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FALL 2003 EA-2A EXAM SOLUTIONS

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Fall 2003 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, 2003.

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:

October 10, 2014	Corrected solution for problem 29
October 23, 2008	Corrected solution for problem 24
November 19, 2007	Corrected solution for problems 5 and 6
October 22, 2006	Corrected solution for problem 22
October 10, 2006	Corrected solution for problem 17
October 3, 2006	Corrected solution for problem 30
August 21, 2006	Corrected solutions for problems 4, 7, 19, 25, 27, 28, 33, 35 and 36
July 14, 2006	Corrected solutions for problems 17, 19, 31 and 37
June 20, 2006	Clarified solution for problem 26, added solutions for problems 6 and 8, corrected solutions for problems 10, 15, 19, 38 and 41
October 21, 2005	Clarified solution for problem 21
July 9, 2005	Corrected solutions for problems 9, 13, 15, 19, 25, 26, 37 and 38
August 9, 2004	Original solutions

Fall 2003 EA-2A Exam Solutions

NOTES on 2003 exam

The 2003 exam was similar to the 2001 exam, and harder than the 2002 exam. This means that you had to get a lower number of points correct to pass in 2003 than in 2002.

If you look at the percentage of students who passed, it was approximately 41% in 2003 and 44% in 2002.

Fall 2003 EA-2A Exam Solutions

Problem 1

FALSE

There are some collectively bargained plans that can't use the shortfall method. The 1.412(c)(1)-2 regulation requires that the plan's rate of contributions is specified in the collective bargaining agreement.

Answer is B

NOTE:

According to the SOA Introductory study note: "The examination will consist entirely of multiple choice questions." I thought we aren't supposed to have true / false questions on EA-2A.

Fall 2003 EA-2A Exam Solutions

Problem 2

TRUE

This question tests your knowledge of the two cost methods. Under Entry Age Normal, the normal cost is calculated assuming that future normal costs are level each year. Under Unit Credit, the normal cost is calculated assuming that future normal costs will increase each year.

At 01/01/2003, the present value of projected benefits equals the present value of normal costs. The present value of normal costs must be identical for both methods, since the present value of projected benefits is independent of cost method. At 01/01/2003, the Entry Age Normal cost must be greater than the Unit Credit normal cost.

At some point in the future, the increasing Unit Credit normal cost will exceed the Entry Age Normal cost.

Answer is A

Fall 2003 EA-2A Exam Solutions

Problem 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

Problem 4**Revised 08/21/06**

The key to this problem is calculating the death benefit available at each age. Then you use those benefits in a typical expression for the present value of an ancillary benefit.

The problem asks for the normal cost for the death benefits. Based on the one year term cost method, this equals the present value of benefits for the expected deaths during the year.

The mortality decrements are assumed to occur at the end of the year. Based on all participants at age 64, you have

$$\text{PV of death benefits} = \sum_{t=0}^{\infty} v^{t+1} {}_tP_{64}^{(T)} q_{64+t}^{(d)} (\text{Death benefit}_{64+t}) (\text{PV factor}_{64+t+1})$$

You have different death benefits based on marital status. The present value will consist of two terms. For single participants who die, value the lump sum death benefit. For married participants who die, value the annuity death benefit:

One year term cost

$$\begin{aligned} \text{For death benefits} &= v^1 {}_0P_{64}^{(T)} q_{64}^{(d)} (\text{Death benefit}_{64}) (\text{PV factor}_{65}) \\ &= v^1 {}_0P_{64}^{(T)} q_{64}^{(d)} [40\% (100)(20,000)(1)] + v^1 {}_0P_{64}^{(T)} q_{64}^{(d)} [60\% (100)(6,000) \ddot{a}_{65}^{(12)}] \\ &= v^1 {}_0P_{64}^{(T)} q_{64}^{(d)} [40\% (100)(20,000)(1) + 60\% (100)(6,000) \ddot{a}_{65}^{(12)}] \\ &= (1.07)^{-1} (1.0)(.04) [40(20,000) + 60(6,000)(10.0)] \\ &= 29,907 + 134,579 \\ &= 164,486 \end{aligned}$$

Answer is B

NOTE:

I made no calculation for the probability of the spouse's survival to the point of death. In most pension valuation software, the marriage assumptions are similar to (but not identical to) those described in the problem:

“60% of participants are assumed to be married with the spouse the same age as the participant”

For valuation purposes, you typically assume that any spouse who dies will be replaced “automatically”. I have made the same assumption in my solution.

You could have calculated the survival probability for the spouse. In that case, you would still fall within answer range B.

Fall 2003 EA-2A Exam Solutions

Problem 5

Similar to 2002 #24

Revised 11/19/07

The key to this problem is handling the change in the interest rate in the §412 MFSA. You have to determine the outstanding amount of the IAL base at 8%, and re-determine the amortization of the base at the new 7% interest rate.

$$\begin{aligned}
 \text{\$412 8\% UAL} &= \text{O/S \$412 bases} - \text{CB} - \text{ARA} \\
 \text{O/S \$412 bases} &= \text{\$412 8\% UAL} + \text{CB} + \text{ARA} \\
 &= 325,000 + 2,500 \\
 &= 327,500
 \end{aligned}$$

Now you can set up the §412 amortization for the IAL base and the new assumption change base at 01/01/03:

Amortization base	Remaining years	8% Outstanding base	New Amortization Amount at 7%
1-1-1999 Initial AL	26 = 30-(2003-1999)	327,500	$327,500 / \ddot{a}_{26 .07}$ = 25,882
1-1-2003 Assump base	10 = 10-(2003-2003)	450,000 - 325,000 = 125,000	$125,000 / \ddot{a}_{10 .07}$ = 16,633

Now you must set up the MFSA for 2003, and solve for the credit balance at 12/31/03:

2003 Minimum Funding Standard Account			
Charges		Credits	
Normal Cost	40,000	Credit Balance	2,500
IAL amortization	25,882		
ASSM amortization	16,633	12/31 contribution	90,000
7% interest	5,776	7% interest	175
Total charges	88,291	Total credits	92,675

You have no information to calculate the §412 Full Funding Limitation. The credit balance at 12/31/03 is $4,384 = 92,675 - 88,291$.

Answer is B

Fall 2003 EA-2A Exam Solutions

Problem 6 - Page 1

Similar to 2002 #40

Revised 11/19/07

As in earlier problems, this one 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).

The main "trick" to the problem is that you must calculate the experience G/L for 2002. Since the 2002 contribution is paid at 12/31/2002, the only source of G/L is the salary experience.

You need to calculate the PUC accrued liability and normal cost at 01/01/2003. Under PUC, the accrued liability is defined as the present value of the "funding accrued benefit" (FAB). The normal cost is defined as the present value of the change in the FAB:

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

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.

Age 51 at 01/01/03
Past service 6
2002 pay 60,000 (age 50 pay)

Since the benefit accrues at the same rate each year, the accrued liability equals the normal cost multiplied by past service:

$$\text{FAB} = 2\%(\text{Past service})(\text{Projected FAE})$$

$$\text{PUC NC} = (\text{FAB})(\ddot{a}_{65}^{(12)})D_{65}/D_{51}$$

$$\text{NC} = \text{AL} / (\text{Past service})$$

Since you are given the PUC normal cost at 01/01/2002, you don't need to do detailed calculations of the accrued liability and normal cost at 01/01/2003. You can simply work from the age 50 normal cost, and allow for actual versus expected pay:

	2002 Actual	2003 Expected	2003 Actual
Valuation pay	50,000	1.04(50,000)	60,000
Normal Cost	6,280	1.07(6,280) = 6,720	(1.07/1.04)(6,280)(60,000/50,000) = 7,753
Accrued Liability	6,280(5) =31,400	1.07(6,280)(6) = 40,318	(1.07/1.04)(6,280)(6)(60/50) = 46,520 = 7,753(6)

Fall 2003 EA-2A Exam Solutions

Problem 6 - Page 2

Revised 06/20/06

$$\begin{aligned}\text{Non-inv G/L} &= AL_1 - {}_eAL_1 \\ &= 46,520 - 40,318 \\ &= 6,202 \text{ Loss}\end{aligned}$$

The last step of the problem is to calculate the minimum required contribution at 01/01/2003. With a zero credit balance, this is the sum of the normal cost and the MFSA amortizations for the IAL and the experience loss:

$$\begin{aligned}01/01 \text{ min} &= NC + IAL / \ddot{a}_{\overline{30}|.07} + \text{Loss} / \ddot{a}_{\overline{5}|.07} \\ &= 7,753 + 31,400 / 13.2777 + 6,202 / 4.3872 \\ &= 11,532\end{aligned}$$

Answer is E

The other way to work this problem is to directly calculate the 01/01/03 accrued liability values based on actual and expected pay:

$$2002 \text{ Pay} = 60,000 \quad (\text{age 50 pay})$$

$$\begin{aligned}\text{Pay}_{64} &= 60,000(1.04)^{14} \\ &= 103,901\end{aligned}$$

$$\begin{aligned}\text{FAE}_{65} &= 103,901(\ddot{a}_{\overline{3}|.04} / 3) \\ &= 99,956\end{aligned}$$

$$\begin{aligned}\text{FAB} &= 2\%(\text{Past service})(\text{Projected FAE}) \\ &= 2\%(6)(99,956) \\ &= 11,995\end{aligned}$$

$$\begin{aligned}\text{PUC AL} &= \text{FAB}(\ddot{a}_{65}^{(12)})D_{65}/D_{51} \\ &= 11,995(10.0)(1.07)^{-14} \\ &= 46,517\end{aligned}$$

$$\begin{aligned}{}_e\text{Pay}_{50} &= 50,000 * 1.04 \\ &= 52,000\end{aligned}$$

$$\begin{aligned}{}_eAL_{50} &= 46,517 * (52,000 / 60,000) \\ &= 40,315\end{aligned}$$

$$\begin{aligned}\text{Loss} &= 46,517 - 40,315 \\ &= 6,202\end{aligned}$$

You also have to calculate the normal cost ($7,753 = 46,517 / 6$) and the IAL ($31,400 = 5 * 6,280$).

Fall 2003 EA-2A Exam Solutions

Problem 7

Revised 08/21/06

You have to calculate the interest earned on the contributions paid for two years. I'll work the problem using simple interest, since that is usually quicker than compound interest. This problem would be much longer if you were subject to the quarterly contribution requirement in 2003.

