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FALL 2004 EA-2A EXAM SOLUTIONS

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Fall 2004 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, 2004.

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 solution for problem 31
June 19, 2012	Corrected solution for problem 5
November 19, 2007	Corrected solution for problem 14, 27 and 41
August 26, 2007	Corrected solution for problem 31
October 31, 2006	Corrected solution for problem 28
October 2, 2006	Corrected solutions for problems 4, 23, 26, 27, 29, 34 and 39
August 21, 2006	Corrected passing percent, and solution for problems 15, 19, 23 and 37
July 14, 2006	Corrected solution for problems 19, 32, 36, 38, 42 and 44
June 20, 2006	Corrected solution for problems 20, 26, 30, 34 and 35
September 5, 2005	Corrected solution for problem 24
August 29, 2005	Corrected pass mark for 2004 (next page)
August 22, 2005	Original solutions

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NOTES on 2004 exam

Revised 08/21/06

The 2004 exam was similar to the 2003 exam, and harder than the 2002 exam. This means that you had to get a lower number of points correct to pass in 2004 than in 2003:

<u>Exam</u> <u>Year</u>	<u>Pass</u> <u>Mark</u>	<u>Percentage</u> <u>Who passed</u>
2004	104	44.6
2003	102	41.4
2002	112	44.1

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Problem 1

Similar to 2003 #3

TRUE

This tests your knowledge of a small detail in the regulation on asset valuation methods. At 1.412(c)(2)-1(b)(3), it says:

"(3) **Consistent valuation dates.** The same day or days (such as the first or the last day of a plan year) must be used for all purposes to value the plan's assets for each plan year, or portion of plan year, for which a valuation is made. For purposes of this section, each such day is a valuation date. A change in the day or days used is a change in funding method."

Answer is A

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Problem 2

Similar to 2003 #9

TRUE

The plan could be exempt from the 412(l) additional funding charge (AFC) for any of these reasons:

- (1) The plan is a multiemployer plan
- (2) The plan had less than 101 participants on each day of the prior plan year
- (3) The Gateway FCL% is 90% or more
- (4) The Gateway FCL% is between 80% and 90%, and the Gateway FCL% is at least 90% for two consecutive years of the prior three.

Based on the general exam conditions, you should assume the plan is not a multiemployer plan. You are told the plan had more than 100 participants in 2003. The pre-2004 years with a FCL of at least 90% are not consecutive

Since the 2004 FCL% is less than 90%, the plan is subject to the 412(l) AFC.

Answer is A

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Problem 3

Similar to 2003 #9

FALSE

Plans are exempt from the quarterly contribution requirement if the prior year's funded current liability percentage (FCL %) is 100% or more.

Answer is B

NOTE:

Per the instructions for line 4a of the Schedule B, this FCL% is calculated as (AAV-zero) / (RPA current liability).

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Problem 4

Revised 10/02/06

The key to this problem is knowing how to calculate costs under the Attained Age Normal (AAN) method. In general, the change in the AAN unfunded accrued liability (UAL) equals the change in the Unit Credit accrued liability.

In this problem, there is no past service credit given for the \$33 benefit. Since the accrued benefit at 01/01/04 does not change, there is no change in the Unit Credit accrued liability (or the AAN UAL).

You are given valuation results based on the old \$30 plan. You need to determine the change in the AAN PVNC, so you can calculate the increase in the AAN normal cost.

For all cost methods, you have the following relationship:

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

Under Unit Credit, it is also true that

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

$$\text{PVNC} = \text{PVB} - \text{AL}$$

Under Attained Age Normal, it is also true that

$$\Delta \text{AAN UAL} = \Delta \text{UC UAL}$$

$$\Delta \text{AAN PVNC} = \Delta \text{UC PVNC}$$

$$\begin{aligned} \$30 \text{ PVNC} &= 2,900,000 - 1,500,000 \\ &= 1,400,000 \end{aligned}$$

$$\begin{aligned} \$33 \text{ PVNC} &= (33/30)(1,400,000) \\ &= 1,540,000 \end{aligned}$$

$$\Delta \text{PVNC} = 140,000 = 1,540,000 - 1,400,000$$

The PVL/L ratio is the average temporary annuity with no salary scale. This is the appropriate definition to calculate a normal cost for a plan where benefits are not based on pay:

$$\begin{aligned} \text{PVL} / \text{L} &= 16,000 / 1,000 \\ &= 16.0 \end{aligned}$$

$$\begin{aligned} \Delta \text{NC} &= 140,000 / 16.0 \\ &= 8,750 \end{aligned}$$

Answer is A

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Problem 5

Similar to 2001 #9

Revised 06/19/12

The key to this problem is carefully handling the effect of the beginning of the year withdrawal decrement assumption.

Age 63 at 01/01/04

Past service 5

Future service 2

$$\Delta AB = 40(12)$$

Under the Unit Credit method, the normal cost is calculated as the present value of the increase in the accrued benefit. With pre-retirement withdrawal decrements, the normal cost is calculated in two pieces – one for retirement, and one for vested exits:

$$NC = v^2 {}_2p_{63}^{(T)} (\Delta \text{ Accd Ben}) \ddot{a}_{65}^{(12)} + \sum_{t=0}^2 v^t {}_t p_{63}^{(T)} q_{63+t}^{(w)} (\text{Vesting \%})_{63+t} (\Delta \text{ Accd Ben}) \ddot{a}_{65}^{(12)}$$

The first term is the portion of the normal cost due to retirement at age 65. The summation is the portion of the normal cost due to withdrawals prior to age 65. The participant must survive the pre-retirement decrements to reach age 65. There is only one term in the summation, which allows for the withdrawal decrement at age 63.

The trick to the problem is that there is NO increase in the accrued benefit for the 6% of the participant that is assumed to exit at age 63. This is because the decrement occurs at the beginning of the year.

As a result, the calculation of the normal cost is fairly short:

$$\begin{aligned} NC &= (v^2)(1-.06)({}_1p_{64})(480) \ddot{a}_{65}^{(12)} + \text{zero} \\ &= (1.07)^{-2}(.94)(1.0)(480)(9.24) \\ &= 3,641 \end{aligned}$$

Answer is B

NOTE

In prior exam problems, retirement decrements usually occur at the beginning of the year. And the non-retirement decrements usually occur at the end of the year.

If the withdrawal decrements occurred at the end of the year in this problem, then you would need to calculate the value of the summation - since the change in the accrued benefit would be non-zero. If this problem had withdrawal decrements beyond current age, you would need to calculate the value of the summation - the change in the accrued benefit at current age would be used to determine the normal cost for future withdrawals.

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Problem 6

Similar to 2002 #23

The key to this problem is the derivation of the average temporary annuity used for the normal cost calculation at 01/01/2004. You must also set up both the expected (and actual) balance sheets at 01/01/04.

Item	Actual 01/01/03	Expected 01/01/04
PVE / E	$15.0 = \frac{1,500,000}{100,000}$	$\frac{(1.07) * (15.0 - 1.0)}{p_x(1.04)}$ $= 14.4038$

The key point of the problem is the formula used for the PVE/E ratio at 01/01/04. 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.

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%,

The minimum contribution for 2003, payable at 12/31/03, is the normal cost increased with 7% interest. You need to be careful when setting up the actual asset value at 01/01/04. The assets at 01/01/03 should be brought forward with the actual investment return of 5%, but the 2003 contribution paid at 12/31/03 does not change:

Item	Actual 01/01/03	Expected 01/01/04	Actual 01/01/04
PVB	200,000	$(1.07)(200,000)$ $= 214,000$	$\frac{(1.03)(214,000)}{(1.04)}$ $= 211,942$
AAV	50,000	$(1.07)(50,000)$ $+ (1.07)(10,000)$	$(1.05)(50,000)$ $+ 10,700$ $= 63,200$
PVNC	150,000		$211,942 - 63,200$ $= 148,742$
PVE / E	15	$= 14.4038$	Same
NC	10,000		$148,742 / 14.4038$ $= 10,327$

Answer is E

NOTE:

The derivation of the formula for the expected PVE/E ratio is shown on page two of the solution for 2002 #23.

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Problem 7

Similar to 2003 #20

This problem did not try to be sneaky about the Full Funding Limitation (FFL) at all. There is nothing hidden or difficult, which is what you expect for a three point problem.

After 2003, the OBRA FFL has expired. 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 are given the OBRA/RPA current liability values at the beginning of the year. This is unusual, and you must calculate the end of year values for the FFL:

$$\begin{aligned}\text{\$412 "ERISA" FFL} &= (1+i) * (\text{EA NC} + \text{EAN AL}) - (1+i) * [\text{lesser (MVA, AAV)} - \text{CB}] \\ &= 1.07 * [10,000 + 105,000 - (90,000 - 0)] \\ &= 26,750\end{aligned}$$

$$\begin{aligned}\text{\$412 "RPA 94" FFL} &= .90 (12/31 \text{ CL}) - (1+i) * (\text{AAV}) && \text{(if no benefit payments)} \\ &= .90 * [(1.0655)(11,000 + 75,000) - 0 \text{ BP}] - [1.07 * (108,000) - 0 \text{ BP}] \\ &= \text{Zero}\end{aligned}$$

The final §412 FFL value is the greater of the RPA '94 and the ERISA FFL values, or 26,750.

Answer is D

Note that the end of year asset value (if any) should be used in calculating the RPA '94 FFL. The reason is that any benefit payments during the year should be reflected at the valuation rate in the assets. They are included at the current liability interest rate (which may be different) in the end of year current liability value.

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Problem 8 - Page 1

The key to this problem is carefully handling the change in actuarial assumptions. You must calculate the 412 amortizations under the old and new assumptions.

This is a very long calculation problem. You must determine the Unit Credit accrued liability at 01/01/03, and use that value for the initial accrued liability. At 01/01/04, you have to allow for the decrease in the interest rate from 7% to 5%.

01/01/2003 Valuation - 7% interest

Description

Birth Date	01/01/64
01/2003 Age	39
Hire Date	01/01/88
Past service	15
Future service	26
Accrued benefit	$12(30)(10) + 12(35)(15-10)$ $= 5,700$
PV accrued benefit	$5,700(D_{65} / D_{39}) \ddot{a}_{65}^{(12)}$
UC accrued liability	$5,700(1.07)^{-26} (9.75)$
IAL	$= 9,570$

01/01/2004 Valuation - 5% interest

Description

Birth Date	01/01/64
01/2004 Age	40
Hire Date	01/01/88
Past service	16
Future service	25
Accrued benefit	$12(30)(10) + 12(35)(16-10)$ $= 6,120$

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Problem 8 - Page 2

01/01/2004 Valuation - 5% interest (continued)

$$\begin{aligned}\text{PV accrued benefit} &= 6,120(D_{65} / D_{40}) \ddot{a}_{65}^{(12)} \\ \text{UC accrued liability} &= 6,120(1.05)^{-25} (11.5) \\ &= 20,783\end{aligned}$$

$$\begin{aligned}\Delta \text{ accrued benefit} &= 12(35) = 420 \\ \text{PV of } \Delta \text{ AB} &= 420(1.05)^{-25} (11.5) \\ &= (420/6,120) * 20,783\end{aligned}$$

$$\text{UC normal cost} = 1,426$$

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.

For the Minimum Funding Standard Account (MFSA), you have two amortization bases. The remaining balance of the IAL should be amortized at 5% for the remaining period of 29 years. You need to determine the change in the accrued liability, and set up an assumption change base, which will be amortized over 10 years.

$$\begin{aligned}7\% \text{ IAL amort} &= 9,570 / \ddot{a}_{30|.07} \\ \text{O/S } 7\% \text{ base} &= 9,570 \left(\ddot{a}_{29|.07} / \ddot{a}_{30|.07} \right) \\ &= 9,468\end{aligned}$$

$$\begin{aligned}5\% \text{ IAL amort} &= 9,468 / \ddot{a}_{29|.05} \\ &= 596\end{aligned}$$

$$\begin{aligned}\text{Old } 7\% \text{ AL} &= 6,120(1.07)^{-25} (9.75) \\ &= 10,994\end{aligned}$$

$$\begin{aligned}\text{Change in AL} &= 20,783 - 10,994 \\ &= 9,789\end{aligned}$$

$$\begin{aligned}5\% \text{ assm amort} &= 9,789 / \ddot{a}_{10|.05} \\ &= 1,207\end{aligned}$$

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Problem 8 - Page 3

2004 Minimum Funding Standard Account			
Charges		Credits	
Normal Cost	1,426	Credit Balance	0
IAL amortization	596		
ASSM amortization	1,207	12/31 contribution	x
5% interest	161	5% interest	0
Total charges	3,390	Total credits	x

You have no information to calculate the §412 Full Funding Limitation. The problem asks for the minimum contribution at 12/31/04. That contribution is 3,390.

Answer is D

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Problem 9 - Page 1

Similar to 2002 #5

The key to this problem is knowing how to determine the unfunded accrued liability at 01/01/04, and calculating the normal cost under the Frozen Initial Liability (FIL) cost method.

$$PVNC = PVB - AAV - UAL$$

$$UAL = O/S \text{ } \$412 \text{ bases} - CB - ARA$$

You are given the outstanding \$412 bases for the initial accrued liability (IAL). You should first calculate the annual amortization amount, and save that for use in the MFSA:

Amortization Base	Outstanding Base	Remaining Period	Amortization Amount
1-1-1998 Initial AL	2,850,000	24 = 30-(2004-1998)	$232,232 = 2,850,000 / \ddot{a}_{24 .07}$

Now you can determine the IAL. Once you have the IAL, you can use it to determine the amount of the UAL (based on funding over a 25 year period). Once you have the UAL, you can solve for the credit balance:

$$UAL = O/S \text{ } 412 \text{ bases} - CB - ARA$$

$$O/S \text{ } 412 \text{ bases} = IAL * \ddot{a}_{24|.07} / \ddot{a}_{30|.07}$$

$$\begin{aligned} IAL &= 2,850,000 * \ddot{a}_{30|.07} / \ddot{a}_{24|.07} \\ &= 3,083,507 \end{aligned}$$

You are told that, at the end of each year, the plan has contributed the normal cost plus amortization of the IAL over 25 years. At first glance, I would assume the 12/31 contribution was equal to $NC + IAL / \ddot{a}_{25|.07}$.

But you can't actually work the problem based on this contribution amount. The reason is that you won't get a simple formula for the UAL after 01/01/98. Under the FIL method, the UAL each year is defined based on the formulas for the expected UAL:

$$\begin{aligned} {}_eUAL_1 &= (1+i)[NC_0 + UAL_0] - \{\text{contribution} + \text{interest}\} \\ &= (1+i)[NC_0 + UAL_0] - \{NC_0 + IAL / \ddot{a}_{25|.07}\} \end{aligned}$$

In order for this formula to simplify, the contribution must include a payment of $(1+i)(NC)$. The best guess for the amount of the 12/31 contribution is that it equals $(1+i)(NC + IAL / \ddot{a}_{25|.07})$,

which also equals $(1+i)(NC) + IAL / \ddot{a}_{25|.07}$.

