.

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Problem 44 – Page 3

For the Minimum Funding Standard Account (MFSA), you only have one amortization base. You need to determine the change in the accrued liability, and set up an assumption change base, which will be amortized over 10 years.

$$\begin{aligned}\text{Change in AL} &= 47,516 - 38,578 \\ &= 8,939\end{aligned}$$

$$\begin{aligned}6\% \text{ assm amort} &= 8,939 / \ddot{a}_{10|.06} \\ &= 1,146\end{aligned}$$

2006 Minimum Funding Standard Account			
Charges		Credits	
Normal Cost	5,940	Credit Balance	0
Assump amortization	1,146	12/31 minimum	x
6% interest	425	6% interest	0
Total charges	<u>7,511</u>	Total credits	<u>x</u>

You have no information on market value, so you must ignore the §412 Full Funding Limitation. The minimum contribution at 12/31/06 is 7,511.

Answer is E

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