2002 Minimum Funding Standard Account			
Charges		Credits	
		Credit Balance	0
		04/01/02 contribution	100,000
		10/01/02 contribution	70,000
		10/01/02 contribution	30,000
		7% interest	6,475
Total charges	<u>200,000</u>	Total credits	<u>206,475</u>

The interest was calculated as $6,475 = (.07)(9/12)(100,000) + (.07)(3/12)(70,000)$. There is no interest (or discount) on the contribution paid after the end of the plan year. The 12/31/02 credit balance is equal to the interest of 6,475.

2003 Minimum Funding Standard Account			
Charges		Credits	
Normal Cost	210,000	Credit Balance	6,475
		04/01/03 contribution	120,000
		09/01/03 contribution	60,000
		01/15/04 contribution	50,000
		09/15/04 contribution	40,000
7% interest	<u>14,700</u>	7% interest	<u>8,153</u>
Total charges	<u>224,700</u>	Total credits	<u>284,628</u>

The interest was calculated as $8,153 = (.07)(9/12)(120,000) + (.07)(4/12)(60,000) + (.07)(6,475)$. There is no interest (or discount) on the contributions paid after the end of the plan year. The credit balance at 12/31/03 is $59,928 = 284,628 - 224,700$.

Answer is E

You could also work the problem using compound interest. The 2002 interest would equal $6,399 = [1.07^{(9/12)} - 1](100,000) + [1.07^{(3/12)} - 1](70,000)$. The 12/31/02 credit balance is 6,399.

The 2003 interest would equal $8,063 = [1.07^{(9/12)} - 1](120,000) + [1.07^{(4/12)} - 1](60,000) + .07(6,399)$. The credit balance at 12/31/03 is $59,762 = 284,462 - 224,700$. As expected, this also produces answer range E.

Fall 2003 EA-2A Exam Solutions

Problem 8 - Page 1

As in earlier problems, this one 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 point is that the normal retirement age is given as age 63.

You need to calculate the investment G/L for 2002:

$$\begin{aligned}\text{Invest G/L} &= \text{AAV}_1 - {}_e\text{AAV}_1 \\ {}_e\text{AAV}_1 &= 7,000(1+.07(9/12)) \quad \text{using simple interest} \\ &= 7,368\end{aligned}$$

To get the AAV at 01/01/2003, you will have to calculate the accrued liability under PUC:

$$\begin{aligned}\text{UAL}_1 &= \text{AL}_1 - \text{AAV}_1 \\ \text{AAV}_1 &= \text{AL}_1 - \text{UAL}_1\end{aligned}$$

Under PUC, the accrued liability is defined as the present value of the “funding accrued benefit” (FAB). The normal cost is defined as the present value of the change in the FAB.

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.

$$\begin{aligned}\text{Age 35 at } 01/01/03 & \\ \text{Past service} &= 10 \\ \text{2001 pay} &= 42,000 \quad (\text{age 33 pay}) \\ \text{2002 pay} &= 43,260 = 42,000(1.03) \quad \text{this is expected pay, no salary G/L} \\ \\ \text{Age 62 pay} &= 98,976 = 42,000(1.03)^{29} \quad \text{normal retirement age is 63} \\ \text{FAB} &= 2.5\%(10)(98,976) \\ &= 24,744 \\ \\ \text{AL} &= \text{PV (FAB)} \\ &= 24,744(D_{63} / D_{35})\ddot{a}_{65}^{(12)} \\ &= 24,744 (1.07)^{-28}(9.22) \\ &= 34,313\end{aligned}$$

With no decrements, the D/D terms are only based on the 7% interest rate.

Problem 8 - Page 2**Revised 06/20/06**

$$\begin{aligned}AAV_1 &= AL_1 - UAL_1 \\&= 34,313 - 28,000 \\&= 6,313\end{aligned}$$

$$\begin{aligned}Inv\ G/L &= AAV_1 - {}_eAAV_1 \\&= 6,313 - 7,368 \\&= 1,055\ \text{Loss}\end{aligned}\quad \text{using simple interest}$$

Answer is D

You could also work the problem using compound interest:

$$\begin{aligned}{}_eAAV_1 &= 7,000(1.07)^{9/12} \\&= 7,364\end{aligned}$$

$$\begin{aligned}Inv\ G/L &= AAV_1 - {}_eAAV_1 \\&= 6,313 - 7,364 \\&= 1,051\ \text{Loss}\end{aligned}$$

As expected, this also produces answer range D.

Another solution technique relies on the fact that, since the non-investment G/L is zero, the total G/L is equal to the investment G/L. You are given the UAL at 01/01/03, so you must calculate the expected UAL.

$$\begin{array}{lll} \text{Age 34 at } 01/01/02 & & \\ \text{Past service } 9 & & \\ \text{2001 pay } 42,000 & (\text{age 33 pay}) & \\ \text{Age 62 pay } 98,976 & = 42,000(1.03)^{29} & \text{normal retirement age is 63} \end{array}$$

$$\begin{aligned}FAB &= 2.5\%(9)(98,976) \\&= 22,270\end{aligned}$$

$$\begin{aligned}AL &= PV(FAB) \\&= 22,270(D_{63} / D_{34})\ddot{a}_{65}^{(12)} \\&= 22,270(1.07)^{-29}(9.22) \\&= 28,861\end{aligned}$$

$$\begin{aligned}{}_eUAL &= (1+i)*(NC_0 + UAL_0) - (\text{contribution} + \text{interest}) \\{}_eUAL_1 &= 1.07(3,207 + 28,861) - 7,000[1+(9/12)*(.07)] \\&= 26,945\end{aligned}$$

$$\begin{aligned}G/L &= {}_eUAL_1 - UAL_1 \\&= 26,945 - 28,000 \quad \rightarrow \quad \text{Loss} = 1,055\end{aligned}$$

Fall 2003 EA-2A Exam Solutions

Problem 9

Revised 07/09/05

I. TRUE

Plans are exempt from the quarterly contribution requirement if the prior year's funded current liability percentage (FCL %) is 100% or more. Per the instructions for line 4a of the Schedule B, this FCL% is calculated as (AAV-zero) / (RPA current liability).

The 2002 FCL% is $101.82\% = (112,000-0)/110,000$. If you incorrectly used the 2002 Gateway FCL%, it gives you a slightly larger result.

II. FALSE

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 always had more than 150 participants.

You need to calculate the 2003 gateway FCL%:
Gateway FCL% = $79.4\% = (85,000-0)/107,000$.

Since this value is less than 80%, the plan must be subject to the 412(l) AFC for 2003.

III. TRUE

For a plan to be subject to the liquidity requirement, it must meet both requirements:

- (1) It must be subject to the quarterly contribution requirement, and
- (2) It must have more than 100 participants on any day of the prior plan year

Since I is true, the plan is exempt from the quarterly contribution requirement for 2003, and it is also exempt from the liquidity requirement for 2003.

Only I and III are true

Answer is E

Fall 2003 EA-2A Exam Solutions

Problem 10

Revised 06/20/06

The key to this problem is calculating the Full Funding Limitation (FFL) credit in the 2003 Minimum Funding Standard Account (MFSA). This problem did not try to be sneaky about the FFL credit at all.

You are told there is a funding waiver of 80,000 at 12/31/2002. You would set up a waiver base at 01/01/2003, and amortize this over five years. You have no information on the Federal mid-term rate. Based on the exam conditions, you should use the valuation rate of interest to amortize the G/L base:

$$\begin{aligned}\text{Waiver amort} &= 80,000 / \ddot{s}_{\overline{5}|.07} \\ &= 18,235\end{aligned}$$

2003 Minimum Funding Standard Account			
Charges		Credits	
Normal Cost	60,000	Credit Balance	0
Waiver	18,235	12/31/03 contribution	x
7% interest	5,476	7% interest	0
Total charges	83,711	Total credits	x

In this problem, you must check the Full Funding Limitation, since the problem implies there is a non-zero FFL credit.

Next, you should calculate the Full Funding Limitation (FFL). You have to ignore both the OBRA FFL and the RPA FFL, since you have no current liability values.

Since this plan uses an aggregate type cost method, the ERISA FFL must be calculated using the entry age normal cost and accrued liability.

$$\begin{aligned}\$412 \text{ "ERISA" FFL} &= (1+i) * (\text{EA NC} + \text{EAN AL}) - (1+i) * [\text{lesser (MVA, AAV)} - \text{CB}] \\ &= 1.07 * (54,000 + 790,000) - 1.07 * (820,000 - 0) \\ &= 25,680\end{aligned}$$

The §412 FFL credit is defined as the excess of the Accumulated funding deficiency (AFD) based on zero contribution and zero credit balance over the FFL. The AFD equals the previously calculated charges of 83,711. Since this exceeds the FFL of 25,680, there is a FFL credit in the MFSA for the excess of 58,031.

Answer is D

Fall 2003 EA-2A Exam Solutions

Problem 11

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:

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

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

$$\begin{aligned} {}_e\text{AAV}_1 &= (1+i)(\text{AAV}_0) - (\text{actual benefit payments} + i) + (\text{contributions} + i) \\ &= 1.07(2,000,000) - [1 + (6/12)(.07)](1,000,000) + [1 + (3/12)(.07)](400,000) \\ &= 2,140,000 - 1,035,000 + 407,000 \\ &= 1,512,000 \end{aligned}$$

You can use the 412 equation of balance to solve for the unfunded actuarial liability. Then you can calculate the actuarial value of assets:

$$\begin{aligned} \text{UAL} &= \text{O/S 412 bases} - \text{CB} - \text{ARA} \\ \text{UAL} &= 1,600,000 - 100,000 - 0 \\ &= 1,500,000 \end{aligned}$$

$$\begin{aligned} \text{UAL} &= \text{AL} - \text{AAV} \\ \text{AAV}_1 &= \text{AL} - \text{UAL} \\ &= 3,500,000 - 1,500,000 \\ &= 2,000,000 \end{aligned}$$

$$\begin{aligned} \text{Gain} &= \text{AAV}_1 - {}_e\text{AAV}_1 \\ &= 2,000,000 - 1,512,000 \\ &= 488,000 \end{aligned}$$

Answer is D

You could also work the problem using compound interest. The expected asset value would equal 1,512,415 and the resulting asset gain is 487,585. As expected, this also produces answer range D.

There is a longer way to work the problem. If you don't know how to calculate the investment G/L directly, you could determine it as the difference between the total G/L and the non-investment G/L:

$$\begin{aligned} \text{Total G/L} &= {}_e\text{UAL}_1 - \text{UAL}_1 \\ \text{Non-inv G/L} &= {}_e\text{AL}_1 - \text{AL}_1 \end{aligned}$$

Fall 2003 EA-2A Exam Solutions

Problem 12 - Page 1

Similar to 2002 #38

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 will include the salary scale.