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Problem 9 - Page 2

$$\begin{aligned}
 01/01/99 {}_e\text{UAL}_1 &= (1+i)[\text{NC}_0 + \text{UAL}_0] - (1+i)\{\text{NC}_0 + \text{IAL} / \ddot{a}_{\overline{25}|.07}\} \\
 &= (1+i)[\text{IAL}] - (1+i)\{\text{IAL} / \ddot{a}_{\overline{25}|.07}\}
 \end{aligned}$$

This eventually simplifies to the expected result:

$$01/01/99 {}_e\text{UAL}_1 = \text{IAL}(\ddot{a}_{\overline{24}|.07} / \ddot{a}_{\overline{25}|.07})$$

$$01/01/00 {}_e\text{UAL}_1 = \text{IAL}(\ddot{a}_{\overline{23}|.07} / \ddot{a}_{\overline{25}|.07})$$

$$\begin{aligned}
 01/01/04 {}_e\text{UAL}_1 &= \text{IAL}(\ddot{a}_{\overline{19}|.07} / \ddot{a}_{\overline{25}|.07}) \\
 &= 3,083,507 * (11.0591/12.4693) \\
 &= 2,734,771
 \end{aligned}$$

$$\begin{aligned}
 \text{UAL} &= \text{O/S 412 bases} - \text{CB} - \text{ARA} \\
 2,734,771 &= 2,850,000 - \text{CB} - 0 \\
 \text{CB} &= 2,850,000 - 2,734,771 \\
 &= 115,229
 \end{aligned}$$

Now calculate the normal cost under the Frozen Initial Liability method:

$$\begin{aligned}
 \text{PVNC} &= \text{PVB} - \text{AAV} - \text{UAL} \\
 &= 9,750,000 - 2,850,000 - 2,734,771 \\
 &= 4,165,229
 \end{aligned}$$

$$\begin{aligned}
 \text{PVE} / \text{E} &= 22,675,000 / 2,000,000 &= 11.3375 \\
 \text{NC} &= 4,165,229 / 11.3375 &= 367,385
 \end{aligned}$$

2004 Minimum Funding Standard Account			
Charges		Credits	
Normal Cost	367,385	Credit Balance	115,229
IAL amortization	232,232	12/31 contribution	x
7% interest	41,973	7% interest	8,066
Total charges	<u>641,590</u>	Total credits	<u>123,295 + x</u>

You have no information to calculate the \$412 Full Funding Limitation. The minimum contribution at 12/31/04 is $641,590 - 123,295 = 518,295$.

Answer is B

(See notes on next page)

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Problem 9 - Page 3

Alternate solution

In this problem, you calculated the UAL, and then solved for the credit balance. You could have solved for the credit balance directly.

If the contribution paid at the end of each year uses a 30 year amortization of the IAL, then the credit balance would be zero:

$$\text{Zero credit balance when 12/31 contribution} = (1+i)(\text{NC} + \text{IAL} / \ddot{a}_{\overline{30}|.07}).$$

Any larger contribution creates a credit balance:

$$12/31/98 \text{ charges} = (1+i)[\text{NC}_0 + \text{IAL} / \ddot{a}_{\overline{30}|.07}]$$

$$12/31/98 \text{ credits} = (1+i)\{\text{NC}_0 + \text{IAL} / \ddot{a}_{\overline{25}|.07}\}$$

$$12/31/98 \text{ CB} = (1+i)\{\text{IAL} / \ddot{a}_{\overline{25}|.07} - \text{IAL} / \ddot{a}_{\overline{30}|.07}\}$$

$$\begin{aligned} 12/31/99 \text{ CB} &= (1+i)[12/31/98 \text{ CB}] + (1+i)\{\text{IAL} / \ddot{a}_{\overline{25}|.07} - \text{IAL} / \ddot{a}_{\overline{30}|.07}\} \\ &= \ddot{s}_{\overline{2}|.07} \{\text{IAL} / \ddot{a}_{\overline{25}|.07} - \text{IAL} / \ddot{a}_{\overline{30}|.07}\} \end{aligned}$$

$$\begin{aligned} 12/31/03 \text{ CB} &= \ddot{s}_{\overline{6}|.07} \{\text{IAL} / \ddot{a}_{\overline{25}|.07} - \text{IAL} / \ddot{a}_{\overline{30}|.07}\} \\ &= 115,229 \end{aligned}$$

Alternate (incorrect) assumption

There is one other assumption that you can make about the contribution paid at 12/31. As shown on the prior page, in order to work the problem, the 12/31 contribution must include the normal cost with interest. But you might not want to include interest on the 25 year amortization payment of the IAL:

$$12/31 \text{ contrib} = (1+i)(\text{NC}) + \text{IAL} / \ddot{a}_{\overline{25}|.07}$$

$$12/31/98 \text{ CB} = \text{IAL} / \ddot{a}_{\overline{25}|.07} - (1+i)\{\text{IAL} / \ddot{a}_{\overline{30}|.07}\}$$

$$\begin{aligned} 12/31/99 \text{ CB} &= (1+i)[12/31/98 \text{ CB}] + \text{IAL} / \ddot{a}_{\overline{25}|.07} - (1+i)\{\text{IAL} / \ddot{a}_{\overline{30}|.07}\} \\ &= s_{\overline{2}|.07} \{\text{IAL} / \ddot{a}_{\overline{25}|.07}\} - (1+i)(s_{\overline{2}|.07})\{\text{IAL} / \ddot{a}_{\overline{30}|.07}\} \end{aligned}$$

$$12/31/03 \text{ CB} = s_{\overline{6}|.07} [\text{IAL} / \ddot{a}_{\overline{25}|.07} - (1+i)(\text{IAL} / \ddot{a}_{\overline{30}|.07})]$$

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Problem 9 - Page 4

$$\begin{aligned} 12/31/03 \text{ CB} &= (7.6540/1.07)[3,083,507/12.4693 - (1.07)(3,083,507/13.2777)] \\ &= -8,595 \end{aligned}$$

This assumption actually leads to a debit balance of 8,595 at 12/31/03.

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

$$\begin{aligned} \text{PVNC} &= 9,750,000 - 2,850,000 - (2,850,000 + 8,595 - 0) \\ &= 4,041,405 \end{aligned}$$

$$\begin{aligned} \text{PVE / E} &= 22,675,000 / 2,000,000 &= 11.3375 \\ \text{NC} &= 356,464 \end{aligned}$$

2004 Minimum Funding Standard Account

Charges		Credits	
Debit balance	8,595	Credit Balance	0
Normal Cost	356,464		
IAL amortization	232,232	12/31 contribution	x
7% interest	41,810	7% interest	0
Total charges	639,101	Total credits	x

You have no information to calculate the §412 Full Funding Limitation. The minimum contribution at 12/31/04 is 639,101.

Answer is E

This is in the incorrect answer range. The conclusion is that it is not reasonable to assume that the 12/31 contribution excludes interest on the 25 year amortization payment.

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Problem 10

Similar to 2001 #36

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%, and re-determine the amortization of all the bases at the new 6% interest rate:

Amortization base	Remaining Years 01/01/04	7% Outstanding base at 01/01/04	6% amortization at 01/01/04
1-1-2002 Initial AL	30-(2004-2002) = 28	$450,000 * (\ddot{a}_{28 .07} / \ddot{a}_{30 .07}) =$	$440,139 / \ddot{a}_{28 .06} = 30,973$
1-1-2003 Gain base	5-(2004-2003) = 4	$-40,000 * (\ddot{a}_{4 .07} / \ddot{a}_{5 .07}) =$	$-33,044 / \ddot{a}_{4 .06} = -8,997$
1-1-2004 Loss base	5-(2004-2004) = 5	70,000	$70,000 / \ddot{a}_{5 .06} = 15,677$
1-1-2004 Assump base	10-(2004-2004) = 10	80,000	$80,000 / \ddot{a}_{10 .06} = 10,254$

2004 Minimum Funding Standard Account

Charges		Credits	
Normal Cost	30,000	Credit Balance	5,200
IAL amortization	30,973	2002 Gain	8,997
2003 Loss	15,677	06/30 contribution	90,000
Assump change	10,254		
6% interest	5,214	6% interest	3,552
Total charges	92,118	Total credits	107,748

Interest on the credits is calculated using simple interest:

$$3,552 = .06(5,200 + 8,997) + (.06)(6/12)(90,000)$$

You have no information to calculate the §412 Full Funding Limitation. The credit balance at 12/31/04 is $107,748 - 92,118 = 15,630$.

Answer is B

If you used compound interest to calculate interest on the contribution, the interest on the credits is slightly smaller, but the credit balance is in the same answer range:

$$\begin{aligned} \text{Interest credited} & 3,513 = .06(5,200 + 8,997) + [(1.06)^{(6/12)} - 1](90,000) \\ \text{Total credits} & 107,709 = 5,200 + 8,997 + 90,000 + 3,513 \\ \text{Credit balance} & 15,591 = 107,709 - 92,118 \end{aligned}$$

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Problem 11 - Page 1

Similar to 2003 #11

The 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 non-investment gain / loss is defined as the difference between the expected and actual accrued liability.

The investment gain / loss is defined as the difference between the expected and actual actuarial value of assets:

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

The first step is calculation of the expected actuarial value of assets:

$$\begin{aligned} {}_e\text{AAV}_1 &= (1+i)(\text{AAV}_0) - (\text{actual benefit payments} + \text{interest}) + (\text{contributions} + \text{interest}) \\ &= 1.07(120,000) - [1 + (6/12)(.07)](20,000) + (50,000) \\ &= 157,700 \end{aligned}$$

$$\begin{aligned} \text{Inv loss} &= {}_e\text{AAV}_1 - \text{AAV}_1 \\ &= 157,700 - 110,000 \\ &= 47,700 \end{aligned}$$

The total experience gain / loss is defined as the difference between the expected and actual unfunded accrued liability:

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

The first step is calculation of the expected unfunded accrued liability:

$$\begin{aligned} {}_e\text{UAL}_1 &= (1+i)(\text{NC}_0 + \text{UAL}_0) - (\text{contribution} + \text{interest}) \\ &= 1.07(10,000 + 0) - 50,000 \\ &= -39,300 \end{aligned}$$

Revenue Ruling 81-213 contains the rules for determination of G/L. Section 6.02 defines the formula for the expected UAL as shown above. This means any negative expected UAL should be treated as negative for determination of G/L.

Section 5.01 defines the actual UAL as the excess, IF ANY, of the AL over the AAV. If the actual UAL is negative, it should be treated as zero for determination of G/L.

$$\begin{aligned} \text{UAL} &= \text{AL} - \text{AAV} \\ &= 125,000 - 110,000 \\ &= 15,000 \end{aligned}$$

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Problem 11 - Page 2

$$\begin{aligned}\text{Loss} &= \text{UAL}_1 - {}_e\text{UAL}_1 \\ &= 15,000 - (-39,300) \\ &= 54,300\end{aligned}$$

$$\begin{aligned}x/y &= (\text{Total Loss}) / (\text{Asset Loss}) \\ &= 47,700 / 54,300 \\ &= 87.85\%\end{aligned}$$

Answer is D

NOTES:

1. Compound interest

You could also work the problem using compound interest for the benefit payments plus interest. The expected asset value would equal 157,712 and the resulting asset loss is 47,712. The ratio of (Total Loss) / (Asset Loss) is 87.87%. As expected, this also produces answer range D.

2. Alternate solution

If you are leery about using the negative expected unfunded, you could calculate the non-investment G/L. Then the total G/L equals the sum of the non-investment G/L and the asset G/L.

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

$$\begin{aligned}{}_e\text{AL}_1 &= (1+i) \cdot (\text{NC}_0 + \text{AL}_0) - (\text{actual benefit payments} + \text{interest}) \\ &= 1.07 \cdot (10,000 + 120,000) - [1 + (6/12)(.07)](20,000) \quad (\text{simple int}) \\ &= 118,400\end{aligned}$$

$$\begin{aligned}\text{Non-inv Loss} &= \text{AL}_1 - {}_e\text{AL}_1 \\ &= 125,000 - 118,400 \\ &= 6,600\end{aligned}$$

$$\begin{aligned}\text{Total Loss} &= \text{non-inv G/L} + \text{asset G/L} \\ &= 6,600 + 47,700 \\ &= 54,300\end{aligned}$$

As expected, this produces the same total G/L as before. This should convince you that the total G/L really should allow for use of a negative expected UAL.

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Problem 12

Similar to 2002 #9

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.

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

Age 62 at 01/01/04

Past service 1

Future service 3

Total service 4

Entry age 61

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

$$\begin{aligned} PVB \text{ at } 61 &= 12,000(D_{65} / D_{61}) \ddot{a}_{65}^{(12)} \\ &= 12,000(1.07)^{-4}(12.41) \\ &= 113,610 \end{aligned}$$

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

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

$$\begin{aligned} s\ddot{a}_{\overline{61:4}|} &= \ddot{a}_{\overline{4}|j} \quad \text{where } 1+j = (1.07 / 1.035), \quad j = 3.38\% \\ &= 3.8080 \end{aligned}$$

$$\begin{aligned} EANC_{61} &= 113,610 / 3.8080 \\ &= 29,835 \end{aligned}$$

$$\begin{aligned} EANC_{62} &= 29,835 * (1.035)^1 \\ &= 30,875 \end{aligned}$$

Answer is A

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Problem 13 - Page 1

Similar to 2001 #22

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 G/L is caused by the exit of Smith and Jones. You need to calculate the normal cost and accrued liability at 01/01/03, and use that to calculate the expected accrued liability at 01/01/04.

Description	<u>Smith</u>	<u>Jones</u>
01/2003 Age	59	44
Past service	29	14
Entry age	30	30
Total service	35	35
Projected benefit	50(12)(35) = 21,000	same
PVB at entry age	21,000 (D ₆₅ / D ₃₀) $\ddot{a}_{65}^{(12)}$ = 21,000(1.07) ⁻³⁵ (9.24) = 18,174	Same
$\ddot{a}_{\overline{EA:RA-EA} }$	$\ddot{a}_{\overline{35 .07}} = 13.8540$	Same
EA normal cost	18,174 / 13.8540 = 1,312	Same
EAN accrued liability	1,312($\ddot{s}_{\overline{CA:CA-EA} }$) 1,312($\ddot{s}_{\overline{29 .07}}$) = 122,606	1,312($\ddot{s}_{\overline{CA:CA-EA} }$) 1,312($\ddot{s}_{\overline{14 .07}}$) = 31,654
${}_eAL_1$	= (1.07)*(1,312+1,312+122,606+31,654) - 50,000 = 117,866	

The calculation above treats Jones' lump sum as a benefit payment at 12/31/03.

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Problem 13 - Page 2

Since we treated Jones' lump sum as a benefit payment at 12/31/03, there is no liability calculation needed for them at 01/01/04.

Description	<u>Smith</u>
01/2004 Age	60
Past service	30
Early retirement benefit	$50(12)(30) = 18,000$
Retired AL	$18,000 \ddot{a}_{60}^{(12)}$ $= 18,000(10.38)$ $= 186,840$
Non-inv G/L	$= {}_eAL_1 - AL_1$ $= 117,866 - 186,840$
LOSS	$= 68,974$

Answer is C

If you prefer, you can treat Jones' lump sum as their liability at 01/01/04. In that case, the benefit payments would be zero. You still get the same 68,974 loss for 2003.

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Problem 14 - Page 1

The key to this problem is carefully handling the salary scale, and calculating the normal cost under the Aggregate method. Under the Aggregate method, the present value of normal costs (PVNC) is defined as the present value of benefits less the 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 based on pay, so the temporary annuity should include the salary scale (even though it is zero).

<u>Description</u>	<u>Smith</u>	<u>Jones</u>	<u>Total</u>
01/2004 Age	25	51	
Past service	2	5	
Total service	42	19	
Benefit rate	(20/20)(50%)	(19/20)(50%)	
Projected benefit	(20/20)(50%)(25,000) = 12,500	(19/20)(50%)(150,000) = 71,250	
PV future benefits	$12,500(D_{65} / D_{25}) \ddot{a}_{65}^{(12)}$ $12,500(1.07)^{-40} (10.0)$ = 8,348	$71,250(D_{65} / D_{51}) \ddot{a}_{65}^{(12)}$ $71,250 (1.07)^{-14} (10.0)$ = 276,320	284,667

Now you can calculate the Aggregate PVNC:

$$\begin{aligned}\$412 \text{ PVNC} &= \text{PVB} - \text{AAV} - (\text{O/S } \$412 \text{ bases} - \text{CB}) && \text{NOTE: No ARA under Aggregate} \\ &= 284,667 - 50,000 - (0 - 5,000) \\ &= 239,667\end{aligned}$$

Now you need to calculate the average pay weighted annuity, which can then be used to calculate the normal cost. There are no pre-retirement decrements (based on general exam condition 19). Since there is no salary scale, the temporary annuity is calculated on an interest only basis.

The trick to the problem is that you don't simply average the temporary annuity values for the two participants. If you do that, you get 21,711 for the 12/31/04 normal cost, which is in the wrong answer range.

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Problem 14 - Page 2

Revised 11/19/07

You need to calculate the average pay weighted annuity by dividing the present value of earnings by the total earnings of 175,000.

<u>Description</u>	<u>Smith</u>	<u>Jones</u>	<u>Total</u>
01/2004 Age	25	51	
Temporary annuity	$s\ddot{a}_{\overline{25:40} }$	$s\ddot{a}_{\overline{51:14} }$	
	$= \ddot{a}_{\overline{40} .07}$	$= \ddot{a}_{\overline{14} .07}$	
	$= 14.2649$	$= 9.3577$	
PV of earnings	$25,000(14.2649)$	$150,000(9.3577)$	
	$= 356,623$	$= 1,403,648$	$1,760,271$
PVE / E	$= 1,760,271 / 175,000$		
	$= 10.0587$		
§412 NC	$= PVNC / (PVE/E)$		
	$= 239,667 / 10.0587$		
	$= 23,827$		
12/31 NC	$= 1.07(23,827)$		
	$= 25,495$		

Answer is D

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Problem 15 - Page 1

Revised 08/21/06

The key to this problem is calculation of the required quarterly installment, and the amount of the underpayment. You have to know how to handle both the FFL credit of 100,000 at 12/31/04, as well as the 412(l) and 412(m) charges at 12/31/03.

To calculate the minimum required quarterly contribution for 2004, 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 other MFSA items for 2003 and 2004, both as of the valuation date.

$$\begin{aligned} 12/31/03 \text{ "MFSA excl CB"} &= (\$412 \text{ NC} + \text{amort} - 0) * 1.07 + 412(l) + 412(m) \\ &= (70,000 + 150,000) * 1.07 + 80,000 + 20,000 \\ &= 335,400 \end{aligned}$$

$$01/01/04 \text{ "MFSA excl CB"} = (\$412 \text{ NC} + \text{amort} - 0) + 412(l)/[1+i^{CL}]$$

Based on Q.4 of Notice 89-52, if the FFL applies for a year, you should use the FFL to calculate the RAP (instead of the minimum in the MFSA.) In this problem, you are given the amount of the FFL credit. If you use that value in determining this year's "MFSA excl CB", it gives the same result as the FFL:

$$\begin{aligned} \text{"AFD"} &= (1+i)(\$412 \text{ NC} + \$412 \text{ amort}) + 412(l) \\ 12/31 \text{ FFL credit} &= \text{"AFD"} - \text{FFL} \\ 12/31 \text{ FFL} &= \text{"AFD"} - (\text{FFL credit}) \\ &= (1+i)(\$412 \text{ NC} + \$412 \text{ amort}) + 412(l) - (\text{FFL credit}) \end{aligned}$$

The only catch is that you want the "MFSA excl CB" at the beginning of the plan year. You need to adjust the FFL back to 01/01/04. For the ERISA FFL, it makes sense to use the valuation interest rate (the RPA FFL is not as clear - usually has two different interest rates).

$$\begin{aligned} 01/01/04 \text{ "MFSA excl CB"} &= (\$412 \text{ NC} + \text{amort}) + [412(l) - (\text{FFL credit})]/(1+i) \\ &= 105,000 + 360,000 - 100,000/1.07 = 371,542 \\ \text{Lesser of 2003 or 90\% of 2004} &= \text{Lesser of } (335,400 \text{ or } .90 * 371,542) = 334,388 \end{aligned}$$

The 2004 required quarterly installment is based on the applicable percentage multiplied by the RAP, which is $25\%(334,388) = 83,597$.

Answer is D

(see notes on next page)

NOTES:

1. These problems usually ask for the minimum required quarterly contribution at a specific date. This problem asks for the minimum required quarterly contribution for 2004. This allows for the fact that you can't actually calculate the 2003 412(m) late quarterly penalty charge of 20,000 until the date the contribution is paid (09/15/04).
2. If you do not include the 412(m) late quarterly penalty charge of 20,000 in the 2003 "MFSA excl CB", the RAP is 315,400. The resulting 2004 required quarterly installment is $25\%(315,400) = 78,850$, which is in the wrong answer range A.
3. If you do not include the FFL credit of 100,000 in the 2004 "MFSA excl CB", the RAP is 335,400. The resulting 2004 required quarterly installment is $25\%(335,400) = 83,850$, which is in the wrong answer range E.
4. The calculation of the 412 "AFD" for the FFL normally includes the 412(m) charge for the year. But you can't include the current year's 412(m) charge when you are determining the current year's RAP. The current year's 412(m) charge is not known until the current year contributions have been paid.

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Problem 16 - Page 1

Similar to 2003 #35

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 problem asks for the accumulated reconciliation account (ARA) balance at 01/01/04. In the absence of any waiver base amortization, you would use this formula to calculate the ARA at 01/01/04:

$$01/04 \text{ ARA} = 1.07(01/03 \text{ ARA}) + [\$412(l) \text{ charge} + \$412(m) \text{ charge}] \text{ for 2003}$$

Based on the general conditions, the §412(d) item for waivers is equal to zero. Most of the work in this problem is calculating the 412(l) charge for 2003.

You are told that the funded current liability percentage (FCL%) has never been greater than 90%, but it is not clear that this also refers to the Gateway FCL%. 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).

$$\begin{aligned} \text{Gateway \%} &= (\text{AAV} - 0) / (\text{CL at highest permissible rate}) \\ &= 1,100,000 / 1,325,000 \\ &= 83.02\% \end{aligned}$$

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.

$$\begin{aligned} \text{UCL} &= \text{CL} - (\text{AAV} - \text{CB}) \\ &= 1,375,000 - (1,100,000 - 0) \\ &= 275,000 \end{aligned}$$

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.

In this problem you are given no information on the UOL. This is the first time this has been done on the EA exams. In the absence of any specific information, you should assume that the UOL is zero. In this problem, you are told nothing about unpredictable contingent events. You must assume there are none.

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Problem 16 - Page 2

$$\begin{aligned}\text{UOL} &= 0 \text{ (assumed)} \\ \text{UNL} &= \text{UCL} - \text{UOL} - \text{UCEL} \\ &= 275,000 - 0 - 0 \text{ (assumed)} \\ &= 275,000\end{aligned}$$

With a zero UOL, the unfunded old liability amount (UOLA) is also zero.

The unfunded new liability amount (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%.

$$\begin{aligned}\text{FCL\%} &= (\text{AAV} - \text{CB}) / \text{CL} \\ &= (1,100,000 - 0) / 1,375,000 \\ &= 80.00\%\end{aligned}$$

$$\begin{aligned}\text{APP\%} &= .30 - .40 \text{ [.80 - .60]} \\ &= 22.00\%\end{aligned}$$

$$\begin{aligned}\text{UNLA} &= 275,000 * 22.00\% \\ &= 60,500\end{aligned}$$

$$\begin{aligned}\text{DRC} &= \text{UOLA} + \text{UNLA} + \text{CLNC} \\ \text{DRC} &= 0 + 60,500 + 114,000 \\ &= 174,500\end{aligned}$$

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

$$\begin{aligned}01/01/03 \text{ §412(l) AFC} &= \text{UCEA} + [\text{DRC} - (\text{§412 NC} + \text{§412 amortizations})] \\ &= 0 + 174,500 - (110,000 + 20,000) \\ &= 44,500\end{aligned}$$

$$\begin{aligned}12/31/03 \text{ §412(l) AFC} &= 44,500 * 1.06 \\ &= 47,170\end{aligned}$$

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Problem 16 - Page 3

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.

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 2002 plan year as 140.

$$\begin{aligned} 12/31/03 \text{ §412(l) AFC} &= 47,170 * [2\% * (140-100)] \\ &= 47,170 * .80 \\ &= 37,736 \end{aligned}$$

Now you can calculate the 01/01/04 ARA:

$$\begin{aligned} 01/01/04 \text{ ARA} &= 1.07(01/01/03 \text{ ARA}) + [\text{§412(l) charge} + \text{§412(m) charge}] \text{ for 2003} \\ &= 1.07(75,000) + 37,736 + 5,000 \\ &= 122,986 \end{aligned}$$

Answer is C

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Problem 17

This problem is relatively straightforward. The main key is knowing the amortization periods for the different types of bases. You can use the actuarial balance equation to solve for "X the unknown".

Original Date	Base Type	Amortization amount	Original Years	Remaining Years	Outstanding Base
01/01/2002	2001 G/L	X	5	$5 - (104-102) = 3$	$X * \ddot{a}_{\overline{3} .07}$
01/01/2002	Plan change	4,200	30	$30 - (104-102) = 28$	$54,544 = 4,200 * \ddot{a}_{\overline{28} .07}$
01/01/2003	2002 Loss	25,000	5	$5 - (104-103) = 4$	$90,608 = 25,000 * \ddot{a}_{\overline{4} .07}$
01/01/2004	2003 Loss	33,000	5	$= 5$	$144,778 = 33,000 * \ddot{a}_{\overline{5} .07}$
TOTAL					$X * \ddot{a}_{\overline{3} .07} + 289,930$

$$\begin{aligned} \text{UAL} &= \text{AL} - \text{AAV} \\ &= 800,000 - 600,000 \end{aligned}$$

$$\begin{aligned} \text{UAL} &= \text{O/S } \$412 \text{ bases} - \text{CB} - \text{ARA} \\ 200,000 &= X * \ddot{a}_{\overline{3}|.07} + 289,930 - 15,000 - 20,000 \end{aligned}$$

$$X * \ddot{a}_{\overline{3}|.07} = 289,930 - 235,000$$

$$\begin{aligned} X &= -54,930 / \ddot{a}_{\overline{3}|.07} \\ &= -19,562 \end{aligned}$$

Answer is C

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Problem 18

Similar to 2001 #36

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

You can use the equation of balance before the interest rate change to calculate the remaining amount of the IAL base:

$$\begin{aligned} 6\% \text{ UAL} &= \text{O/S } \$412 \text{ bases} - \text{CB} - \text{ARA} \\ 240,000 &= \text{O/S } \$412 \text{ bases} - 40,000 - 0 \\ \text{O/S base} &= 280,000 \end{aligned}$$

Amortization base	Remaining Years 01/01/04	Outstanding base at 01/01/04	7% amortization at 01/01/04
1-1-1994 Initial AL	30-(2004-1994) = 20	280,000	$280,000 / \ddot{a}_{\overline{20} .07} = 24,701$
1-1-2004 Assump base	10-(2004-2004) = 10	-80,000	$-80,000 / \ddot{a}_{\overline{10} .07} = 10,645$

2004 Minimum Funding Standard Account

Charges		Credits	
Normal Cost	60,000	Credit Balance	40,000
IAL amortization	24,701	Assump change	10,645
		12/31 contribution	x
7% interest	5,929	7% interest	3,545
Total charges	90,630	Total credits	x + 54,190

You have no information to calculate the §412 Full Funding Limitation. The minimum contribution at 12/31/04 is $90,630 - 54,190 = 36,440$.

Answer is E

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Problem 19 - Page 1

Similar to 2003 #19

Revised 08/21/06

The key to this problem is remembering to calculate the gain / loss for 2003. This is primarily a problem on the MFSA, with a bit of deductible limit calculations.

You must determine the expected UAL at 01/01/04, as well as the actual UAL at 01/01/04. The difference between those two values is the experience gain or loss base.

One shortcut is that you don't need to determine the amount of the deductible limit for 2003. Since the contribution was paid at 12/31/03, the asset value at 12/31/03 must equal the amount of the contribution:

$$\begin{aligned} 01/01/04 \text{ } _e\text{UAL} &= (1+i)*(NC_0 + \text{UAL}_0) - (\text{contribution} + \text{interest}) \\ &= 1.07 * (45,000 + 350,000) - (\text{Deductible limit}) \\ &= 422,650 - (\text{Deductible limit}) \end{aligned}$$

$$\begin{aligned} 01/01/04 \text{ UAL} &= \text{AL} - \text{AAV} \\ &= 370,000 - (\text{Deductible limit}) \end{aligned}$$

$$\begin{aligned} \text{Gain base} &= 422,650 - 370,000 \\ &= 52,650 \end{aligned}$$

$$\begin{aligned} \text{Gain amort} &= 52,650 \div \ddot{a}_{\overline{5}|.07} \\ &= 12,001 \end{aligned}$$

You also need to determine the credit balance at 12/31/03. It is equal to the difference between the minimum required contribution and the deductible limit.