In other similar exam problems, you typically calculate final average earnings by projecting pay to ARA-1, and multiply by $(\ddot{a}_{n|.035}/n)$. In this problem, you should not use that approach, since the salary increase changes in the last year.

<u>OLD assumptions</u>	<u>One employee</u>	<u>ALL TOTAL</u>
01/2003 Age	45	
2003 pay (age 45)	50,000	
Age 49 pay	$57,376 = 50,000(1.035)^4$	
Salary scale	3.5% each year	
Projected FAE3 at 52	$(57,376)[1+1.035+(1.035)^2] / 3$ $= 59,408$	
Projected benefit	$29,704 = .50(59,408)$	
PV future benefits	$29,704(D_{52} / D_{45})\ddot{a}_{52}^{(12)}$ $(29,704)(1.07)^{-7}(11.8)$ $= 218,277$	$17(218,277)$ $= 3,710,715$

Now you can calculate the Aggregate PVNC:

$$\begin{aligned}
 \text{\$412 PVNC} &= \text{PVB} - \text{AAV} - (\text{O/S } \text{\$412 bases} - \text{CB}) && \text{NOTE: No ARA under Aggregate} \\
 &= 3,710,715 - 3,400,000 - (0 - 0) \\
 &= 310,715
 \end{aligned}$$

Now you need to calculate the average pay weighted annuity, which can then be used to calculate the normal cost. The temporary annuity with salary scale looks like this:

$$\begin{aligned}
 s\ddot{a}_{45:7|} &= 1 + (1.035/1.07)^1 + \dots + (1.035/1.07)^6 \\
 &= \ddot{a}_{7|j} \text{ where } 1+j = (1.070 / 1.035), \quad j = 3.38\%
 \end{aligned}$$

Fall 2003 EA-2A Exam Solutions

Problem 12 - Page 2

Now you need to calculate the average weighted annuity, which can then be used to calculate the normal cost. Since all participants are the same age, the average weighted annuity (PVE/E) is equal to the temporary annuity for any one participant:

$$\begin{aligned} s\ddot{a}_{\overline{45:7}|} &= \ddot{a}_{\overline{7}|3.38\%} \\ &= 6.3493 \end{aligned}$$

$$\begin{aligned} \$412 \text{ NC} &= \text{PVNC} / (\text{PVE}/E) \\ &= 310,715 / 6.3493 \\ &= 48,937 \end{aligned}$$

<u>NEW assumptions</u>	<u>One employee</u>	<u>ALL TOTAL</u>
01/2003 Age	45	
2003 pay (age 45)	50,000	
Age 49 pay	$57,376 = 50,000(1.035)^4$	
Salary scale	3.5% yearly, 40% in final year	
Projected FAE3 at 52	$(57,376)[1 + 1.035 + (1.035)(1.40)] / 3$	
	$= 66,633$	
PV future benefits	$(66,633/59,408)(218,277)$	$17(244,824)$
	$= 244,824$	$= 4,162,007$

Now you can calculate the Aggregate PVNC:

$$\begin{aligned} \$412 \text{ PVNC} &= \text{PVB} - \text{AAV} - (\text{O/S } \$412 \text{ bases} - \text{CB}) && \text{NOTE: No ARA under Aggregate} \\ &= 4,162,007 - 3,400,000 - (0 - 0) \\ &= 762,007 \end{aligned}$$

Now you need to calculate the average pay weighted annuity, which can then be used to calculate the normal cost. The temporary annuity with salary scale looks like this:

$$s\ddot{a}_{\overline{45:7}|} = 1 + (1.035/1.07)^1 + \dots + (1.035/1.07)^5 + (1.035/1.07)^5(1.40/1.07)$$

The easiest way to evaluate this is to separate the first six terms from the last one.

$$s\ddot{a}_{\overline{45:7}|} = \text{AAA} + (1.035/1.07)^5(1.40/1.07)$$

$$\text{AAA} = \ddot{a}_{\overline{6}|j} \text{ where } 1+j = (1.070 / 1.035), \quad j = 3.38\%$$

Fall 2003 EA-2A Exam Solutions

Problem 12 - Page 3

Now you need to calculate the average weighted annuity, which can then be used to calculate the normal cost. Since all participants are the same age, the average weighted annuity (PVE/E) is equal to the temporary annuity for any one participant:

$$\begin{aligned} s\ddot{a}_{\overline{45:7}|} &= \ddot{a}_{\overline{6}|3.38\%} + (1.035/1.07)^5(1.40/1.07) \\ &= 5.5302 + 1.1080 \\ &= 6.6382 \end{aligned}$$

$$\begin{aligned} \$412 \text{ NC} &= \text{PVNC} / (\text{PVE}/E) \\ &= 762,007 / 6.6382 \\ &= 114,791 \end{aligned}$$

The increase in the normal cost is $114,791 - 48,937 = 65,854$.

Answer is B

Fall 2003 EA-2A Exam Solutions

Problem 13

Revised 07/09/05

This is a straightforward question on how a plan change affects the MFSA. The new MFSA base is equal to the difference in the Entry Age Normal accrued liability due to the plan change.

$$\begin{aligned} \text{UAL} &= \text{new EAN AL} - \text{old EAN AL} \\ &= 150,000 \end{aligned}$$

Now you can calculate the annual amortization amounts for the §412 bases:

Amortization base	Initial Base	Original Years	Amortization amount
1-1-1997 Initial AL	500,000	30	$37,657 = 500,000 / \ddot{a}_{\overline{30} .07}$
1-1-2003 Plan chg	150,000	30	$11,297 = 150,000 / \ddot{a}_{\overline{30} .07}$

2003 Minimum Funding Standard Account

Charges		Credits	
Normal Cost	X	Credit Balance	25,000
IAL amortization	37,657	12/31/03 minimum	72,000
PLAN amortization	11,297		
7% interest	$3,427 + .07X$	7% interest	$1,750$
Total charges	$52,381 + 1.07X$	Total credits	$98,750$

Now you can solve for the normal cost at 01/01/03, since payment of the minimum contribution produces a zero credit balance at 12/31/03:

$$\begin{aligned} 52,381 + 1.07X &= 98,750 \\ 1.07X &= 46,369 \\ X &= 43,335 \end{aligned}$$

Answer is C

Fall 2003 EA-2A Exam Solutions

Problem 14

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

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

$$\begin{aligned}\$412 \text{ PVNC} &= \text{PVB} - \text{AAV} - (\text{O/S } \$412 \text{ bases} - \text{CB}) && \text{NOTE: no ARA under Aggregate} \\ \text{AGG NC} &= \text{PVNC} / \left(\text{average } \ddot{a}_{\overline{\text{X:RA-X}}|} \right)\end{aligned}$$

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

$$\$412 \text{ PVNC} = (\text{PVB} + \text{refunds}) - (\text{AAV} + \text{EECWI} + \text{PVEEC}) - (\text{O/S } \$412 \text{ bases} - \text{CB})$$

In this problem, you must assume that the present value of benefits includes the present value of future refunds. You must assume that the AAV given includes the past EECWI.

$$\begin{aligned}\$412 \text{ PVNC} &= 2,000,000 - (275,000 + 250,000) - (0 - 0) \\ &= 1,475,000\end{aligned}$$

You must determine the average temporary annuity to use in the normal cost calculation. Since you have no salary scale, the weighted average is based on the number of participants:

$$\begin{aligned}\text{Avg annuity} &= [30(\ddot{a}_{\overline{53:12}|}) + 20(\ddot{a}_{\overline{55:10}|})] / [30 + 20] \\ &= [30(\ddot{a}_{\overline{12|.07}|}) + 20(\ddot{a}_{\overline{10|.07}|})] / [30 + 20] \\ &= 405.26 / 50 \\ &= 8.1053\end{aligned}$$

$$\begin{aligned}\text{AGG NC} &= 1,475,000 / 8.1053 \\ &= 181,980\end{aligned}$$

Answer is B

NOTE:

This is the first problem of this type that did not allow an alternate method of solution. Since the contribution rate is not specified, you can't determine the mandatory employee contributions for the current year. These calculations are shown in the alternate solution for 2002 #20.

Fall 2003 EA-2A Exam Solutions

Problem 15 - Page 1

Similar to 1999 #21

Revised 06/20/06

With an individual cost method, there are two things to be aware of. One is that you should check the Full Funding Limitation (FFL) if you have sufficient information. The other is that you should check for experience gains or losses each year.

You have to calculate the experience G/L during 2002. You must determine the expected UAL at 01/01/03, as well as the actual UAL at 01/01/03 before the plan amendment. The difference between those two values is the experience gain or loss base:

$$\begin{aligned} 01/01/03 \text{ } _e\text{UAL} &= (1+i) * (NC_0 + \text{UAL}_0) - (\text{contribution} + \text{interest}) \\ &= 1.07 * (25,000 + 20,000) - 32,000 \\ &= 16,150 \end{aligned}$$

$$\begin{aligned} 01/01/03 \text{ UAL} &= 330,000 - 300,000 = 30,000 \\ \text{Old plan UAL} &= 305,000 - 300,000 = 5,000 \end{aligned}$$

$$\begin{aligned} \text{Gain base} &= 16,150 - 5,000 = 11,150 \\ \text{Amortization} &= 2,541 = 11,150 \div \ddot{a}_{\overline{5}|.07} \end{aligned}$$

$$\begin{aligned} \text{Plan change} &= 330,000 - 305,000 = 25,000 \\ \text{Amortization} &= 1,883 = 25,000 \div \ddot{a}_{\overline{30}|.07} \end{aligned}$$

Since you don't have the effective date of the plan, you can't solve for the outstanding amount of the IAL amortization base. You don't know how many years are left in the amortization of the IAL.

To complete the MFSA for 2003, you must determine the amortization for the initial accrued liability. To do this, you have to use the 2002 MFSA results:

2002 Minimum Funding Standard Account			
Charges		Credits	
Normal Cost	25,000	Credit Balance	2,500
IAL amortization	X	12/31/03 contribution	32,000
7% interest	$1,750 + .07X$	7% interest	175
Total charges	$26,750 + 1.07X$	Total credits	34,675

$$\begin{aligned} 12/31/02 \text{ CB} &= 5,000 \\ &= 34,675 - (26,750 + 1.07X) \\ 26,750 + 1.07X &= 29,675 \\ X &= 2,734 \end{aligned}$$

You can't check the Full Funding Limitation, since you don't know the value of the accrued liability at 01/01/02.