You don't need to construct the MFSA for 2003 to calculate the credit balance. The deductible limit includes a 10 year amortization of the initial accrued liability, and the minimum uses a 30 year amortization:

$$\begin{aligned} 2003 \text{ Deductible limit} &= (1.07)(NC + \text{IAL} / \ddot{a}_{\overline{10}|.07}) \\ 12/31 \text{ Minimum contrib} &= (1.07)(NC + \text{IAL} / \ddot{a}_{\overline{30}|.07}) \\ 12/31/03 \text{ credit balance} &= (1.07)(\text{IAL} / \ddot{a}_{\overline{10}|.07} - \text{IAL} / \ddot{a}_{\overline{30}|.07}) \\ &= (1.07)(350,000 / \ddot{a}_{\overline{10}|.07} - 350,000 / \ddot{a}_{\overline{30}|.07}) \\ &= 21,627 \end{aligned}$$

While doing this calculation, you should store the value of $(350,000 / \ddot{a}_{\overline{30}|.07} = 26,360)$, since that is the MFSA amortization for the IAL.

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Problem 19 - Page 2

Revised 07/14/06

Now you can set up the MFSA and calculate the 12/31/04 minimum contribution:

2004 Minimum Funding Standard Account			
Charges		Credits	
Normal Cost	35,000	Credit Balance	21,627
IAL amortization	26,360	Gain amortization	12,001
		12/31/04 minimum	x
7% interest	4,295	7% interest	2,354
Total charges	<u>65,655</u>	Total credits	<u>x + 35,982</u>

Since this is almost a brand new plan, you can ignore the FFL calculations. It would be VERY unusual for it to affect the minimum contribution calculation. The minimum contribution at 12/31/04 is $29,673 = 65,655 - 35,982$.

Answer is B

NOTE:

You could have used a different technique to calculate the 2003 G/L. Since the only asset is the contribution is paid at 12/31, you can assume the investment G/L is zero. Then you can use the non-investment G/L formulas:

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

$$\begin{aligned} {}_e\text{AL}_1 &= (1+i) \cdot (\text{NC}_0 + \text{AL}_0) - (\text{actual benefit payments} + \text{interest}) \\ &= 1.07 \cdot (45,000 + 350,000) - \text{zero} \\ &= 422,650 \end{aligned}$$

$$\begin{aligned} \text{Non-inv Gain} &= {}_e\text{AL}_1 - \text{AL}_1 \\ &= 422,650 - 370,000 \\ &= 52,650 \end{aligned}$$

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Problem 20 - Page 1

Similar to 2001 #41

The key point of this problem is whether you know how to calculate the Full Funding Limitation (FFL) under §404 when you have a contribution that was deducted in advance. The method of calculation when you have a non-deducted contribution is outlined in Revenue Ruling 82-125, which says that you should adjust the FFL by adding the amount of the NDC, but with no interest adjustment.

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 should be 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.

General rule - no NDC / ADC

Assume AAV = assets used for §412 costs

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

Intuitive FFL - with NDC

If you did not know the rules in RR 82-125, you would adjust the FFL definition by substituting the §404 asset definition in place of the §412 definition:

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

RR 82-125 - with NDC

But that is not the definition shown in the examples in RR 82-125. The difference is that the NDC should not get any interest credit, which produces a slightly lower FFL:

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

404 FFL - with ADC

RR 82-125 does not show how to calculate the 404 FFL when you have an advance deducted contribution (ADC). The 404 assets should be increased by the ADC, since they were deducted in a prior tax year. It should make sense that the ADC gets credited with interest, which depends on the contribution date.

$$\text{\$404 AAV} = \text{AAV} + \text{ADC}$$

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

This formula gives a full year of interest on the ADC, since the contribution was paid to the trust at the beginning of the plan year.

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 ignore the RPA FFL, since you have no current liability values.

$$\begin{aligned}\text{\$404 "ERISA" FFL} &= (1+i)(\text{EA NC} + \text{EAN AL}) - (1+i)[\text{lesser (MVA, AAV)} + \text{ADC}] \\ &= 1.07 * (59,000 + 288,000) - 1.07 * (185,000 + 12,000) \\ &= 160,500\end{aligned}$$

Answer is C

NOTE:

It did not matter if you ignored the interest on the ADC. You would still have an answer in range C.

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Problem 21 - Page 1

Similar to 2003 #30

Unit Credit is an individual cost method. The key point of this problem is that you must calculate the amount of the experience gain / loss for 2003, and set up that base at 01/01/2004. You have no information for the 2003 valuation, so you must use the 412 actuarial equation of balance to solve for the amount of the G/L base.

$$\begin{aligned} \text{UAL} &= \text{O/S } \$412 \text{ bases} - \text{CB} - \text{ARA} \\ &= \text{O/S } \$412 \text{ bases} - 10,000 - 5,000 \end{aligned}$$

Original Date	Base Type	Amortization amount	Original Years	Remaining Years	Outstanding Base
01/01/2001	Initial AL	65,000	30	$30 - (104-101) = 27$	$833,676 = 65,000 * \ddot{a}_{27 .07}$
01/01/2004	Assump chg	15,000	10	$10 - (104-104) = 10$	$112,728 = 15,000 * \ddot{a}_{10 .07}$
TOTAL					946,404

$$\begin{aligned} \text{UAL} &= \text{AL} - \text{AAV} \\ &= 2,000,000 - 1,100,000 \end{aligned}$$

$$\begin{aligned} 900,000 &= 946,404 + \text{LOSS} - 10,000 - 5,000 \\ \text{LOSS} &= 900,000 - 946,404 + 15,000 \\ &= -31,404 \quad (\text{actually a net gain}) \end{aligned}$$

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. You need to calculate the amount of the initial accrued liability (IAL) to calculate the limit adjustments:

$$\begin{aligned} \text{IAL} &= 65,000 * \ddot{a}_{30|.07} \\ &= 863,049 \end{aligned}$$

$$\begin{aligned} \text{Ded limit} &= 1.07 * (100,000 + (863,049 + 112,728 - 31,404) \div \ddot{a}_{10|.07}) \\ &= 241,457 \end{aligned}$$

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

$$\begin{aligned} \text{\$404 "ERISA" FFL} &= (1+i) * (\text{NC} + \text{AL}) - (1+i) * (\text{lesser MVA, AAV}) \\ &= 1.07 * (100,000 + 2,000,000 - 1,100,000) \\ &= 1,070,000 \end{aligned}$$

You don't need to calculate the 404 RPA FFL, since it will only make the 404 FFL even larger. It is clear that the 404 FFL will not affect the deductible limit.

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Problem 21 - Page 2

Now you usually check the §412 minimum contribution to see if it is greater. But it should be clear that it won't affect the deductible limit. The reason is that you have a gain base at 01/01/04, which is amortized over 10 years for the deductible limit, but over 5 years for the MFSA. This will tend to make the required minimum smaller than the deductible limit. In addition, there is a credit balance, and the IAL is amortized over 30 years for the minimum.

The final calculation of the deductible limit is the 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:

$$\begin{aligned}\text{\$404 "RPA 94" UCL} &= 1.00 (12/31 \text{ CL}) - (1+i)*(AAV) && \text{(if no benefit payments)} \\ &= 1,410,000 - 1.07*(1,100,000) \\ &= 233,000\end{aligned}$$

The 404 UCL does not affect the deductible limit. The final deductible limit is still the normal cost plus limit adjustments of 241,457.

Now you can complete the MFSA for 2004. You need to calculate the amortization payment for the gain base:

$$\begin{aligned}\text{Gain Amort} &= 31,404 \div \ddot{a}_{\overline{5}|.07} \\ &= 7,158\end{aligned}$$

2004 Minimum Funding Standard Account

Charges		Credits	
Normal Cost	100,000	Credit Balance	10,000
IAL amortization	65,000	Gain amortization	7,158
Assump amortization	15,000	12/31 contribution	241,457
7% interest	12,600	7% interest	1,201
Total charges	192,600	Total credits	259,816

You must still check to see if the §412 FFL applies. With a non-zero credit balance, the §412 FFL is larger than the §404 FFL (which is greater than 1,070,000), so it has no effect on the minimum contribution.

The 12/31/04 credit balance is $259,816 - 192,600 = 67,217$.

Answer is D

NOTE:

Note that the end of year asset value (if any) would be used in calculating the RPA '94 FFL. 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.

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Problem 22

Similar to 2001 #22

The key to this problem is that 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.

In general, under the Unit Credit method, you would expect a loss upon early retirement, unless the early retirement benefits are actuarially reduced. 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

Description

01/2004 Age	63
Past service	30
Future service	2

$$\begin{aligned}\text{Accrued benefit} & 25(12)(30) \\ & = 9,000\end{aligned}$$

$$\begin{aligned}\text{Active AL} & 9,000 (D_{65} / D_{63}) \ddot{a}_{65}^{(12)} \\ & = 9,000(1.07)^{-2}(9.24) \\ & = 72,635\end{aligned}$$

$$\begin{aligned}\text{Early retirement factor} & 1 - 2(.06) = .88 \\ \text{Early retirement benefit} & .88(9,000) = 7,920\end{aligned}$$

$$\begin{aligned}\text{Retired AL} & 7,920 \ddot{a}_{63}^{(12)} \\ & = 7,920(9.72) \\ & = 76,982\end{aligned}$$

The loss is 4,347, calculated as 76,982 - 72,635.

Answer is B

Fall 2004 EA-2A Exam Solutions

Problem 23 - Page 1

Similar to 2003 #16

Revised 08/21/06

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).

$$\begin{aligned}\text{Gateway \%} &= (\text{AAV} - 0) / (\text{CL at highest permissible rate}) \\ &= 350,000 / 450,000 \\ &= 77.78\%\end{aligned}$$

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.

$$\begin{aligned}\text{UCL} &= \text{CL} - (\text{AAV} - \text{CB}) \\ &= 450,000 - (350,000 - 17,700) \\ &= 117,700\end{aligned}$$

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.

Since this is a plan established after OBRA '87, the UOL is zero. Since the plan's effective date is after 1994, both layers of the Unfunded Old Liability are equal to 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.

$$\begin{aligned}\text{UOL} &= 0 \text{ (assumed)} \\ \text{UNL} &= \text{UCL} - \text{UOL} - \text{UCEL} \\ &= 117,700 - 0 - 0 \text{ (assumed)} \\ &= 117,700\end{aligned}$$

With a zero UOL, the unfunded old liability amount (UOLA) is also zero. The unfunded new liability amount (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.

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Problem 23 - Page 2

Revised 10/02/06

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%.

$$\begin{aligned}\text{FCL\%} &= (\text{AAV} - \text{CB}) / \text{CL} \\ &= (350,000 - 17,700) / 450,000 \\ &= 73.84\%\end{aligned}$$

$$\begin{aligned}\text{APP\%} &= .30 - .40 [.7384 - .60] \\ &= 24.46\%\end{aligned}$$

$$\begin{aligned}\text{UNLA} &= 117,700 * 24.46\% \\ &= 28,789\end{aligned}$$

$$\begin{aligned}\text{DRC} &= \text{UOLA} + \text{UNLA} + \text{CLNC} \\ \text{DRC} &= 0 + 28,789 + 25,000 \\ &= 53,789\end{aligned}$$

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

$$\begin{aligned}01/01/04 \text{ §412(l) AFC} &= \text{UCEA} + [\text{DRC} - (\text{§412 NC} + \text{§412 amortizations})] \\ &= 0 + 53,789 - (27,000 + 3,500 - 11,000) \\ &= 34,289\end{aligned}$$

One point of this problem is that the net §412 amortizations can be negative, as shown in this problem. Based on the Schedule B instructions, you should NOT limit the net §412 amortizations to zero.

$$\begin{aligned}12/31/04 \text{ §412(l) AFC} &= 34,289 * 1.0655 \\ &= 36,535\end{aligned}$$

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.

Answer is E

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Problem 24 - Page 1

Similar to 1999 #31

Revised 09/05/05

Unit Credit is an individual cost method. The key point of this problem is that you must calculate the amount of the experience gain / loss for 2003, and set up that base at 01/01/2004.

You are told that all prior bases were considered fully amortized at 12/31/03 (probably due to a Full Funding credit). This means that the equation of balance no longer "works".

You are NOT told to use the Fresh Start alternative, which produces an unusual problem. You are not given the Initial Accrued Liability, so you can't determine the limit adjustments for the deductible limit.

I will assume that the prior §404 bases have been eliminated at 12/31/03. You must set the §404 loss base for 2003 equal to the §404 UAL at 01/01/04. This is required in order to satisfy the "§404 balance equation":

$$\begin{aligned}\text{§404 Loss base} &= \text{§404 UAL} \\ &= \text{§404 AL} - 404 \text{ AAV} \\ &= 1,000,000 - 800,000 \\ &= 200,000\end{aligned}$$

The end result is that it looks like we used the Fresh Start alternative to calculate the deductible limit. We really did not do that. After satisfying the "§404 balance equation", we have the same results as the Fresh Start alternative.

The first step in the deductible limit calculations is calculating the normal cost plus limit adjustments. 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.

$$\begin{aligned}\text{Limit adjustment} &= 200,000 / \ddot{a}_{\overline{10}|.07} \\ &= 26,613\end{aligned}$$

$$\begin{aligned}\text{Deductible limit} &= (75,000 + 26,613) * (1.07) \\ &= 108,726\end{aligned}$$

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

$$\begin{aligned}\text{§404 "ERISA" FFL} &= (1+i) * (\text{NC} + \text{AL} - (\text{lesser MVA, AAV})) \\ &= 1.07 * (75,000 + 1,000,000 - 800,000) \\ &= 294,250\end{aligned}$$

$$\text{§404 "RPA 94" FFL} = .90 (12/31 \text{ CL}) - (1+i) * (\text{AAV}) \quad (\text{if no benefit payments})$$

You don't need to calculate the 404 RPA FFL, since it will only make the 404 FFL even larger. It is clear that the 404 FFL will not affect the deductible limit.

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Problem 24 - Page 2

Revised 09/05/05

Since the §404 FFL does not apply, you need to at least think about calculating the §412 minimum contribution. With a loss base, it is likely that the minimum could exceed the normal cost plus limit adjustments. The reason is that the loss is amortized over five years versus ten years for the deductible limit. In this problem, there are no other limit adjustments, so it is more likely.

You have to use the §412 equation of balance in an atypical way. Section 7 of RR 81-213 defines a "Special G/L" calculation that establishes an amortization base that FORCES the theoretical equation of balance to hold. Section 7 of RR 81-213 states that you can do a special determination of the G/L only when an experience loss has occurred, and when there are no other amortization bases. The proposed regulation at §1.412(b)-1(f)(2)(ii) contains basically the same rule, except that it does not require a loss to have occurred.

This year, you simply "back into" the amount of the base needed, and call that an experience loss base:

$$\begin{aligned}\text{Loss base} &= \text{UAL} + \text{credit balance} + \text{ARA} \\ &= 200,000 + 10,000 \\ &= 210,000\end{aligned}$$

You need to calculate the amortization payment for the loss base:

$$\begin{aligned}\text{Loss Amort} &= 210,000 \div \ddot{a}_{\overline{5}|.07} \\ &= 47,866\end{aligned}$$

2004 Minimum Funding Standard Account			
Charges		Credits	
Normal Cost	75,000	Credit Balance	10,000
Loss amortization	47,866	12/31 minimum	x
7% interest	8,601	7% interest	700
Total charges	<u>131,467</u>	Total credits	<u>x + 10,700</u>

You must still check to see if the §412 FFL applies. With a non-zero credit balance, the §412 FFL is larger than the §404 FFL, so it has no effect on the minimum contribution.

The §412 minimum is $131,467 - 10,700 = 120,767$. This does exceed the previously calculated deductible limit of 108,726.

Problem 24 - Page 3

Revised 09/05/05

The final calculation of the deductible limit is the 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:

$$\begin{aligned}\text{\$404 "RPA 94" UCL} &= 1.00 (12/31 \text{ CL}) - (1+i) * (\text{AAV}) && \text{(if no benefit payments)} \\ &= 800,000 - 1.07 * (800,000) \\ &= \text{zero}\end{aligned}$$

Since the unfunded current liability does not apply, the final deductible limit is the minimum contribution of 120,767.

Answer is D!

NOTES:

1. **The answer key for this exam shows C as the correct answer.** But the Joint Board also gave credit for answer range D as the correct answer. I'm not sure why they never updated the answer key.

To get answer range C, you would solve for the minimum contribution payable at 07/01/04. The result is $116,817 = 127,167 - 10,350$ (using simple interest). This does not make sense, since the amount of the deductible limit is typically calculated at the end of the year. The contribution can be paid at any time during the year.

2. The only §404 base that you have at 01/01/04 is the new gain/loss base (since you have an individual cost method). The regulation at 1.404(a)-14(g)(1) says the §404 G/L base is "equal to the net experience G/L required under section 412".

As shown in this problem, sometimes the loss bases must be different under §404 and §412. This is the only way for the balance equation to work under both §404 and §412:

$$\begin{aligned}\text{\$412 Loss base} &= \text{\$412 UAL} + \text{credit balance} + \text{ARA} \\ \text{\$404 Loss base} &= \text{\$404 UAL}\end{aligned}$$

3. Note that the end of year asset value (if any) would be used in calculating the RPA '94 FFL. 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.
4. You really don't know whether the prior §404 bases were eliminated. The reason is that, in 1.404(a)-14(k), the §404 bases are eliminated when the actual deduction is greater than or equal to the §404 Full Funding Limitation.

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Problem 25

This is a trick question. In 2003, the instructions to the Schedule B were changed. The penalty rate for late quarterly contributions is now defined as the greater of:

- 175% of the Federal mid-term rate, or
- the RPA '94 current liability interest rate, or
- the valuation interest rate.

The penalty equals the excess of interest at the penalty rate applied until the payment date over valuation interest that would be credited in the funding standard account. Since the valuation rate is the same as the penalty rate, and all contributions were paid by the end of the plan year, the additional interest charge is zero.

Answer is A

NOTE:

If all contributions are not paid by the end of the plan year, you could have a non-zero interest penalty charge in this problem.

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Problem 26 - Page 1

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.

In this problem, you are given the benefit as 1,000 per month. The key to this problem is recognizing that general exam condition 10 requires you to use the 01/01/96 age as the entry age:

"Service for purposes of vesting and benefit accrual is credited on the basis of time elapsed since date of hire."

This is based on the concept that, if the plan formula accrues benefits for all years of service, you should use the participant's age at hire as their entry age (EA).

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

Age 53 at 01/01/04

Age 45 at 01/01/96

Entry age 45

$$\begin{aligned} PVB \text{ at } 45 &= 12(1,000)(D_{65} / D_{45}) \ddot{a}_{65}^{(12)} \\ &= 12,000(1.07)^{-20}(10.0) \end{aligned}$$

The PVB calculation uses no pre-retirement decrements, based on general exam condition 19. The next step is calculation of the EA normal cost and accrued liability at 01/01/01.

$$\text{Level \$ EANC: } PVB_{45} / \ddot{a}_{45:20}$$

$$\ddot{a}_{45:20} = \ddot{a}_{20|.07} \quad (\text{no pre-retirement decrements})$$

$$\begin{aligned} EANC_{45} &= 12,000(1.07)^{-20}(10.0) / \ddot{a}_{20|.07} \\ &= 120,000 / \ddot{s}_{20|.07} \\ &= 2,736 \end{aligned}$$

$$\begin{aligned} 01/2001 \text{ IAL} &= 2,736 / \ddot{s}_{5|.07} \\ &= 16,833 \end{aligned}$$

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Problem 26 - Page 2

To calculate the 12/31/04 minimum contribution, you must do a Frozen Initial Liability (FIL) valuation for 2004. You need to determine the credit balance, AAV and UAL at 01/01/04.

The problem states that 5,000 was contributed each year at 12/31. The AAV at 01/01/04 is simply the accumulation of the 5,000 contributions for 3 years:

$$\begin{aligned} 01/04 \text{ AAV} &= 5,000 / s_{\overline{3}|.07} \\ &= 16,075 \end{aligned}$$

You are told that there have been no experience gains or losses in any year. The UAL each year must be equal to the expected UAL:

$$\begin{aligned} 01/02 {}_e\text{UAL}_1 &= (1+i)(\text{NC}_0 + \text{UAL}_0) - (\text{contribution} + \text{interest}) \\ &= (1.07)[2,736 + 2,736(\ddot{s}_{\overline{5}|.07})] - 5,000 \\ &= 2,736\ddot{s}_{\overline{6}|.07} - 5,000 \end{aligned}$$

$$\begin{aligned} 01/03 {}_e\text{UAL}_1 &= (1.07)[2,736 + \text{UAL}] - 5,000 \\ &= 2,736\ddot{s}_{\overline{7}|.07} - 5,000s_{\overline{2}|.07} \end{aligned}$$

$$\begin{aligned} 01/04 {}_e\text{UAL}_1 &= (1.07)[2,736 + \text{UAL}] - 5,000 \\ &= 2,736\ddot{s}_{\overline{8}|.07} - 5,000s_{\overline{3}|.07} \\ &= 30,032 - 16,075 \\ &= 13,957 \end{aligned}$$

Now you can use the actuarial equation of balance to solve for the 01/01/04 credit balance. You should also store the value of the 30 year IAL amortization payment for the MFSA (equal to 1,268):

$$\begin{aligned} \text{UAL} &= \text{O/S 412 bases} - \text{CB} - \text{ARA} \\ \text{CB} &= \text{O/S 412 bases} - \text{UAL} - 0 \\ &= 16,833(\ddot{a}_{\overline{27}|.07} / \ddot{a}_{\overline{30}|.07}) - 13,957 \\ &= 2,303 \end{aligned}$$

Finally, you need to calculate the normal cost under the FIL cost method. The FIL method uses the EAN accrued liability to determine the starting value of the UAL. As a result, there is NO method change base in this problem.

A shortcut in this problem is that the FIL normal cost must equal the Entry Age Normal cost of 2,736 for this participant. This is true because there is only one participant, and all actuarial assumptions have been met. There are no decrements, and investments are the only G/L source.

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Problem 26 - Page 3

Revised 10/02/06

$$\begin{aligned}\text{IAL amort} &= 16,833 / \ddot{a}_{30|.07} \\ &= 1,268\end{aligned}$$

2004 Minimum Funding Standard Account			
Charges		Credits	
Normal Cost	2,736	Credit Balance	2,303
IAL amortization	1,268	12/31 minimum	x
7% interest	280	7% interest	161
Total charges	4,284	Total credits	x + 2,464

You can ignore the FFL calculation. The EAN UAL equals 13,957, so the FFL will not apply. The §412 minimum is $4,284 - 2,464 = 1,819$.

Answer is C

NOTES:

1. The idea of using the participant's age at hire as their entry age (EA) has been tested before on the exam. See 2003 #25 and 2002 #09.
2. If you incorrectly use the 01/2001 age of 50 as the entry age, you will have a very large final answer. This is a clue that something is very wrong with the solution.
3. Here are the details of how the 01/01/04 FIL normal cost is calculated. As described on the prior page, it must equal the EANC of 2,736:

Age 53 at 01/01/04

$$\begin{aligned}\text{PVB at 53} &= 12(1,000)(D_{65} / D_{53}) \ddot{a}_{65}^{(12)} \\ &= 12,000(1.07)^{-12}(10.0) \\ &= 53,281\end{aligned}$$

$$\begin{aligned}\text{FIL PVNC} &= \text{PVB} - \text{AAV} - \text{UAL} \\ &= 53,281 - 16,075 - 13,957 \\ &= 23,249\end{aligned}$$

$$\begin{aligned}\text{NC} &= \text{PVNC} / (\text{PVL}/L) \\ &= 23,249 / \ddot{a}_{53:12|} \\ &= 23,249 / \ddot{a}_{12|.07} \\ &= 2,736\end{aligned}$$

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Problem 27

Similar to 2001 #31

Revised 11/19/07

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

01/01/81 Age 25 at hire

Total Service 37

The key point of the problem is that the normal retirement age is 62. Another point is that the first layer of ILP normal cost is established at the later of age at hire, or age at plan inception:

01/01/91 Age 35 at plan inception

Normal cost calculation date

	01/01/91	01/01/02	01/01/04
Age	35	46	48
Plan Benefit	\$20	\$25	\$30
Projected benefit	12(20)(37)	12(25)(37)	12(30)(37)
Δ Projected benefit	12(20)(37) [‡]	12(5)(37)	12(5)(37)
PV (Δ Proj Benefit)	$8,880v^{(62-35)}\ddot{a}_{62}^{(12)}$	$2,220v^{(62-46)}\ddot{a}_{62}^{(12)}$	$2,220v^{(62-48)}\ddot{a}_{62}^{(12)}$
Δ Normal cost	$8,880v^{27}\ddot{a}_{62}^{(12)} / \ddot{a}_{27 .07}$ $= 8,880\ddot{a}_{62}^{(12)} / \ddot{s}_{27 .07}$	$2,220v^{16}\ddot{a}_{62}^{(12)} / \ddot{a}_{16 .07}$ $= 2,220\ddot{a}_{62}^{(12)} / \ddot{s}_{16 .07}$	$2,220v^{14}\ddot{a}_{62}^{(12)} / \ddot{a}_{14 .07}$ $= 2,220\ddot{a}_{62}^{(12)} / \ddot{s}_{14 .07}$
Δ Normal cost	1,100	735	908
Total normal cost	1,100	1,835	2,743

[‡] NOTE: Some students don't like this identification of the initial normal cost layer. I consider that their benefit increases from zero to 8,800 when they enter the plan.

Answer is E

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Problem 28 - Page 1

Similar to 2002 #27

The key to this problem is the derivation of the average temporary annuity used for the normal cost calculation at 01/01/2004. You must set up both the expected (and actual) balance sheets at 01/01/04.

This problem uses the Aggregate cost method, which has no UAL. 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):

$$\text{AGG PVNC} = \text{PVB} - \text{AAV} - (\text{O/S } \$412 \text{ bases} - \text{CB} + \text{DB}) \quad \text{NOTE: No ARA under Aggregate}$$

Item	Actual 01/01/03	Expected 01/01/04
PVB	10,000,000	$(1.08)(10,000,000) - (\text{BP} + \text{int})$
AAV	2,000,000	$(1.08)(2,000,000) - (\text{BP} + \text{int})$
DB	500,000	0
PVNC	$10,000,000 - 2,000,000 - [0 - 0 + 500,000]$ $= 7,500,000$	(don't care)
PVE / E	$6.6667 = 50,000,000 / 7,500,000$	$5.8846 = \frac{(1.08) * (6.6667 - 1.0)}{p_x(1.04)}$
NC	1,125,000	(don't care)

The key point of the problem is the formula used for the PVE/E ratio at 01/01/04. The calculation of the expected PVE/E assumes that there are no pre-retirement decrements, which is based on general exam condition 19.

Once you have calculated the expected PVE/E, you must set up the 2003 MFSA and calculate the 12/31/2003 deficiency. This will be the same as the amount of the waiver base that is established at 01/01/2004:

2003 Minimum Funding Standard Account			
Charges		Credits	
Debit balance	500,000	Credit Balance	0
Normal Cost	1,125,000	12/31/03 contribution	0
8% interest	130,000	8% interest	0
Total charges	1,755,000	Total credits	0

This problem is unusual because you are not told anything about the actual investment experience or salary increases during 2003. It is also the first problem of this type that had a funding deficiency and a waiver.

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Problem 28 - Page 2

Revised 10/31/06

Item	Actual 01/01/03	Expected 01/01/04	Actual 01/01/04
PVB	10,000,000	$(1.08)(10,000,000) - (BP+i)$	$(1.08)(10,000,000) - (BP+i)$
AAV	2,000,000	$(1.08)(2,000,000) - (BP+i)$	$(1.08)(2,000,000) - (BP+i)$
DB	500,000	0	0
Waiver	0	0	1,755,000

PVNC	7,500,000	(don't care)	$(1.08)(8,000,000) - 1,755,000$ $= 6,885,000$
PVE / E	6.6667	5.8846	5.8846
NC	1,125,000	(don't care)	1,170,000

You need to calculate the waiver amortization over five years. The waiver should be amortized at the greater of the valuation rate, or 150% of the Federal mid-term rate. In this problem, you should amortize the waiver at the valuation rate of 8%:

$$\begin{aligned}\text{Waiver amort} &= 1,755,000 / \ddot{a}_{\overline{5}|.08} \\ &= 406,992\end{aligned}$$

Finally, you can complete the 2004 MFSA:

2004 Minimum Funding Standard Account			
Charges		Credits	
Normal Cost	1,170,000	Credit Balance	0
Waiver	406,992	12/31/01 contribution	x
8% interest	126,159	8% interest	0
Total charges	1,703,151	Total credits	x

You have no information to calculate the §412 Full Funding Limitation. The minimum contribution payable 12/31/04 is 1,703,151.

Answer is C

NOTES:

- Based on the data in this problem, there are no retirees. The values of the expected PVB and AAV should reflect any benefit payments with interest. Even if there were retirees in this problem, the benefit payments terms would cancel out when you calculate the PVNC.
- 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.
- The derivation of the formula for the expected PVE/E ratio is shown on page two of the solution for 2002 #23.

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Problem 29

Similar to 2002 #10

Revised 10/02/06

The key to this problem is knowing the rules in Revenue Procedure 2000-40 for changes in cost method, asset valuation method, and valuation date.

I. FALSE

This tests a small detail in RP 2000-40. In Section 3.01(1), it specifically excludes a cash balance plan from getting automatic approval to change to the Unit Credit method.