Fall 2003 EA-2A Exam Solutions

Problem 15 - Page 2

Revised 06/20/06

Now you have enough information to complete the 2003 MFSA:

2003 Minimum Funding Standard Account			
Charges		Credits	
Normal Cost	28,000	Credit Balance	5,000
IAL amortization	2,734	Gain amortization	2,541
PLAN amortization	1,883	12/31/03 minimum	x
7% interest	2,283	7% interest	528
Total charges	<u>34,900</u>	Total credits	<u>8,069 + x</u>

The 12/31/03 minimum contribution is $34,900 - 8,069 = 26,831$. You should check the Full Funding Limitation:

$$\begin{aligned}\text{\$412 "ERISA" FFL} &= (1+i) * (\text{NC} + \text{AL}) - (1+i) * [\text{lesser (MVA, AAV)} - \text{CB}] \\ &= 1.07 * (28,000 + 330,000) - 1.07 * (300,000 - 5,000) \\ &= 67,410\end{aligned}$$

Since the FFL exceeds the MFSA charges less the amortization credits, there is no FFL credit for 2003. The 2003 minimum contribution is unchanged at 26,831.

Since the 12/31/02 contribution of 32,000 produced a credit balance of 5,000, the 12/31/02 minimum contribution is $32,000 - 5,000 = 27,000$.

The absolute value of the difference in the 12/31 minimum contributions between 2003 and 2002 is $27,000 - 26,831 = 169$.

Answer is A

Fall 2003 EA-2A Exam Solutions

Problem 16 - Page 1

Similar to 1999 #29

Based on the Gateway FCL%, the plan is subject to §412(l). The problem would be too easy if they were not subject to §412(l)! This problem gives you all the values needed to calculate the Deficit Reduction Contribution (DRC) and the §412(l) AFC.

The MFSA charges should be increased by the Unpredictable Contingent Event amount plus the excess, if any, of the DRC over the §412 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 new liability (UNL) is the excess of the unfunded current liability (UCL) over the remaining portion of the unfunded old liability (UOL) plus any unpredictable contingent event liability. 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.

Since this is a plan established after OBRA '87, the UOL is zero (you are also told that the UOL is zero). The entire unfunded current liability will be considered as unfunded new liability.

You are not given the AAV in this problem. You are given the FCL%, and you can use it to solve for the AAV. In calculating the FCL%, any debit balance is treated as a zero CB. The resulting FCL% should be rounded to the nearest .01%:

$$\begin{aligned}\text{FCL\%} &= (\text{AAV} - \text{CB}) / \text{CL} \\ .73 &= (\text{AAV} - 24,000) / 1,200,000 \\ \text{AAV} &= 900,000\end{aligned}$$

$$\begin{aligned}\text{UCL} &= \text{CL} - (\text{AAV} - \text{CB}) \\ &= 1,200,000 - (900,000 - 24,000) \\ &= 324,000\end{aligned}$$

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

$$\begin{aligned}\text{UCEL} &= 0 \\ \text{UOL} &= 0 \\ \text{UNL} &= \text{UCL} - \text{UOL} - \text{UCEL} \\ &= 324,000\end{aligned}$$

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 the formula, and the FCL percentage. If the FCL% is less than 60%, then the APP% would be limited to 30%.

Fall 2003 EA-2A Exam Solutions

Problem 16 - Page 2

$$\begin{aligned}\text{APP\%} &= .30 - .40 [.73 - .60] \\ &= 24.80\%\end{aligned}$$

$$\begin{aligned}\text{UNLA} &= 324,000 * .2480 \\ &= 80,352\end{aligned}$$

$$\begin{aligned}\text{DRC} &= \text{UOLA} + \text{UNLA} + \text{CLNC} \\ \text{DRC} &= 0 + 80,352 + 100,000 \\ &= 180,352\end{aligned}$$

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.

$$\begin{aligned}01/01/03 \text{ §412(l) charge} &= 180,352 - (120,000 + 200,000 / \ddot{s}_{30|.07}) \\ &= 45,289 \\ 12/31/03 \text{ §412(l) charge} &= 45,289 * 1.06 \\ &= 48,006\end{aligned}$$

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.

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.

2003 Minimum Funding Standard Account

Charges		Credits	
Normal Cost	120,000	Credit Balance	24,000
IAL amortization	15,063	12/31/03 minimum	x
7% interest	9,454	7% interest	1,680
12/31 412(l) AFC	48,006		
Total charges	192,523	Total credits	25,680 +x

You do not have sufficient information to calculate the Full Funding Limitation. The minimum contribution at 12/31/03 is $166,843 = 192,523 - 25,680$.

Answer is B

Fall 2003 EA-2A Exam Solutions

Problem 17 - Page 1

The key to this problem is carefully handling Jones' early retirement, and calculating the initial accrued liability and the normal cost under the Attained Age Normal (AAN) method. Under AAN, the present value of normal costs (PVNC) is defined as the present value of benefits less the assets less the unfunded actuarial liability. The AAN normal cost is calculated by dividing the PVNC by the average temporary annuity from current age to the assumed retirement age.

This is a very long calculation problem. You must determine the Unit Credit accrued liability at 01/01/02, and use that value for the initial accrued liability under AAN. Then you determine the projected benefits and AAN normal cost at 01/01/02.

You need to set up the minimum funding standard account (MFSA) for 2002 to determine the credit balance at 12/31/02. At 01/01/03, Jones has retired. After you determine their retirement benefit, you can calculate the AAN normal cost at 01/01/03. Finally, you can set up the MFSA for 2003.

01/01/2002 Valuation

<u>Description</u>	<u>Smith</u>	<u>Jones</u>	<u>Total</u>
Birth Date	01/01/63	01/01/41	
01/2002 Age	39	61	
Hire Date	01/01/89	01/01/78	
Past service	13	24	
Total service	39	28	
Accrued benefit	12(35)(13) = 5,460	12(35)(24) = 10,080	
PV accrued benefit	$5,460(D_{65} / D_{39}) \ddot{a}_{65}^{(12)}$	$10,080(D_{65} / D_{61}) \ddot{a}_{65}^{(12)}$	
UC accrued liability	$5,460(1.07)^{-26} (10.0)$	$10,080 (1.07)^{-4} (10.0)$	
IAL	= 9,402	= 76,900	86,302
Projected benefit	12(35)(39)	12(35)(28)	
PV future benefits	$(39/13)(9,402)$ = 28,206	$(28/24)(76,900)$ = 89,716	117,922

Fall 2003 EA-2A Exam Solutions

Problem 17 - Page 2

Now you can calculate the AAN PVNC:

$$\begin{aligned}\$412 \text{ PVNC} &= \text{PVB} - \text{AAV} - \text{UAL} \\ &= 117,922 - 0 - 86,302 \\ &= 31,620\end{aligned}$$

Now you need to calculate the average weighted annuity, which can then be used to calculate the normal cost.

<u>Description</u>	<u>Smith</u>	<u>Jones</u>	<u>Total</u>
01/2002 Age	39	61	
Temporary annuity	$\ddot{a}_{39:26 }$	$\ddot{a}_{61:4 }$	
	$= \ddot{a}_{26 .07}$	$= \ddot{a}_{4 .07}$	
	$= 12.6536$	$= 3.6243$	16.2779

The average weighted annuity is calculated by dividing the sum of the temporary annuities by the number of participants with a non-zero temporary annuity:

$$\begin{aligned}\text{Average annuity} &= 16.2779 / 2 \\ &= 8.1389\end{aligned}$$

$$\begin{aligned}01/01/02 \text{ NC} &= 31,620 / 8.1389 \\ &= 3,885\end{aligned}$$

$$\begin{aligned}\text{IAL amort} &= 86,302 / \ddot{a}_{30|.07} \\ &= 6,500\end{aligned}$$

2002 Minimum Funding Standard Account			
Charges		Credits	
Normal Cost	3,885	Credit Balance	0
IAL amortization	6,500	12/31 contribution	16,000
7% interest	727	7% interest	0
Total charges	11,112	Total credits	16,000

The credit balance at 12/31/02 is $4,888 = 16,000 - 11,112$.

Fall 2003 EA-2A Exam Solutions

Problem 17 - Page 3

Revised 10/10/06

01/01/2003 Valuation

<u>Description</u>	<u>Smith</u>	<u>Jones</u>	<u>Total</u>
01/2003 Age	40	62	
Past service	14	25	
Total service	39	28	
Accrued benefit	N/A	12(35)(25)	
	N/A	= 10,500	

Smith is now one year older, but the projected benefit has not changed. There is one less year of interest discount, so Smith's PVB increases by 1.07:

$$\begin{aligned}01/03 \text{ Smith PVB} &= 1.07(28,206) \\ &= 30,180\end{aligned}$$

Jones retired at 12/31/02, and the early retirement benefit is reduced 4% per year prior to age 65:

$$\begin{aligned}\text{Jones ret benefit} &= 10,500(1-.04(3)) \\ &= 9,240\end{aligned}$$

The liability for Jones reflects their retirement at age 62:

$$\begin{aligned}01/03 \text{ Jones PVB} &= 9,240(\ddot{a}_{62}^{(12)}) \\ &= 97,944\end{aligned}$$

$$\begin{aligned}01/03 \text{ Total PVB} &= 30,180 + 97,944 \\ &= 128,124\end{aligned}$$

One final step is calculation of the UAL at 01/01/03. Under aggregate type cost methods, the UAL is equal to the expected UAL from the prior year:

$$\begin{aligned}01/03 {}_e\text{UAL} &= (1+i) * (NC_0 + UAL_0) - (\text{contrib} + i) \\ &= 1.07 * (3,885 + 86,302) - 16,000 \\ &= 80,500\end{aligned}$$

Now you can calculate the AAN PVNC:

$$\begin{aligned}\$412 \text{ PVNC} &= \text{PVB} - \text{AAV} - \text{UAL} \\ &= 128,124 - 16,000 - 80,500 \\ &= 31,624\end{aligned}$$

Fall 2003 EA-2A Exam Solutions

Problem 17 - Page 4

Revised 07/14/06

The average weighted annuity is calculated by dividing the sum of the temporary annuities by the number of participants with a non-zero temporary annuity. Since Smith is the only active participant, the average temporary annuity is equal to Smith's temporary annuity.