II. FALSE

Initially, this item seems to be true. Under Section 6.02(3), you can't change the cost method until after 2007, since the cost method was changed in one of the four prior plan years (2003-2006).

In section 6.02(3), it states that the 4 year limitation only applies to the method changes in Section 3. There are many other method changes in Section 4 which are not subject to the 4 year limitation.

III. TRUE

In each of the asset valuation methods, it states that the actuarial value of assets must be limited to be within 20% of the fair market value of assets.

Based on the exam conditions, this question does not refer to a multiemployer plan. The wider asset corridor for multiemployer plans (15% of the fair market value of assets or 20% of the fair market value of assets) does not apply for this question.

Only III is true

Answer is E

Fall 2004 EA-2A Exam Solutions

Problem 30 - Page 1

Similar to 2001 #43

The key to this problem is carefully doing the 01/01/2004 valuation based on the new asset valuation method. Another key is knowing the rules in Revenue Procedure 2000-40 for setting up a new amortization base when there is a change in cost method.

Section 5.01(1) specifies that certain bases must be maintained regardless of the funding method that is used. These bases include waivers, shortfall gains and losses, and switchback from the AMFSA.

In general, the calculation of the normal cost must satisfy the formulas that are applicable to all reasonable funding methods (see the regulations at §1.412(c)(3)-1):

$$\begin{aligned} \text{PV Future Normal costs} &= \text{PV Future Benefits} - \text{Actuarial Assets} \\ &\quad - (\text{O/S §412 amortization bases} - \text{credit balance} - \text{ARA}) \end{aligned}$$

Except under the
Aggregate method

Section 5.01(2) requires that you set up a new method change base such that the $\text{UAL} = \text{O/S §412 bases} - \text{credit balance} - \text{ARA}$. If you change to a method other than Aggregate, then you must determine the method change base so that the equation of balance is satisfied.

You are told that the old asset valuation method uses 50% of market value and 50% of book value:

$$\begin{aligned} \text{old AAV} &= 350,000 \times .50 + 570,000 \times .50 \\ &= 460,000 \end{aligned}$$

The problem tells you that the AAV must be limited to be within 20% of market value. You should always do this, even if it is not stated in the problem:

$$\begin{aligned} \text{AAV limits} &= 350,000 \times .80 < \text{AAV} < 350,000 \times 1.20 \\ &= 280,000 < \text{AAV} < 420,000 \end{aligned}$$

$$\text{old AAV} = 420,000 \text{ (limited)}$$

The new AAV equals the market value of 350,000. The effect of the change in asset valuation method is a decrease in the AAV of 70,000.

Under the Frozen Initial Liability method, the UAL must be adjusted for plan changes, assumption changes, and cost method changes. The asset valuation method change results in an increase of 70,000 in the UAL.

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Problem 30 - Page 2

Revised 06/20/06

You need to use the actuarial equation of balance to solve for the UAL at 12/31/03, before the change in asset valuation method. At 01/01/04, there are 16 years left in the amortization of the IAL:

$$\begin{aligned} 12/31/03 \text{ UAL} &= \text{O/S 412 bases} - \text{CB} - \text{ARA} \\ &= 350,000(\ddot{a}_{16|.07} / \ddot{a}_{30|.07}) - 43,000 - 0 \\ &= 26,360(\ddot{a}_{16|.07}) - 43,000 - 0 \\ &= 223,445 \end{aligned}$$

You should save the 30 year amortization of the IAL for later use in the 2004 MFSA. Now you can calculate the adjusted FIL UAL, and the FIL normal cost:

$$\begin{aligned} \text{new FIL UAL} &= 223,445 + 70,000 \\ &= 293,445 \end{aligned}$$

$$\begin{aligned} \text{PVNC} &= \text{PVFB} - \text{AAV} - \text{UAL} \\ &= 1,800,000 - 350,000 - 293,445 \\ &= 1,156,555 \end{aligned}$$

$$\text{PVE/E} = 4,000,000 / 600,000 = 6.6667$$

$$\text{NC} = 1,156,555 / 6.6667 = 173,483$$

You must calculate the new amortization charges for the MFSA. The amortization period for all cost method change amortization bases specified in Revenue Procedure 2000-40 is 10 years:

$$\begin{aligned} \text{Method amortization} &= 70,000 / \ddot{a}_{10|.07} \\ &= 9,314 \end{aligned}$$

2004 Minimum Funding Standard Account			
Charges		Credits	
Normal Cost	173,483	Credit Balance	43,000
IAL amortization	26,360	12/31 minimum	x
Method amortization	9,314		
7% interest	14,641	7% interest	3,010
Total charges	223,798	Total credits	x + 46,010

Since you have no Entry Age Normal valuation results, you can ignore the FFL calculation. The §412 minimum is $223,798 - 46,010 = 177,788$.

Answer is B

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Problem 31 - Page 1

Similar to 2002 #21

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.

(16) Smoothed market value with phase-in

The description of Method 16 in the Revenue Procedure is quite vague. 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 description in the study note on page 3-11 states that the AAV is set equal to market value at the date the AAV method was changed (01/01/02). The calculations are similar to those in Method 15. The main difference is that the gain or loss (G/L) for the year of the change in asset valuation method (at 01/01/02) and earlier will be zeroed out.

The actuarial value of assets is calculated using decreasing fractions of each of the prior year's gain or loss. With a five year average, the fractions are 4/5, 3/5, 2/5, and 1/5. With a four year average, the fractions are 3/4, 2/4, and 1/4. With a three year average, the fractions are 2/3 and 1/3.

The "phase-in" part of the asset valuation method means that the fractions used will vary until the method has been in place 4 years:

$$\begin{aligned}01/03 \text{ AAV} &= 01/03 \text{ MVA} - 4/5(2002 \text{ G/L}) \\01/04 \text{ AAV} &= 01/04 \text{ MVA} - 4/5(2003 \text{ G/L}) - 3/5(2002 \text{ G/L}) \\01/05 \text{ AAV} &= 01/05 \text{ MVA} - 4/5(2004 \text{ G/L}) - 3/5(2003 \text{ G/L}) - 2/5(2002 \text{ G/L}) \\01/06 \text{ AAV} &= 01/06 \text{ MVA} - 4/5(2005 \text{ G/L}) - 3/5(2004 \text{ G/L}) - 2/5(2003 \text{ G/L}) - 1/5(2002 \text{ G/L})\end{aligned}$$

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Problem 31 - Page 2

Revised 09/03/19

You need to determine the market value at 01/01/04:

$$\begin{aligned} 01/04 \text{ MVA} &= 01/03 \text{ MVA} + \text{contributions} - (\text{benefit payments}) + (\text{investment income}) \\ &= 4,100,000 + 250,000 - 250,000 + 500,000 \\ &= 4,600,000 \end{aligned}$$

You need to calculate the 2003 and 2004 G/L items. To do this, you need to calculate the expected value of assets at 01/01/03 and 01/01/04.

01/01/03 Asset calculations

$$\begin{aligned} 01/03 \text{ } e\text{MVA} &= (1.07)(5,000,000) + (1.035)(200,000 - 300,000) && \text{(simple interest)} \\ &= 5,246,500 \end{aligned}$$

$$\begin{aligned} 2002 \text{ G/L} &= 01/03 \text{ MVA} - 01/03 \text{ } e\text{MVA} \\ &= 4,100,000 - 5,246,500 \\ &= -1,146,500 && \text{(loss)} \end{aligned}$$

$$\begin{aligned} 01/03 \text{ AAV} &= 01/03 \text{ MVA} - 4/5(2002 \text{ G/L}) \\ &= 4,100,000 - (.80)(-1,146,500) \\ &= 5,017,200 \end{aligned}$$

The key to this problem is checking the corridor limits for the AAV. The AAV must be within 20% of market value:

$$\begin{aligned} 01/03 \text{ AAV} &= \text{Lesser of } [120\%(\text{MVA}) \text{ and greater of } (\text{AAV or } 80\%(\text{MVA}))] \\ &= \text{Lesser of } [1.2(4,100,000) \text{ and greater of } (5,017,200 \text{ or } .80(4,100,000))] \\ &= 4,920,000 \end{aligned}$$

01/01/04 Asset calculations

$$\begin{aligned} 01/04 \text{ } e\text{MVA} &= (1.07)(4,100,000) + (1.035)(250,000 - 250,000) && \text{(simple interest)} \\ &= 4,387,000 \end{aligned}$$

$$\begin{aligned} 2003 \text{ G/L} &= 01/04 \text{ MVA} - 01/04 \text{ } e\text{MVA} \\ &= 4,600,000 - 4,387,000 \\ &= 213,000 && \text{(gain)} \end{aligned}$$

$$\begin{aligned} 01/04 \text{ AAV} &= 01/04 \text{ MVA} - 4/5(2003 \text{ G/L}) - 3/5(2002 \text{ G/L}) \\ &= 4,600,000 - (.80)(213,000) - (.60)(-1,146,500) \\ &= 5,117,500 \end{aligned}$$

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Problem 31 - Page 3

Revised 08/26/07

$$\begin{aligned} 01/04 \text{ AAV} &= \text{Lesser of } [120\%(\text{MVA}) \text{ and greater of } (\text{AAV or } 80\%(\text{MVA}))] \\ &= \text{Lesser of } [1.2(4,600,000) \text{ and greater of } (5,117,500 \text{ or } .80(4,600,000))] \\ &= 5,117,500 \end{aligned}$$

The difference between the AAV at 01/01/04 and 01/01/03 is $197,500 = 5,117,500 - 4,920,000$.

Answer is B

NOTE

If you used compound interest to calculate the expected market values, the expected asset values and G/L values for 2003 are slightly different:

$$\begin{aligned} 01/03 \text{ } e\text{MVA} &= 5,246,559 \\ 2002 \text{ G/L} &= -1,146,559 \\ 01/03 \text{ AAV} &= 4,920,000 \quad (\text{corridor still applies}) \end{aligned}$$

There is no difference in the expected market value at 01/01/04, since the net cash flow is zero.
There is no difference in the actuarial asset value at 01/01/03, since the corridor still limits the value. The final answer is unchanged at 197,500.

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Problem 32 - Page 1

Unit Credit is an individual cost method. You usually must calculate the amount of the experience gain / loss. In this problem, you don't need to, since you are given the net MFSA amortizations at 01/01/04.

The key point of this problem is that this is a collectively bargained plan. RPA '94 added §412(c)(12) to the Internal Revenue Code, which states "In determining projected benefits, the funding method ... shall anticipate benefit increases ..." This requires that, for collectively bargained plans, the minimum funding requirement is determined based on the ultimate level of benefits. There is NO requirement that the current liability reflect any benefit increases that become effective beyond the end of the current plan year.

This problem asks for the deductible limit for the year, but you should still allow for scheduled benefit increases. In general, the deductible limit is based on the same valuation results used for minimum funding purposes.

You need to be careful not to use the \$60 benefit level for both participants. Smith will retire before the \$60 benefit level goes into effect on 07/01/2006. In the absence of specific information, I would not assume the benefit increases apply to participants who had retired prior to the effective date of the plan change.

Description	<u>Smith</u>	<u>Brown</u>
01/2004 Age	63	54
Past service	28	20
Future service	2	11
Attain NRA	01/01/2006	01/01/2015
Benefit level at NRA	\$50	\$60

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.

Under Unit Credit, the accrued liability is defined as the present value of the accrued benefit (AB).

Description	<u>Smith</u>	<u>Brown</u>	<u>Total</u>
Accrued benefit	$50(12)(28) = 16,800$	$60(12)(20) = 14,400$	
PV of accrued benefit	$16,800 (D_{65} / D_{63}) \ddot{a}_{65}^{(12)}$ $= 16,800(1.07)^{-2}(9.24)$ $= 135,586$	$14,400 (D_{65} / D_{54}) \ddot{a}_{65}^{(12)}$ $= 14,400(1.07)^{-11}(9.24)$ $= 63,214$	198,800

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Problem 32 - Page 2

Revised 07/14/06

The normal cost is defined as the present value of the change in the AB. You can use a shortcut to calculate the normal cost based on the accrued liability:

Description	<u>Smith</u>	<u>Brown</u>	<u>Total</u>
Change in accd benefit	$50(12) = 600$	$60(12) = 720$	
PV of Δ accd benefit	$600 (D_{65} / D_{63}) \ddot{a}_{65}^{(12)}$ $= (1/28)(135,586)$ $= 4,842$	$720 (D_{65} / D_{54}) \ddot{a}_{65}^{(12)}$ $= (1/20)(63,214)$ $= 3,161$	8,003

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:

$$\begin{aligned}\text{UAL} &= \text{AL} - \text{AAV} \\ &= 198,800 - 150,000 \\ &= 48,800\end{aligned}$$

$$\begin{aligned}\text{Deductible limit} &= 1.07 * (8,003 + 48,800 \div \ddot{a}_{10|.07}) \\ &= 15,512\end{aligned}$$

The second step for the deductible limit is to check the Full Funding Limitation under 404. Based on the size of the UAL, it should be clear that the FFL will not reduce the deductible limit of 15,512.

Now you usually check the §412 minimum contribution to see if it is greater. But it should be clear that it won't affect the deductible limit. The reason is that you have a plan change base at 01/01/04, as well as the IAL base (which is unknown). Both of these bases are amortized over 30 years for the MFSA, which tends to make the required minimum smaller than the deductible limit. In addition, there is a credit balance, which has the same effect.

You can't calculate the 404 UCL. The final deductible limit is still the normal cost plus limit adjustments of 15,512.

Answer is D

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Problem 33 - Page 1

Similar to 2001 #22

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 01/01/2004. 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

Description

01/2004 Age	59
Past service	25
Future service	1

You need to read the problem carefully to see that the benefit is based on the highest three years of the final five. This is the first EA-2 problem where the FAE years are not consecutive:

$$\begin{aligned}\text{High FAE3 @ 59} &= (1/3)(100,000 + 108,000 + 91,000) \\ &= 99,666.67\end{aligned}$$

$$\begin{aligned}\text{Accrued benefit} &= 2\%(25)(\text{High FAE3 @ 59}) \\ &= 2\%(25)(99,666.67) = 49,833\end{aligned}$$

$$\begin{aligned}\text{Early retirement factor @ 59} &= 1 - 5/15 - 1/30 = .6333 \\ \text{Early retirement benefit} &= .6333(49,833) = 31,561\end{aligned}$$

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Problem 33 - Page 2

$$\begin{aligned}\text{Retired AL} & 31,561 \ddot{a}_{59}^{(12)} \\ & = 342,438\end{aligned}$$

For the active accrued liability, you use the "funding accrued benefit". This requires that you project one more year of pay, out to retirement age 60 at 01/01/05:

$$\text{Projected pay for 2004} = 1.035(100,000) = 103,500$$

The three year average ending in 2004 is calculated as follows (again, non-consecutive years):

$$\begin{aligned}\text{FAE3 @ 60} & = (1/3)[103,500 + 100,000 + 108,000] \\ & = 103,833.33\end{aligned}$$

$$\begin{aligned}\text{Funding Accrued benefit} & 2\%(25)(\text{High FAE3 @ 60}) \\ & 2\%(25)(103,833.33) = 51,917\end{aligned}$$

$$\text{Early retirement factor @ 60} \quad 1 - 5/15 = .6667$$

$$\text{Early retirement benefit} \quad .6667(51,917) = 34,611$$

$$\begin{aligned}\text{Active AL} & 34,611 (D_{60} / D_{59}) \ddot{a}_{60}^{(12)} \\ & = 34,611(1.07)^{-1}(10.12) \\ & = 327,350\end{aligned}$$

The loss is 15,088, calculated as 342,438 - 327,350.