Smith is one year older at 01/01/03:

$$\begin{aligned}\text{Smith's annuity} &= \ddot{a}_{\overline{40:25}|} \\ &= \ddot{a}_{\overline{25}|.07} \\ &= 12.4693\end{aligned}$$

$$\begin{aligned}01/01/03 \text{ NC} &= 31,624 / 12.4693 \\ &= 2,536\end{aligned}$$

2003 Minimum Funding Standard Account			
Charges		Credits	
Normal Cost	2,536	Credit Balance	4,888
IAL amortization	6,500	12/31 minimum	x
NO interest	0	NO interest	0
Total charges	9,036	Total credits	4,888 + x

The MFSA is set up with NO interest, since the problem asks for the minimum contribution at 01/01/03. That contribution is 4,148, which equals 9,036 - 4,888.

Answer is B

NOTES:

1. If you incorrectly calculate the minimum contribution at 12/31/03, you get 4,439, which is in answer range C. Specifying the minimum contribution at the beginning of the year is a "cheap trick".
2. 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.

Fall 2003 EA-2A Exam Solutions

Problem 18

Similar to 1999 #29

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

The deductible limit for the taxable year ending 12/31/03 is based on the valuation for the plan year beginning in that tax year. The 07/01/03 valuation should be used to determine the deductible limit needed for the answer to this problem.

The first step should be to calculate the normal cost plus limit adjustments. The ten year amortization bases include the initial accrued liability. The deductible limit is the normal cost plus limit adjustments brought forward with interest to the earlier of the end of the plan year, or the end of the tax year, which is 12/31/03.

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

You need to use the information given to determine the amount of the IAL:

$$\begin{aligned}\text{UAL} &= \text{O/S } \$412 \text{ bases} - \text{CB} - \text{ARA} \\ 450,000 &= \text{IAL} \left(\ddot{a}_{\overline{24}|.07} / \ddot{a}_{\overline{30}|.07} \right) - 25,000 - 0 \\ \text{IAL} &= 475,000 * \left(\ddot{a}_{\overline{30}|.07} / \ddot{a}_{\overline{24}|.07} \right) \\ &= 513,918\end{aligned}$$

$$\begin{aligned}\text{Limit adjustment} &= 513,918 / \ddot{a}_{\overline{10}|.07} \\ &= 68,383 \\ \text{Deductible limit} &= (45,000 + 68,383) * [1 + (6/12) * .07] \\ &= 117,352\end{aligned}$$

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 only the IAL base (and a credit balance), the minimum is clearly lower than the previous calculation of the deductible limit. Based on the calculations so far, the deductible limit is 117,352. You can not calculate the deductible limit based on unfunded current liability.

Answer is C

On a compound interest basis, the deductible limit is 117,285, which is also answer range C.

Fall 2003 EA-2A Exam Solutions

Problem 19 - Page 1

Revised 06/20/06

The key to this problem is remembering to calculate the gain / loss for 2002. This is primarily a problem on the MFSA, with a bit of deductible limit calculations.

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:

$$\begin{aligned}\text{Limit adjustment} &= \text{IAL} / \ddot{a}_{10|.07} \\ &= 100,000 / 7.5152 \\ &= 13,306\end{aligned}$$

$$\begin{aligned}\text{Deductible limit} &= (55,000 + 13,306) * (1.07) \\ &= 73,088\end{aligned}$$

Since the plan was just established in 2002, and it grants credit for past service, it should be clear that the FFL will not apply. With only one IAL base, it should be clear that the 412 minimum contribution will be lower than the deductible limit of 73,088.

One point of the problem is knowing that the deductible limit can be paid at any point during the year. Now you can use the 07/01/02 contribution of the deductible limit to determine the amount of the credit balance. You need to calculate the amortization of the IAL:

$$\begin{aligned}\text{IAL amort.} &= \text{IAL} / \ddot{a}_{30|.07} \\ &= 100,000 / 13.2777 \\ &= 7,531\end{aligned}$$

2002 Minimum Funding Standard Account			
Charges		Credits	
Normal Cost	55,000	Credit Balance	0
IAL amortization	7,531	07/01/02 contribution	73,088
7% interest	4,377	7% interest	2,558
Total charges	66,908	Total credits	75,646

The MFSA used simple interest on the 07/01/02 contribution, which gives $2,558 = (6/12)(.07)(73,088)$. The credit balance at 12/31/02 is $8,738 = 75,646 - 66,908$.

Fall 2003 EA-2A Exam Solutions

Problem 19 - Page 2

Revised 08/21/06

01/01/2003 Valuation

The main point of the problem is that you need to determine the amount of experience G/L during 2002. You must determine the expected UAL at 01/01/03, as well as the actual UAL at 01/01/03. The difference between those two values is the experience gain or loss base:

$$\begin{aligned} 01/01/03 {}_e\text{UAL} &= (1+i) * (\text{NC}_0 + \text{UAL}_0) - (\text{contrib} + i) \\ &= 1.07 * (55,000 + 100,000) - 1.035(73,088) && \text{(simple interest)} \\ &= 90,204 \end{aligned}$$

$$\begin{aligned} 01/01/03 \text{ UAL} &= \text{AL} - \text{AAV} \\ &= 130,000 - 75,000 \\ &= 55,000 \end{aligned}$$

$$\begin{aligned} \text{Gain base} &= 90,204 - 55,000 \\ &= 35,204 \end{aligned}$$

$$\begin{aligned} \text{Amortization} &= 35,204 \div \ddot{a}_{\overline{5}|.07} \\ &= 8,024 \end{aligned}$$

2003 Minimum Funding Standard Account			
Charges		Credits	
Normal Cost	40,000	Credit Balance	8,737
IAL amortization	7,531	Gain amortization	8,024
		12/31/03 minimum	x
7% interest	3,327	7% interest	1,173
Total charges	50,858	Total credits	x + 17,935

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 12/31/03 is $32,923 = 50,858 - 17,935$.

Answer is B

You could have worked the problem with compound interest:

$$\begin{aligned} 2002 \text{ MFSA interest} &= 2,515 \\ 12/31/02 \text{ MFSA CB} &= 8,694 \\ 2003 {}_e\text{UAL}_1 &= 90,247 \\ 2002 \text{ Gain base} &= 35,247 \\ \text{Gain amortization} &= 8,034 \\ 2003 \text{ MFSA interest} &= 1,171 \\ 12/31/03 \text{ minimum} &= 32,960 \end{aligned}$$

Fall 2003 EA-2A Exam Solutions

Problem 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.

For 2003, the OBRA FFL calculation uses 170% of the current liability. 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:

$$\begin{aligned}\text{\$412 "ERISA" FFL} &= (1+i) * (\text{EA NC} + \text{EAN AL}) - (1+i) * [\text{lesser (MVA, AAV)} - \text{CB}] \\ &= 1.07 * (75,000 + 675,000 - (801,000 - 0)) \\ &= \text{Zero}\end{aligned}$$

$$\begin{aligned}\text{\$412 "OBRA" FFL} &= 1.70 (12/31 \text{ CL}) - (1+i) * [\text{lesser (MVA, AAV)} - \text{CB}] \quad (\text{if no benefit payments}) \\ &\text{Skip, will have no effect on FFL}\end{aligned}$$

$$\begin{aligned}\text{\$412 "RPA 94" FFL} &= .90 (12/31 \text{ CL}) - (1+i) * (\text{AAV}) \quad (\text{if no benefit payments}) \\ &= .90 * [(1.06)(83,000 + 910,000) - 0 \text{ BP}] - [1.07 * (819,000) - 0 \text{ BP}] \\ &= 70,992\end{aligned}$$

The final §412 FFL value is the greater of the RPA '94 floor, and the lesser of the ERISA and OBRA FFL values, or 70,992. You do not need to calculate the OBRA FFL, since the lesser of the ERISA and OBRA values would always equal zero.

Answer is B

Note that the end of year asset value (if any) should be used in calculating the OBRA '87 and 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.

Problem 21 - Page 1**Revised 10/21/05**

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

You are given data for two DB plans, and two DC plans. Since some people are covered under most of the possible DB / DC plan combinations (Plan A + Plan C, Plan A + Plan D, and Plan B + Plan D), you should aggregate the four plans when you calculate the DB / DC limits.

DB PLANS

First you should aggregate the information given for the two DB plans:

Description	Plan A	Plan B	Total for DB
Minimum 412 contribution	8,500,000	1,250,000	9,750,000
Actual contribution	9,000,000	1,400,000	10,400,000
Unfunded current liability projected to year-end	7,500,000	1,000,000	8,500,000
Maximum 404 contribution	12,000,000	1,500,000	13,500,000

The actual contribution exceeds the unfunded current liability (UCL), so it is not based on the 404 UCL. Instead, it is based on the normal cost plus limit adjustments, which gives the final deductible limit of 13,500,000. The final DB plan deduction for 2003 is equal to the contribution of 10,400,000.

DC PLANS

Money purchase plans have a deduction limitation equal to 25% of pay. The total pay for all three divisions is $38,000,000 = 22,000,000 + 10,000,000 + 6,000,000$. This calculation is based on the compensation for all employees covered by the plans.

The 25% of compensation limit is $9,500,000 = .25(38,000,000)$. The total contributions paid to the DC plans of 800,000 ($= 500,000 + 300,000$) do not exceed this limit.

OVERALL DB/DC

The overall deduction limitation is defined as the greater of 25% of taxable compensation, or the minimum contribution requirement for the DB plan. The deductible limit for a DB plan may be based on the unfunded current liability. The overall deduction limitation is defined as the greater of 25% of taxable compensation, or the greater of

- (a) the minimum contribution requirement for the DB plan, or
- (b) the lesser of
 - (i) the DB plan unfunded current liability under 404(a)(1)(D), or
 - (ii) the DB plan contribution.

The total pay for all three divisions is $38,000,000 = 22,000,000 + 10,000,000 + 6,000,000$. This calculation is based on the compensation for all employees covered by the plans.

The 25% of compensation limit is $9,500,000 = .25(38,000,000)$. The DB plan calculation produces a final result of 9,750,000 (which equals the 412 minimum contribution requirement).

The greater of these is the final DB / DC limit of 9,750,000. Now you should compare the total contributions for all plans to determine the non-deductible amount:

	Plan A	Plan B	Total for DB
Actual contribution	9,000,000	1,400,000	10,400,000
	Plan C	Plan D	Total for DC
Actual contribution	500,000	300,000	800,000
All total			11,200,000

The employer has contributed 11,200,000 to both the DB and DC plans. This exceeds the overall DB/DC limit of 9,750,000. The excess of 1,450,000 is the amount of the non-deductible contribution.

Answer is C

EXCISE TAX - EXTRA CREDIT

Students have often asked "How would you calculate the excise tax in this problem"? The excise tax is NOT based solely on the non-deductible contribution. There are two different excise tax exemptions at 4972(c)(6), and 4972(c)(7). In general, you would not check the excise tax exemption at 4972(c)(7), unless the employer has elected it.

Problem 21 - Page 3**Added 10/21/05**

You need to determine if either DB plan had a non-deductible contribution. This is a necessary first step for determining the excise tax. The reason is that the 4972(c)(6) excise tax exemption only applies to any DC plan non-deductible contributions. If the DB plans have a non-deductible contribution, the 4972(c)(6) excise tax exemption will not apply to them. Neither Plan A nor Plan B's contribution exceeded the maximum 404 contribution given.

Under 4972(c)(6), there is an exemption from the excise tax for the lesser of

- (i) the DC plan contribution, or
- (ii) the greater of
 - (a) 6% of total compensation, or
 - (b) the sum of the contributions under §401(m)(4) plus the employee elective pre-tax deferrals under §402(g)(3). These are the same as the employer matching contributions and the §401(k) pre-tax deferrals.

In this problem, 6% of total compensation is $6\%(38,000,000) = 2,280,000$. The excise tax exemption is the lesser of the DC contribution and that value, which gives 800,000.

At the end of 4972(c)(6), it states that you must apply the DB/DC limit under 404(a)(7) first to the DB plan, and then to the DC plan. This is designed to prevent you from applying the DC plan excise tax exemption to any non-deductible contributions under the DB plan.

Here are the details of the excise tax calculation:

4972(c)(6) Exemption

DB contributions	10,400,000
DB plan deductible limit	13,500,000
DB non-deductible	0
DB excise tax	0
Overall DB/DC 25% limit	9,500,000
Or 412 min, if greater	9,750,000
Or UCL deduction, if greater	9,750,000
Total contributions	11,200,000
Total non-deductible (NDC)	1,450,000
NDC attributed to DC	1,450,000
DC contributions	800,000
6% of earnings, or 401(m)/(k)	2,280,000
Lesser of 6% or DC contrib.	800,000

Fall 2003 EA-2A Exam Solutions

Problem 21 - Page 4

Added 10/21/05

DC plan subject to excise tax	0
DC excise tax	0
Total excise tax	0

This is an unusual result, and may explain why the original exam question did not ask for the excise tax. The entire DC contribution is exempt from excise tax.

But that does not mean the excise tax is zero. Of the total non-deductible contribution of 1,450,000, only 800,000 is exempt from excise tax. That means the remainder of 650,000 is not exempt. The resulting 10% excise tax is 65,000.

This excise tax is attributed to the DB plans. That should make sense, since the DB / DC limit of 9,750,000 was less than the DB plan contributions of 11,200,000.

Fall 2003 EA-2A Exam Solutions

Problem 22 - Page 1

Similar to 2002 #25

The key to this problem is recognizing the impact of the ERISA full funding credit for 2002. That means that all the prior year's MFSA bases were eliminated at 01/01/2003. This destroys the actuarial equation of balance.

Section 7 of Revenue Ruling 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.

Unit Credit is an individual cost method, and you normally would calculate the experience G/L each year. For the 2002 loss base (established at 01/01/2003), you simply "back into" the amount of the base needed, and call that an experience loss base:

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

$$\begin{aligned}\text{UAL} &= 170,000 - 110,000 \\ \text{O/S } \$412 \text{ bases} &= \text{Loss} + 30,000 + 20,000 - 10,000\end{aligned}$$

$$\begin{aligned}60,000 &= \text{Loss} + 40,000 - 5,000 - 0 \\ \text{Loss} &= 25,000\end{aligned}$$

Now you can calculate the annual amortization amounts for the \$412 bases:

Original Date	Base Type	Initial Base	Original Years	Amortization amount
01/01/2003	Plan change	30,000	30	$2,259 = 30,000 / \ddot{a}_{30 .07}$
01/01/2003	Assump chg	20,000	10	$2,661 = 20,000 / \ddot{a}_{10 .07}$
01/01/2003	Method change	(10,000)	10	$(1,331) = (10,000) / \ddot{a}_{10 .07}$
01/01/2003	Loss	25,000	5	$5,698 = 25,000 / \ddot{a}_{5 .07}$

Fall 2003 EA-2A Exam Solutions

Problem 22 - Page 2

Revised 10/22/06

2003 Minimum Funding Standard Account			
Charges		Credits	
Normal Cost	10,000	Credit Balance	5,000
PLAN amortization	2,259	METHOD amortization	1,331
ASSM amortization	2,661		
LOSS amortization	5,698	12/31 contribution	x
7% interest	1,443	7% interest	443
Total charges	<u>22,061</u>	Total credits	<u>x + 6,774</u>

You have no information to calculate the §412 Full Funding Limitation. The minimum contribution payable 12/31/03 is $15,287 = 22,061 - 6,774$.

Answer is D

There was a cost method change at 01/01/2003 from Entry Age Normal to Unit Credit. This problem would have been slightly more difficult if the new cost method was Attained Age Normal, or Frozen Initial Liability.

The reason is that you would still set up a G/L base under Section 7 of Revenue Ruling 81-213. The initial valuation for 2003 must be done under the prior year's cost method. If you don't set up the G/L base, then the equation of balance would not be met.

Fall 2003 EA-2A Exam Solutions

Problem 23

This problem is relatively straightforward. The main key is knowing the amortization periods for the different types of bases:

Original Date	Base Type	O/S Base	Original Years	Remaining Years	Amortization amount
01/01/1997	Initial AL	500,000	30	$30 - (103-97) = 24$	$40,743 = 500,000 / \ddot{a}_{\overline{24} .07}$
01/01/2000	Assump chg	50,000	10	$10 - (103-100) = 7$	$8,671 = 50,000 / \ddot{a}_{\overline{7} .07}$
01/01/2002	Plan change	75,000	30	$30 - (103-102) = 29$	$5,709 = 75,000 / \ddot{a}_{\overline{29} .07}$

2003 Minimum Funding Standard Account

Charges		Credits	
Normal Cost	30,500	Credit Balance	3,000
IAL amortization	40,743		
ASSM amortization	8,671		
PLAN amortization	5,709	12/31 contribution	x
7% interest	5,994	7% interest	210
Total charges	91,617	Total credits	x + 3,210

You have no information to calculate the §412 Full Funding Limitation. The minimum contribution payable 12/31/03 is $88,407 = 91,617 - 3,210$.

Answer is D

Fall 2003 EA-2A Exam Solutions

Problem 24 - Page 1

Revised 10/23/08

As in earlier problems, this one has a benefit based on final average pay, and a cost method given as Unit Credit. The key to this problem is knowing that the calculations are done using Projected Unit Credit (PUC). Another key item is using the normal retirement age of 62.

You need to calculate the PUC normal cost and accrued liability at 01/01/2003. Under PUC, the accrued liability is defined as the present value of the "funding accrued benefit" (FAB). The normal cost is defined as the present value of the change in the FAB.

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.

Age 49 at 01/01/03

Past service 2

2003 pay 190,000 (age 49 pay)

FAE3 at 62 190,000 (no salary scale)

$$\text{FAB} = 4\%(2)(190,000)$$

$$\text{FAB} = 4\%(190,000)$$

$$\begin{aligned}\text{AL} &= 4\%(2)(190,000)(D_{62} / D_{49}) \ddot{a}_{62}^{(12)} \\ &= 8\%(190,000)(1.07)^{-13}(9.25) \\ &= 58,344\end{aligned}$$

With no decrements, the D/D terms are only based on the 7% interest rate.

$$\begin{aligned}\text{NC} &= \text{PV}(\text{FAB}) \\ &= \frac{1}{2} * \text{AL} \\ &= 29,172\end{aligned}$$

Fall 2003 EA-2A Exam Solutions

Problem 24 - Page 2

Revised 10/23/08

The last step of the problem is to calculate the minimum required contribution at 12/31/2003. This is a brand new plan with a zero credit balance. The minimum at 01/01/2003 equals the sum of the normal cost and the MFSA amortization for the IAL:

$$\begin{aligned} 01/01 \text{ min} &= NC + IAL / \ddot{a}_{\overline{30}|.07} \\ &= 29,172 + 58,344 / 13.2777 \\ &= 33,566 \end{aligned}$$

$$\begin{aligned} 12/31 \text{ min} &= 33,566 * 1.07 \\ &= 35,916 \end{aligned}$$

Answer is D

NOTE

You did not have to work this as a Projected Unit Credit problem. Since there is no salary scale in this problem, you will get identical results using traditional Unit Credit.

Fall 2003 EA-2A Exam Solutions

Problem 25 - 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 will include the salary scale.

The participant's pay exceeds the 401(a)(17) limit, so the projected benefit must be based on the limited pay of 200,000.

<u>Description</u>	<u>Calculation</u>	<u>Limited by 401(a)(17)</u>
01/2003 Age	50	
Past service	10	
Total service	25	
2002 pay (Age 49)	400,000	200,000
Age 64 pay	$400,000(1.04)^{15}$	200,000
Projected benefit	$25(2\%)(200,000)$ $= 100,000$	
PV future benefits	$100,000(D_{65} / D_{50}) \ddot{a}_{65}^{(12)}$ $100,000(1.07)^{-15} (10.2)$ $= 369,694$	

Now you can calculate the Aggregate PVNC:

$$\begin{aligned}\$412 \text{ PVNC} &= \text{PVB} - \text{AAV} - (\text{O/S } \$412 \text{ bases} - \text{CB}) && \text{NOTE: No ARA under Aggregate} \\ &= 369,694 - 190,000 - (0 - 0) \\ &= 179,695\end{aligned}$$

Now you need to calculate the average pay weighted annuity, which can then be used to calculate the normal cost. The temporary annuity with salary scale looks like this:

$$s\ddot{a}_{50:15} = 1 + (1.04/1.07)^1 + \dots + (1.04/1.07)^{14}$$

One key point of the problem is that it does not matter if the plan participant earns more or less than 200,000. This is based on general exam condition 26, which states that the temporary annuity calculation ignores the 401(a)(17) pay limit.