Answer is C

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Problem 34 - Page 1

Similar to 2001 #22

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 accrued liability at 01/01/2004. The PUC accrued liability is defined as the present value of the "funding accrued benefit" (FAB). The PUC normal cost is defined as the present value of the change in the FAB:

$$\begin{aligned} \text{AL} &= \text{PV (FAB)} \\ \text{NC} &= \text{PV } (\Delta \text{ FAB}) \end{aligned}$$

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.

One key point of the problem is that the calculation of the normal cost must be done in two parts. In most problems you do not use the one year term cost method for the death benefit. Without the one year term cost, you have a summation calculation for the Unit Credit normal cost. For an example, see 2002 #35.

The first part of the problem is the calculation of the normal cost for retirement benefits:

Description	<u>Smith</u>	<u>Jones</u>
01/2004 Age	63	64
Past service	14	14
Future service	2	1
2003 pay	50,000	70,000
Projected pay at 64	$50,000(1.03)^2$ = 53,045	$70,000(1.03)^1$ = 72,100
Funding Accrued Benefit	$2\%(14)(53,045)$	$2\%(14)(72,100)$
Δ in FAB	$2\%(53,045)$ = 1,061	$2\%(72,100)$ = 1,442

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Problem 34 - Page 2

Revised 10/02/06

Description	<u>Smith</u>	<u>Jones</u>	<u>Total</u>
PUC NC for Retirement	$1,061 (D_{65} / D_{63}) \ddot{a}_{65}^{(12)}$ $= 1,061 v^2 {}_2p_{63} \ddot{a}_{65}^{(12)}$ $= 1,061(.8734)(.98)(.96)(9.24)$ $= 8,055$	$1,442 (D_{65} / D_{64}) \ddot{a}_{65}^{(12)}$ $= 1,442 v^1 {}_1p_{64} \ddot{a}_{65}^{(12)}$ $= 1,442(.9346)(.96)(9.24)$ $= 11,954$	20,010

Now you need to calculate the one year term cost for the death benefits. This is simply the present value of the death benefits for the expected exits during 2004:

PUC NC for Death	$50,000 v^1 {}_1q_{63}$ $= 50,000(.9346)(.02)$ $= 935$	$50,000 v^1 {}_1q_{64}$ $= 50,000(.9346)(.04)$ $= 1,869$	2,804
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Now you can set up the Minimum Funding Standard Account for 2004:

2004 Minimum Funding Standard Account			
Charges		Credits	
Normal Cost - Ret	20,010	Credit Balance	10,000
1 yr term Cost - Death	2,804	01/01 contribution	60,000
Net amortizations	30,000		
7% interest	3,697	7% interest	4,900
Total charges	<u>56,511</u>	Total credits	<u>74,900</u>

Since you have no market value of assets, you can ignore the FFL calculation. The §412 credit balance is $74,900 - 56,511 = 18,389$.

Answer is D

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Problem 35 - Page 1

This problem is quite similar to the prior one. It is simpler since the cost method is true Unit Credit (UC), and there is only one participant.

You need to calculate the UC accrued liability and normal cost at 01/01/2004. The UC accrued liability is defined as the present value of the accrued benefit. The UC normal cost is defined as the present value of the change in the AB:

$$\begin{aligned} \text{AL} &= \text{PV (AB)} \\ \text{NC} &= \text{PV } (\Delta \text{ AB}) \end{aligned}$$

One key point of the problem is that the calculation of the normal cost must be done in two parts. In most problems you do not use the one year term cost method for the death benefit. Without the one year term cost, you have a summation calculation for the Unit Credit normal cost. For an example, see 2002 #35.

The first part of the problem is the calculation of the normal cost for retirement benefits:

Description

01/2004 Age	50
Past service	10
Future service	15

$$\text{Accrued Benefit} \quad 12(50)(10) = 6,000$$

$$\begin{aligned} \text{UC Accrued Liability} &= 6,000 (D_{65} / D_{50}) \ddot{a}_{65}^{(12)} \\ &= 6,000 v^{15} {}_{15}p_{50} \ddot{a}_{65}^{(12)} \end{aligned}$$

$$\begin{aligned} \text{Survival from 50 to 65} \quad {}_{15}p_{50} &= l_{65} / l_{50} \\ &= 826,026 / 952,223 = .8675 \end{aligned}$$

$$\begin{aligned} \text{UC Accrued Liability} &= 6,000(.3624)(.8675)(8.73) \\ &= 16,469 \end{aligned}$$

The normal cost is defined as the present value of the change in the AB. You can use a shortcut to calculate the normal cost based on the accrued liability:

$$\begin{aligned} \Delta \text{ in Accrued Benefit} &= 12(50) = 600 \\ \text{PUC NC for Retirement} &= 600 (D_{65} / D_{50}) \ddot{a}_{65}^{(12)} \\ &= (600/6,000)(16,469) \\ &= 1,647 \end{aligned}$$

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Problem 35 - Page 2

Revised 06/20/06

Now you need to calculate the one year term cost for the death benefits. This is simply the present value of the death benefits for the expected exits during 2004:

$$\begin{aligned} \text{UC NC for Death} & 35,000 v^1 {}_1q_{50} \\ \text{Survival from 50 to 51} & {}_1p_{50} = l_{51} / l_{50} \\ & = 947,695 / 952,223 = .9952 \end{aligned}$$

$$\begin{aligned} \text{UC NC for Death} & = 35,000(.9346)(1-.9952) \\ & = 156 \end{aligned}$$

You need to calculate the MFSA amortization charge for the initial accrued liability (IAL). The IAL equals the AL calculated at 01/01/04:

$$\begin{aligned} \text{IAL amort} & = 16,469 \div \ddot{a}_{\overline{30}|.07} \\ & = 1,240 \end{aligned}$$

Now you can set up the Minimum Funding Standard Account for 2004:

2004 Minimum Funding Standard Account			
Charges		Credits	
Normal Cost - Ret	1,647	Credit Balance	0
Normal Cost - Death	156	12/31 minimum	x
IAL amortization	1,240		
7% interest	213	7% interest	0
Total charges	<u>3,256</u>	Total credits	<u>x</u>

Since you have no market value of assets, you can ignore the FFL calculation. The minimum contribution is 3,256.

Answer is C

Problem 36 - Page 1**Revised 07/14/06**

The key point of this problem is knowing how to calculate the deductible limit. Since you have no current liability values, the calculations are simpler than usual.

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 calculate the deductible limit for 2003 first, then set up the MFSA for 2003 to determine the credit balance at 12/31/03.

2003 Valuation

$$\begin{aligned} \text{2003 Ded limit} &= 1.07 * (95,000 + 950,000 \div \ddot{a}_{10|.07}) \\ &= 236,909 \end{aligned}$$

There are no other calculations necessary for the deductible limit. You should skip the FFL calculation, since you don't have the Entry Age normal results. With a new plan, the minimum contribution must be less than the deductible limit.

You need to calculate the MFSA amortization charge for the initial accrued liability (IAL):

$$\begin{aligned} \text{IAL amort} &= 950,000 \div \ddot{a}_{30|.07} \\ &= 71,549 \end{aligned}$$

2003 Minimum Funding Standard Account			
Charges		Credits	
Normal Cost	95,000	Credit Balance	0
IAL amortization	71,549	12/31 contribution	236,909
7% interest	11,658	7% interest	0
Total charges	<u>178,207</u>	Total credits	<u>236,909</u>

The 12/31/03 credit balance is $236,909 - 178,207 = 58,702$.

2004 Valuation

You are told that a plan change increased the 01/01/04 UAL by 15%. You need to determine the 01/01/04 UAL so you can calculate the amount of the plan change base. You can either write down the UAL from 2003, or use the 412 actuarial equation of balance. Both will give you the same result.

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Problem 36 - Page 2

Revised 07/14/06

$$\begin{aligned}\text{UAL} &= \text{O/S 412 bases} - \text{CB} - \text{ARA} \\ &= 950,000(\ddot{a}_{\overline{29}|.07} / \ddot{a}_{\overline{30}|.07}) - 58,702 - 0 \\ &= 881,241\end{aligned}$$

$$\begin{aligned}\text{Plan chg} &= 15\%(881,241) \\ &= 132,186\end{aligned}$$

$$\begin{aligned}\text{2004 Ded limit} &= 1.07*(100,000 + (950,000 + 132,186) \div \ddot{a}_{\overline{10}|.07}) \\ &= 261,079\end{aligned}$$

There are no other calculations necessary for the deductible limit. You should skip the FFL calculation, since you don't have the Entry Age normal results. With bases that are amortized over 30 years (and a credit balance), the minimum contribution must be less than the deductible limit.

You need to calculate the MFSA amortization charge for the plan change base:

$$\begin{aligned}\text{Plan chg amort} &= 132,186 \div \ddot{a}_{\overline{30}|.07} \\ &= 9,956\end{aligned}$$

2004 Minimum Funding Standard Account			
Charges		Credits	
Normal Cost	100,000	Credit Balance	58,702
IAL amortization	71,549		
Plan chg amortization	9,956	01/01 contribution	261,079
7% interest	12,705	7% interest	22,385
Total charges	194,210	Total credits	342,165

The 12/31/04 credit balance is $342,165 - 194,210 = 147,956$.

Answer is C

NOTE:

One minor point of the problem is that the deductible limit is calculated at the end of the year. But you can contribute that amount at any point in time.

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Problem 37 - Page 1

Similar to 2003 #35

Revised 08/21/06

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. You are told that the plan is subject to the AFC, so you can skip the Gateway test.

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.

$$\begin{aligned}\text{UCL} &= \text{CL} - (\text{AAV} - \text{CB}) \\ &= 3,500,000 - (2,950,000 - 80,000) \\ &= 630,000\end{aligned}$$

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. In this problem, you are told nothing about unpredictable contingent events. You must assume there are none.

In this problem you are given the UOL, and you must calculate the UNL:

$$\begin{aligned}\text{UOL} &= 100,000 \text{ (given)} \\ \text{UNL} &= \text{UCL} - \text{UOL} - \text{UCEL} \\ &= 630,000 - 100,000 - 0 \\ &= 530,000\end{aligned}$$

The UOLA equals the amortization of the remaining portion of the unfunded old liability over a period that was 18 years at 01/01/89. At 01/01/04, there are 3 = 18 - (2004 - 1989) years left.

$$\begin{aligned}\text{UOLA} &= 100,000 / \ddot{s}_{\overline{3}|.065} \\ &= 35,453\end{aligned}$$

The unfunded new liability amount (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.

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Problem 37 - Page 2

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%.

$$\begin{aligned}\text{FCL\%} &= (\text{AAV} - \text{CB}) / \text{CL} \\ &= (2,950,000 - 80,000) / 3,500,000 \\ &= 82.00\%\end{aligned}$$

$$\begin{aligned}\text{APP\%} &= .30 - .40 [.8200 - .60] \\ &= 21.200\%\end{aligned}$$

$$\begin{aligned}\text{UNLA} &= 530,000 * 21.200\% \\ &= 112,360\end{aligned}$$

$$\begin{aligned}\text{DRC} &= \text{UOLA} + \text{UNLA} + \text{CLNC} \\ \text{DRC} &= 35,453 + 112,360 + 30,000 \\ &= 177,813\end{aligned}$$

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

$$\begin{aligned}01/01/04 \text{ §412(l) AFC} &= \text{UCEA} + [\text{DRC} - (\text{§412 NC} + \text{§412 amortizations})] \\ &= 0 + 177,813 - (30,000 + 45,000) \\ &= 102,813\end{aligned}$$

$$\begin{aligned}12/31/04 \text{ §412(l) AFC} &= 102,813 * 1.065 \\ &= 109,496\end{aligned}$$

Since you have more than 149 participants during 2003, you do not need to pro-rate the 412(l) AFC.

Answer is C

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 38 - Page 1

Revised 07/14/06

Unit Credit is an individual cost method. The key point of this problem is knowing that you should calculate the experience G/L for 2003.

The first step in the solution is to determine the credit balance at 12/31/03.

2003 Minimum Funding Standard Account			
Charges		Credits	
Normal Cost	12,000	Credit Balance	2,000
Net amortizations	5,000	7/1/04 contribution	19,000
7% interest	1,190	7% interest	140
Total charges	18,190	Total credits	21,140

You should check the Full Funding Limitation:

$$\begin{aligned}\text{\$412 "ERISA" FFL} &= (1+i) \cdot (\text{NC} + \text{AL}) - (1+i) \cdot [(\text{lesser MVA, AAV}) - \text{CB}] \\ &= 1.07 \cdot (12,000 + 85,000 - [78,000 - 2,000]) \\ &= 22,470\end{aligned}$$

The FFL clearly exceeds the AFD, so it will have no effect. The 12/31/03 credit balance is $21,140 - 18,190 = 2,950$.

One trick to the problem is that the contribution is paid at 07/01/04, not during 2003. The contribution earns no interest in the MFSA, since it is treated as paid at 12/31/03.

It seems like there should be an interest penalty charge for late quarterly contributions. But you can't calculate the "required annual payment", since you don't have any 2002 valuation results. You don't know if this plan is even subject to quarterly contributions, since you have no current liability information, and no participant count.

The next step is determination of the 2003 G/L base at 01/01/04. You need to calculate the actual and expected unfunded accrued liabilities:

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

$$\begin{aligned}01/01/04 {}_e\text{UAL} &= (1+i) \cdot (\text{NC}_0 + \text{UAL}_0) - (\text{contribution} + \text{interest}) \\ &= 1.07 \cdot [12,000 + (85,000 - 78,000)] - 19,000 \\ &= 1.07 \cdot 19,000 - 19,000 \\ &= 1,330\end{aligned}$$

$$\begin{aligned}01/01/04 \text{UAL} &= 90,000 - 85,000 \\ &= 5,000\end{aligned}$$

$$\begin{aligned}01/01/04 \text{Loss} &= 5,000 - 1,330 \\ &= 3,670\end{aligned}$$

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Problem 38 - Page 2

You need to calculate the MFSA amortization charge for the loss base:

$$\begin{aligned}\text{Loss amort} &= 3,670 \div \ddot{s}_{\overline{5}|.07} \\ &= 836\end{aligned}$$

Finally, you can complete the 2004 MFSA:

2004 Minimum Funding Standard Account			
Charges		Credits	
Normal Cost	11,000	Credit Balance	2,950
Net amortizations	5,000		
Loss amortization	836		
7% interest	1,179	7% interest	207
Total charges	18,015	Total credits	3,157

The 12/31/04 debit balance is $18,015 - 3,157 = 14,859$. The excise tax on the funding deficiency is $10\%(14,859) = 1,486$.

Answer is D

NOTES:

1. Once again, it seems like there should be an interest penalty charge for late quarterly contributions. As described earlier, you really don't know if this plan is subject to quarterly contributions, since you have no current liability information, and no participant count.
2. Assuming the plan is subject to quarterly contributions, you still can't calculate the penalty charge. If no waiver is granted, you need to know the date the contributions are paid. If a waiver is granted, you could calculate the penalty charge based on a date of 09/15/05.

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Problem 39

Revised 10/02/06

This is a question that has not been asked on the EA exams for about 20 years. In 412(e), it allows for extension of amortization periods up to 10 additional years. When this is done, the amortization is based on the same interest rate definition as a funding waiver. You use the greater of the valuation interest rate, or 150% of the Federal Mid-term Rate.

You need to calculate the MFSA amortization charge for the IAL base, both before and after the extension:

Before extension

There are 22 years left in the IAL amortization period.

$$\begin{aligned}\text{O/S IAL base} &= 65,000 * (\ddot{a}_{\overline{22}|.07}) \\ &= 769,309\end{aligned}$$

After extension

There are 32 = 22 + 10 years in the IAL amortization period. Since the valuation rate exceeds 150% of the FMR, use 7% to amortize the O/S IAL base:

$$\begin{aligned}\text{IAL amort} &= 769,309 \div \ddot{a}_{\overline{32}|.07} \\ &= 56,852\end{aligned}$$

The change in the 12/31/04 minimum contribution is $8,718 = 1.07(65,000 - 56,852)$.

Answer is C

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Problem 40 - Page 1

Similar to 2003 #16

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. You are told that the plan is subject to the AFC, so you can skip the Gateway test.

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.

$$\begin{aligned}\text{UCL} &= \text{CL} - (\text{AAV} - \text{CB}) \\ &= 1,300,000 - (1,000,000 - 100,000) \\ &= 400,000\end{aligned}$$

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.

$$\begin{aligned}\text{UNL} &= \text{UCL} - \text{UOL} - \text{UCEL} \\ &= 400,000 - 0 - 0 \quad (\text{assumed}) \\ &= 400,000\end{aligned}$$

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%.

$$\begin{aligned}\text{FCL\%} &= (\text{AAV} - \text{CB}) / \text{CL} \\ &= (1,000,000 - 100,000) / 1,300,000 \\ &= 69.23\%\end{aligned}$$

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Problem 40 - Page 2

$$\begin{aligned}\text{APP\%} &= .30 - .40 [.6923 - .60] \\ &= 26.31\%\end{aligned}$$

$$\begin{aligned}\text{UNLA} &= 400,000 * .2631 \\ &= 105,232\end{aligned}$$

$$\begin{aligned}\text{DRC} &= \text{UOLA} + \text{UNLA} + \text{CLNC} \\ \text{DRC} &= 0 + 105,232 + 150,000 \\ &= 255,232\end{aligned}$$

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.

$$\begin{aligned}01/01/04 \text{ §412(l) charge} &= 255,232 - (125,000 + 50,000) \\ &= 80,232\end{aligned}$$

$$\begin{aligned}12/31/04 \text{ §412(l) charge} &= 80,232 * 1.06 \\ &= 85,046\end{aligned}$$

With more than 149 plan participants, you don't pro-rate the additional §412(l) charge. Now you need to set up the minimum funding standard account to determine the minimum contribution.

2004 Minimum Funding Standard Account

Charges		Credits	
Normal Cost	125,000	Credit Balance	100,000
IAL amortization	50,000	12/31 minimum	x
7% interest	12,250	7% interest	7,000
12/31 412(l) AFC	85,046		
Total charges	272,296	Total credits	107,000 +x

You should check the Full Funding Limitation before you calculate the minimum contribution.

$$\begin{aligned}\text{§412 "ERISA" FFL} &= (1+i) * (\text{NC} + \text{AL}) - (1+i) * [\text{lesser (MVA, AAV)} - \text{CB}] \\ &= 1.07 * [125,000 + 1,110,000 - (1,000,000 - 100,000)] \\ &= 358,450\end{aligned}$$

$$\text{§412 "RPA 94" FFL} = .90 (12/31 \text{ RPA CL}) - (1+i) * (\text{AAV}) \quad (\text{if no benefit payments})$$

You don't need to calculate the RPA FFL, since it will only make the FFL even larger. It is clear that the FFL exceeds the MFSA charges of 272,296, and the FFL will not apply.

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Problem 40 - Page 3

The minimum contribution at 12/31/04 is $165,296 = 272,296 - 107,000$.

Answer is D

NOTES:

1. Note that the end of year asset value (if any) should be used in calculating the RPA '94 FFL. The reason is that any benefit payments during the year should be reflected at the valuation rate in the assets. They are included at the current liability interest rate in the end of year current liability value.
2. 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 41

Revised 11/19/07

The key to this problem is knowing the amortization periods for the various bases. There is a shortcut you can use, since you are given the original base amounts. You can shorten the problem by grouping all the G/L bases together, and grouping the other bases together. The only potential "gotcha" is to be sure that none of the amortization periods for the G/L bases has expired:

Amortization Base	Original Base	Original Period	Amortization Amount
Plan change	50,000	30	$41,423 = 550,000 / \ddot{a}_{30 .07}$
Initial AL	500,000		
2001 Loss	15,000	5	$-6,838 = -30,000 / \ddot{a}_{5 .07}$
2002 Gain	-20,000		
2003 Gain	-25,000		

2004 Minimum Funding Standard Account

Charges		Credits	
Normal Cost	40,000	Credit Balance	10,000
Charge amortization	41,423	Credit amortization	6,838
		12/31 contribution	x
7% interest	5,700	7% interest	1,179
Total charges	87,123	Total credits	18,017 + x

You have no information to calculate the §412 Full Funding Limitation. The minimum contribution at 12/31/04 is $87,123 - 18,017 = 69,106$.

Answer is C

Fall 2004 EA-2A Exam Solutions

Problem 42 - Page 1

Similar to 2002 #16

Revised 07/14/06

The key to this problem is knowing the rules in Revenue Procedure 2000-40 for setting up a new amortization base when there is a change in cost method.

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. Based on the size of the 2003 contribution, you should check if it exceeded the deductible limit for 2003.

2003 Valuation

First you need to calculate the amount of the initial accrued liability. In 2003, the plan is funded under the Frozen Initial Liability (FIL) method.

$$\begin{aligned} \text{IAL} &= 280,000(\ddot{a}_{\overline{30}|.07}) \\ &= 3,717,749 \end{aligned}$$

$$\begin{aligned} \text{2003 Ded limit} &= 1.07*(460,000 + 3,717,749 \div \ddot{a}_{\overline{10}|.07}) \\ &= 1,021,424 \end{aligned}$$

There are no other calculations necessary for the deductible limit. You should skip the FFL calculation, since you don't have the Entry Age Normal results. Since the IAL is amortized over 30 years for the MFSA, and you have a credit balance, the minimum contribution must be less than the deductible limit.

Since the 2003 contribution is lower, you do not have a non-deductible contribution for 2003.

2004 Valuation

The plan is funded under the Entry Age Normal (EAN) method in 2004. Section 5.01(1) of Revenue Procedure 2000-40 specifies that certain bases must be maintained regardless of the funding method that is used. These bases include waivers, shortfall gains and losses, and switchback from the AMFSA.

In general, the calculation of the normal cost must satisfy the formulas that are applicable to all reasonable funding methods (see the regulations at §1.412(c)(3)-1):

$$\begin{aligned} \text{PV Future Normal costs} &= \text{PV Future Benefits} - \text{Actuarial Assets} \\ &\quad - (\text{O/S §412 amortization bases} - \text{credit balance} - \text{ARA}) \end{aligned}$$

Except under the
Aggregate method

Section 5.01(2) requires that you set up a new method change base such that the $\text{UAL} = \text{O/S §412 bases} - \text{credit balance} - \text{ARA}$. If you change to a method other than Aggregate, then you must determine the method change base so that the equation of balance is satisfied.

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Problem 42 - Page 2

Revised 07/14/06

$$\begin{aligned} 01/01/04 \text{ EAN UAL} &= \text{EAN AL} - \text{AAV} \\ &= 12/31/03 \text{ O/S } \$412 \text{ bases} + \text{Method change} - \text{CB} - \text{ARA} \end{aligned}$$

You need to set up the 2003 MFSA to determine the 12/31/03 CB:

2003 Minimum Funding Standard Account			
Charges		Credits	
Normal Cost	460,000	Credit Balance	50,000
IAL amortization	280,000	12/31/03 contribution	900,000
7% interest	51,800	7% interest	3,500
Total charges	791,800	Total credits	953,500

The 12/31/03 credit balance is $953,500 - 791,800 = 161,700$.

$$\begin{aligned} \text{EAN UAL} &= 4,750,000 - 1,750,000 \\ &= 3,000,000 \end{aligned}$$

Based on the effective date of 01/01/1997, there are 23 years remaining to amortize the IAL:

$$\begin{aligned} \text{O/S } \$412 \text{ IAL base} &= 280,000(\ddot{a}_{\overline{23}|.07}) \\ &= 3,377,147 \end{aligned}$$

$$\begin{aligned} 01/01/04 \text{ EAN UAL} &= 12/31/03 \text{ O/S } \$412 \text{ bases} + \text{Method change} - \text{CB} - \text{ARA} \\ 3,000,000 &= 3,377,147 + \text{Method change} - 161,700 - 0 \\ \text{Method change} &= -215,447 \end{aligned}$$

Finally, you can calculate the deductible limit for 2004:

$$\begin{aligned} 2004 \text{ Ded limit} &= 1.07 * (520,000 + (3,717,749 - 215,447) \div \ddot{a}_{\overline{10}|.07}) \\ &= 1,055,049 \end{aligned}$$

There are no other calculations necessary for the deductible limit. Based on the size of the UAL, it should be clear that the FFL will have no impact. You can skip the 412 MFSA calculations. With bases that are amortized over 30 years, the minimum contribution must be less than the deductible limit.

Answer is D

(see note on next page)

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Problem 42 - Page 3

NOTE:

There is another way to calculate the method change base, which requires that you write down the FIL UAL from 2003 to 2004:

$$\begin{aligned} 12/31/03 \text{ FIL UAL} &= {}_e\text{UAL} \\ &= (1+i)*(NC_0 + \text{UAL}_0) - (\text{contribution} + \text{interest}) \\ &= 12/31/03 \text{ O/S } \S 412 \text{ bases} - \text{CB} - \text{ARA} \end{aligned}$$

$$\begin{aligned} 01/01/04 \text{ EAN UAL} &= \text{EAN AL} - \text{AAV} \\ &= 12/31/03 \text{ O/S } \S 412 \text{ bases} + \text{Method change} - \text{CB} - \text{ARA} \end{aligned}$$

Now you can subtract the ${}_e\text{UAL}$ from the EAN UAL. The difference is the method change base. Using this approach, you don't need to set up the 2003 MFSA to calculate the credit balance.

$$\text{Method change} = 01/01/04 \text{ EAN UAL} - 12/31/03 {}_e\text{UAL}$$

As expected, this produces the same method change base of -215,447.

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Problem 43

Similar to 2002 #19

The key to this problem is handling the waiver in the MFSA. The waiver should be amortized at the greater of the valuation rate, or 150% of the Federal mid-term rate. The current liability rates in this problem are extraneous information.

You are told there is a full waiver for 2001. At 01/01/02, the new waiver base is established. You should amortize the waiver at the valuation rate of 7%, since it is higher than 150% of the Federal mid-term rate in 2002.

Since you are amortizing the waiver at the valuation rate, it does not create anything in the accumulated reconciliation account. You simply bring forward the items you are given in the problem at the 7% valuation rate to 01/01/04:

$$01/03 \text{ ARA} = 20,000 + 25,000$$

$$\begin{aligned} 01/04 \text{ ARA} &= (1+i)(01/03 \text{ ARA}) + 12/31/03 \text{ ARA items} \\ &= 1.07(45,000) + 27,000 \\ &= 75,150 \end{aligned}$$

Answer is D

NOTE:

One way to get the wrong answer is to read the problem incorrectly and set up the waiver base at 01/01/2001. You might tend to do this, in an attempt to find a way to use the higher 150% FMR value for 2001.

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Problem 44

Similar to 2003 #18

Revised 07/14/06

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. In this problem, you actually have a chance to "guess" incorrectly.

The deductible limit for the taxable year ending 9/30/04 is based on the valuation for the plan year beginning in that tax year. The 01/01/04 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 9/30/04.

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.

$$\begin{aligned}\text{Limit adjustment} &= 4,000,000 / \ddot{s}_{\overline{10}|.07} \\ &= 532,252\end{aligned}$$

$$\begin{aligned}\text{Deductible limit} &= (1,400,000 + 532,252) * [1 + (9/12) * .07] \\ &= 2,033,696\end{aligned}$$

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. With no credit balance you can't check the 412 minimum contribution.

You can't calculate the deductible limit based on unfunded current liability. The final deductible limit is 2,033,696.

Answer is C

On a compound interest basis, the deductible limit is 2,032,832, which is also answer range C.

Fall 2004 EA-2A Exam Solutions

Problem 45

Similar to 2001 #11

The 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 non-investment gain / loss is defined as the difference between the expected and actual accrued liability. The investment gain / loss is defined as the difference between the expected and actual actuarial value of assets.

The first step is calculation of the expected actuarial value of assets:

$$\begin{aligned} {}_eAAV_1 &= (1+i)(AAV_0) - (\text{actual benefit payments} + \text{interest}) + (\text{contributions} + \text{interest}) \\ &= 1.07(450,000 - 20,000) + 80,000 \\ &= 540,100 \end{aligned}$$

$$\begin{aligned} \text{Loss} &= {}_eAAV_1 - AAV_1 \\ &= 540,100 - 520,000 \\ &= 20,100 \end{aligned}$$

One minor shortcut is based on knowledge of the Aggregate cost method. The effect of this loss is fully reflected in the PVNC, and the normal cost. There is no need to set up the funding standard account.

$$\begin{aligned} PVE/E &= 9,600,000 / 1,200,000 \\ &= 8.0 \end{aligned}$$

$$\Delta PVNC = 20,100$$

$$\begin{aligned} \Delta NC &= 20,100 / 8.0 \\ &= 2,513 \end{aligned}$$

Answer is A