Problem 25 - Page 2**Revised 08/21/06**

You can simplify this to a certain annuity at a single interest rate:

$$\begin{aligned} {}^{s}\ddot{a}_{50:15} &= \ddot{a}_{15|j} \text{ where } 1+j = (1.07 / 1.04), \quad j = 2.88\% \\ &= 12.3854 \end{aligned}$$

In general, you calculate the average pay weighted annuity by dividing the present value of earnings by the total earnings. Since you only have one participant, the average temporary annuity (PVE/E) is equal to Smith's temporary annuity of 12.3854.

$$\begin{aligned} \$412 \text{ NC} &= \text{PVNC} / (\text{PVE}/\text{E}) \\ &= 179,695 / 12.3854 \\ &= 14,509 \end{aligned}$$

The main point of this problem is that you should not calculate the 12/31/03 minimum contribution yet. You should calculate the Full Funding Limitation (FFL) value first.

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

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

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

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

Age 50 at 01/01/03
Entry age 40

Projected benefit 100,000 (previously calculated for Aggregate)

$$\begin{aligned} \text{PVB at 40} &= 100,000(D_{65} / D_{40}) \ddot{a}_{65}^{(12)} \\ &= 100,000(1.07)^{-25}(10.2) \\ &= 187,934 \end{aligned}$$

Fall 2003 EA-2A Exam Solutions

Problem 25 - Page 3

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

Level % EANC: $PVB_{EA} / \ddot{s}_{40:25}$ EANC at entry age - adjust later ages by salary scale

$$\begin{aligned}\ddot{s}_{40:25} &= \ddot{a}_{25|j} \quad \text{where } 1+j = (1.07 / 1.04), \quad j = 2.88\% \\ &= 18.1480\end{aligned}$$

$$\begin{aligned}EANC_{40} &= 187,934 / 18.1480 \\ &= 10,356\end{aligned}$$

$$\begin{aligned}EANC_{50} &= 10,356 * (1.04)^{10} \\ &= 15,329\end{aligned}$$

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

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

$$\begin{aligned}PV(EANC) &= EANC_{50}(\ddot{s}_{50:15}) \\ &= 15,329(12.3854) \quad (\text{previously calculated for Aggregate}) \\ &= 189,855\end{aligned}$$

$$\begin{aligned}EAN AL &= 369,694 - 189,855 \\ &= 179,840\end{aligned}$$

Finally, you have enough information to calculate the FFL. For 2003, the OBRA FFL calculation uses 170% of the current liability:

$$\begin{aligned}\S 412 \text{ "ERISA" FFL} &= (1+i)*(EANC + EAN AL) - (1+i)*[\text{lesser (MVA, AAV)} - CB] \\ &= 1.07 * (15,329 + 179,840 - (185,000 - 0)) \\ &= 10,881\end{aligned}$$

$$\begin{aligned}\S 412 \text{ "OBRA" FFL} &= 1.70 (12/31 CL) - (1+i)*[\text{lesser (MVA, AAV)} - CB] \quad (\text{if no benefit payments}) \\ &= 1.70 * (175,000) - 1.07(185,000 - 0) \\ &= 99,550\end{aligned}$$

$$\begin{aligned}\S 412 \text{ "RPA 94" FFL} &= .90 (12/31 CL) - (1+i)*(AAV) \quad (\text{if no benefit payments}) \\ &= .90 * (175,000) - 1.07 * (190,000) \\ &= \text{zero}\end{aligned}$$

Fall 2003 EA-2A Exam Solutions

Problem 25 - Page 4

Revised 07/09/05

Note that the end of year asset value (if any) should be used in calculating the OBRA '87 and 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. The final §412 FFL value is the greater of the RPA '94 floor, and the lesser of the ERISA and OBRA FFL values, or 10,881.

You do not need to complete the MFSA for 2003. Since the normal cost exceeds the FFL, there will be a FFL credit in the MFSA. Since the credit balance is zero, the 12/31/03 minimum contribution will equal the FFL of 10,881.

Answer is B

In case you are not convinced, here are the details of the MFSA. The §412 FFL credit is defined as the excess of the Accumulated funding deficiency (AFD) based on zero contribution and zero credit balance over the FFL.

Under the Aggregate method, there are usually no charges except the normal cost. The AFD is 15,525, which equals 1.07 times the Aggregate normal cost. Since this exceeds the FFL of 10,881, there is a FFL credit in the MFSA for the excess of 4,644.

2003 Minimum Funding Standard Account			
Charges		Credits	
Normal Cost	14,509	Credit Balance	0
		12/31/ FFL credit	4,644
		12/31 minimum	x
7% interest	1,016	7% interest	0
Total charges	15,525	Total credits	x + 4,644

The minimum contribution payable 12/31/03 is $10,881 = 15,525 - 4,644$.

Fall 2003 EA-2A Exam Solutions

Problem 26 - Page 1

Revised 06/20/06

The key to this problem is calculation of the required quarterly installment, and the amount of the underpayment. To calculate the minimum required quarterly contribution at 07/15/2003, 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 for 2003 and 2002, both as of the valuation date. You can use the initial accrued liability to calculate the amortization payment for 2002. Since FIL is an aggregate type cost method, you have the same amortization payment for 2003.

$$\begin{aligned} \text{IAL Amort} &= 1,000,000 / \ddot{a}_{\overline{30}|.07} = 75,314 \\ 12/31/02 \text{ "MFSA excl CB"} &= (\$412 \text{ NC} + \$412 \text{ amort} - 0) * 1.07 \\ &= (125,000 + 75,314) * 1.07 = 214,336 \\ 01/01/03 \text{ "MFSA excl CB"} &= (\$412 \text{ NC} + \$412 \text{ amort} - 0) \\ &= (140,000 + 75,314) = 215,314 \\ \text{Lesser of 2002 or 90\% of 2003} &= \text{Lesser of } (214,336 \text{ or } .90 * 215,314) = 193,783 \end{aligned}$$

The 2003 required quarterly installment is based on the applicable percentage multiplied by the RAP, which is $25\%(193,783) = 48,446$.

The 12/31/02 minimum contribution requirement shown above is 214,336. The 2002 contribution paid on 04/15/2002 is 210,000. With the credit balance of 5,000 at 01/01/02, there is clearly a credit balance at 12/31/02.

If the credit balance was close to the amount of the 2003 required quarterly installment, it could affect the minimum quarterly contribution due at 07/15/03. Since the credit balance is small, there will be no overpayment available at 07/15/03. The minimum quarterly contribution due at 07/15/03 is 48,446.

Answer is D

NOTES:

1. You may not feel comfortable with skipping the step of completing the 2002 MFSA:

2002 Minimum Funding Standard Account			
Charges		Credits	
Normal Cost	125,000	Credit Balance	5,000
IAL amortization	75,314	04/15/02 contribution	210,000
7% interest	14,022	7% interest	10,763
Total charges	214,336	Total credits	225,763

Fall 2003 EA-2A Exam Solutions

Problem 26 - Page 2

The 12/31/02 credit balance is $11,427 = 225,763 - 214,336$. You are told that the minimum required quarterly installment was paid at 04/15/03. That payment would be less than 48,446, since you can apply the 12/31/02 credit balance towards the required quarterly installment.

There will be no overpayment available at 07/15/03. The minimum quarterly contribution due at 07/15/03 is 48,446.

2. The interest of 10,763 in the 2002 MFSA was calculated using simple interest:

$$.07(5,000) + .07(8.5/12)(210,000)$$

Whether you used simple or compound interest would change the amount of the 12/31/02 credit balance, but it would not affect the final answer. The minimum quarterly contribution due at 07/15/03 is still 48,446.

Fall 2003 EA-2A Exam Solutions

Problem 27

Revised 08/21/06

The key to this problem is being careful in handling the plan change at 01/01/2003. You also must be careful to calculate the change in the minimum at the beginning of the year (not 12/31).

$$01/01 \text{ min} = NC + (IAL) / \ddot{a}_{\overline{30}|.07}$$

You need to calculate the Unit Credit normal cost and accrued liability at 01/01/2003. Under Unit Credit, the accrued liability is defined as the present value of the accrued benefit (AB). The normal cost is defined as the present value of the change in the AB.

Age 51 at 01/01/03

Past service 28

Description	Old Plan	New Plan	Difference
01/2003 accrued benefit	14,112 = 28(12)(42)	15,792 = 28(12)(47)	1,680
Increase in accrued benefit During 2003	504 = 12(42)	600 = 12(50)	96
Accrued liability	$14,112(D_{65} / D_{51}) \ddot{a}_{65}^{(12)}$	$15,792(D_{65} / D_{51}) \ddot{a}_{65}^{(12)}$	$1,680(D_{65} / D_{51}) \ddot{a}_{65}^{(12)}$
Normal cost	$504(D_{65} / D_{51}) \ddot{a}_{65}^{(12)}$	$600(D_{65} / D_{51}) \ddot{a}_{65}^{(12)}$	$96(D_{65} / D_{51}) \ddot{a}_{65}^{(12)}$

$$\begin{aligned} AL &= (1,680)(1.07)^{-14}(10.00) \\ &= 6,515 \end{aligned}$$

With no decrements, the D/D terms are only based on the 7% interest rate.

$$\begin{aligned} NC &= (96)(1.07)^{-14}(10.00) \\ &= 372 \end{aligned}$$

The change in the minimum contribution at 01/01/2003 equals the sum of the normal cost and the MFSA amortization for the new plan change base:

$$\begin{aligned} 01/01 \text{ min} &= NC + (UAL) / \ddot{a}_{\overline{30}|.07} \\ &= 372 + 6,515 / 13.2777 \\ &= 863 \end{aligned}$$

Answer is B

Fall 2003 EA-2A Exam Solutions

Problem 28 - Page 1

Similar to EA-2 2001 #21

Revised 08/21/06

You need to set up the Minimum Funding Standard Account (MFSA) for 2003, both at the old 7.5% interest rate and the new 7.0% interest rate. You must be careful to calculate the minimum contribution at the beginning of the year (not 12/31).

You are given 20,000 as the change in normal cost due to the interest rate change. You can assume the 7.5% normal cost is zero, and the new 7.0% normal cost is 20,000. The credit balance at 12/31/02 is immaterial, so you can treat it as zero.

2003 Minimum Funding Standard Account at 7.5%

Charges		Credits	
Normal Cost	0	Credit Balance	0
IAL amortization	10,000		
PLAN amortization	30,000	Loss amortization	50,000
ASSM amortization	100,000		
NO interest		NO interest	
Total charges	140,000	Total credits	50,000

You have no information to calculate the §412 Full Funding Limitation. The minimum contribution payable 01/01/03 is 90,000 = 140,000 - 50,000.

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

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

Amortization base	Remaining years	7.5% Outstanding base	New Amortization Amount at 7.0%
01/01/2000 Initial AL	27 = 30-(2003-2000)	$122,995 = 10,000 * \ddot{a}_{\overline{27} .075}$	$122,995 / \ddot{a}_{\overline{27} .070} = 9,590$
01/01/2001 Plan change	28 = 30-(2003-2001)	$373,241 = 30,000 * \ddot{a}_{\overline{28} .075}$	$373,241 / \ddot{a}_{\overline{28} .070} = 28,740$
01/01/2002 Assum base	29 = 30-(2003-2002)	$1,257,338 = 100,000 * \ddot{a}_{\overline{29} .075}$	$1,257,338 / \ddot{a}_{\overline{29} .070} = 95,709$
01/01/2002 Gain base	14 = 15-(2003-2002)	$456,292 = 50,000 * \ddot{a}_{\overline{14} .075}$	$456,292 / \ddot{a}_{\overline{14} .070} = 48,761$
01/01/2003 Assum base	30 = 30-(2003-2003)	101,000	$101,000 / \ddot{a}_{\overline{30} .070} = 7,607$

Fall 2003 EA-2A Exam Solutions

Problem 28 - Page 2

Revised 08/21/06

2003 Minimum Funding Standard Account at 7%			
Charges		Credits	
Normal Cost	20,000	Credit Balance	0
IAL amortization	9,590		
PLAN amortization	28,740	Loss amortization	48,761
ASSM1 amortization	95,709		
ASSM2 amortization	7,607		
NO interest		NO interest	
Total charges	<u>161,646</u>	Total credits	<u>48,761</u>

You have no information to calculate the §412 Full Funding Limitation. The minimum contribution payable 01/01/03 is $112,885 = 161,646 - 48,761$.

The increase in the 01/01/03 minimum due to the interest change is $22,885 = 112,885 - 90,000$.

Answer is B

Fall 2003 EA-2A Exam Solutions

Problem 29

Similar to EA-2 2002 #38

Revised 10/10/14

The key to this problem is reflecting the effect of the change in assumptions on both the present value of benefits and in the temporary annuity used for the normal cost.

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).

	New assumptions	Old assumptions
Assumed retirement age	64	65
01/01/03 Age	55	55
Past service	25	25
Normal retirement age	64	65
Future service	9	10
Total service	34	35
Projected benefit	12(\$20)(34) = 8,160	12(\$20)(35) = 8,400
PV Future benefits	$8,160(D_{64} / D_{55}) \ddot{a}_{64}^{(12)}$ = $8,160v^9 \ddot{a}_{64}^{(12)}$ = $8,160(1.07)^{-9}(8.35)$ = 37,061	$8,400(D_{65} / D_{55}) \ddot{a}_{65}^{(12)}$ = $8,400v^{10} \ddot{a}_{65}^{(12)}$ = $8,400(1.07)^{-10}(8.14)$ = 34,759
Actuarial asset value	10,000	10,000
Credit balance	0	0
PVNC	27,061	24,759

Now you need to calculate the average weighted annuity, which can then be used to calculate the normal cost. With no decrements, this is an annuity certain at 7%:

	New assumptions	Old assumptions
Future service	9	10
$\ddot{a}_{\overline{X:ARA-X} }$	$\ddot{a}_{\overline{9 .07}}$ = 6.9713	$\ddot{a}_{\overline{10 .07}}$ = 7.5152
Normal cost	3,882	3,294

The increase in the normal cost is $3,882 - 3,294 = 587$.

Answer is C

Fall 2003 EA-2A Exam Solutions

Problem 30 - Page 1

Revised 10/03/06

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 2002, and set up that base at 01/01/2003.

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

$$\begin{aligned} 01/01/03 {}_e\text{UAL} &= (1+i) * (\text{NC}_0 + \text{UAL}_0) - (\text{contribution} + \text{interest}) \\ &= 1.07 * (75,000 + 0) - 1.035(80,000) && \text{(using simple interest)} \\ &= -2,550 \end{aligned}$$

The expected UAL is defined in section 6 of Revenue Ruling 81-213. Using that definition, the expected UAL can be a negative number.

The actual UAL should not be a negative number; it should be no less than zero. Section 5 of Revenue Ruling 81-213 defines the UAL as the excess (if any) of the accrued liability over the actuarial value of assets.

$$\begin{aligned} 01/01/03 \text{ UAL} &= \text{AL}_1 - \text{AAV}_1 \\ &= 134,000 - 50,000 \\ &= 84,000 \end{aligned}$$

$$\begin{aligned} \text{Loss base} &= 84,000 - (2,550) \\ &= 86,550 \end{aligned}$$

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:

$$\begin{aligned} \text{Deductible limit} &= 1.07 * (75,000 + 86,550 \div \ddot{s}_{\overline{10}|.07}) \\ &= 92,573 \end{aligned}$$

(next page)

Fall 2003 EA-2A Exam Solutions

Problem 30 - Page 2

The second step is to check the Full Funding Limitation under 404. For 2003, the OBRA FFL calculation uses 170% of the current liability.

$$\begin{aligned}\text{\$404 "ERISA" FFL} &= (1+i)(\text{NC} + \text{AL}) - (1+i)(\text{lesser MVA, AAV}) \\ &= 1.07 * (75,000 + 134,000 - 50,000) \\ &= 170,130\end{aligned}$$

$$\begin{aligned}\text{\$404 "OBRA" FFL} &= 1.70 (12/31 \text{ CL}) - (1+i)(\text{lesser MVA, AAV}) \quad (\text{if no benefit payments}) \\ &= 1.70 * (144,000) - 1.07 * (50,000) \\ &= 191,300\end{aligned}$$

$$\begin{aligned}\text{\$404 "RPA 94" FFL} &= .90 (12/31 \text{ CL}) - (1+i)(\text{AAV}) \quad (\text{if no benefit payments}) \\ &= .90 * (144,000) - 1.07 * (50,000) \\ &= 76,100\end{aligned}$$

Note that the end of year asset value (if any) should be used in calculating the OBRA '87 and 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.

The final §404 FFL value is the greater of the RPA '94 floor, and the lesser of the ERISA and OBRA FFL values, or 170,130. The §404 FFL of 170,130 does not affect the deductible limit.

Now you must check the §412 minimum contribution to see if it is greater. One reason this may happen is the loss base at 01/01/03. This is amortized over 10 years for the deductible limit, but over 5 years for the MFSA:

$$\text{Loss Amort} = 19,728 = 86,550 \div \ddot{a}_{\overline{5}|.07}$$

Use the actuarial equation of balance to derive the credit balance at 01/01/03:

$$\begin{aligned}01/01/03 \text{ UAL} &= \text{O/S 412 bases} - \text{CB} - \text{ARA} \\ 84,000 &= 86,550 - \text{CB} - 0 \\ \text{CB} &= 2,550\end{aligned}$$

The credit balance is equal to the absolute value of the expected UAL. This should make sense, since you could have used the balance equation at 12/31/02 (prior to the G/L base):

$$\begin{aligned}12/31/02 \text{ } {}_e\text{UAL} &= \text{O/S 412 bases} - \text{CB} - \text{ARA} \\ -2,550 &= 0 - \text{CB} - 0 \\ \text{CB} &= 2,550\end{aligned}$$

Fall 2003 EA-2A Exam Solutions

Problem 30 - Page 3

2003 Minimum Funding Standard Account			
Charges		Credits	
Normal Cost	75,000	Credit Balance	2,550
Loss amortization	19,728	12/31 minimum	x
7% interest	6,631	7% interest	179
Total charges	101,359	Total credits	x + 2,729

The minimum contribution payable 12/31/03 is $98,630 = 101,359 - 2,729$. 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 of 170,130, so it has no effect on the minimum contribution.

The deductible limit is the lesser of the 404 FFL of 170,130, or the greater of [the normal cost plus limit adjustments of 92,753 and the minimum contribution of 98,630]. The final result is 98,630.

The final calculation 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:

$$\begin{aligned}\text{\$404 "RPA 94" UCL} &= 1.00 (12/31 \text{ CL}) - (1+i) * (\text{AAV}) && \text{(if no benefit payments)} \\ &= 144,000 - 1.07 * (50,000) \\ &= 90,500\end{aligned}$$

The 404 UCL does not affect the deductible limit. The final deductible limit is still the §412 minimum of 98,630.

Answer is E

You could have worked the problem using compound interest instead of simple interest. As expected, this produces a numerical answer that is in the same answer range:

$$\begin{aligned}01/01/03 \text{ } e\text{UAL} &= -2,503 \\ \text{Loss base} &= 86,503 \\ \text{NC} + \text{LA} &= 92,566 \\ \text{Loss Amort} &= 19,717 \\ \text{Credit balance} &= 2,503 \\ 412 \text{ minimum} &= 98,669 \\ \text{Ded. Limit} &= 98,669\end{aligned}$$

Fall 2003 EA-2A Exam Solutions

Problem 31

Revised 07/14/06

With an individual cost method, there are two things to be aware of. One is that you should check the Full Funding Limitation if you have sufficient information. The key point of this problem is that you need to solve for the 1999 experience gain or loss.

You must use the actuarial equation of balance to calculate the amortization payment for the G/L base that was setup at 01/01/2000:

Original Date	Base Type	O/S Base	Original Years	Remaining Years
01/01/1995	Initial AL	200,000	30	22 = 30 - (103-95)
01/01/2000	Gain / Loss	GL	5	2 = 5 - (103-100)

$$\begin{aligned}
 \text{UAL} &= \text{O/S } \$412 \text{ bases} - \text{CB} - \text{ARA} \\
 70,000 &= (200,000) * (\ddot{a}_{22|\cdot 07} / \ddot{a}_{30|\cdot 07}) + (\text{GL}) * (\ddot{a}_{2|\cdot 07} / \ddot{a}_{5|\cdot 07}) - 10,000 - 0 \\
 80,000 &= \ddot{a}_{22|\cdot 07} * (200,000 / \ddot{a}_{30|\cdot 07}) + \ddot{a}_{2|\cdot 07} * (\text{GL}) / \ddot{a}_{5|\cdot 07}
 \end{aligned}$$

It is slightly quicker to calculate the amortization of the G/L base, instead of the original amount of the base. You should store the IAL amortization ($15,063 = 200,000 / \ddot{a}_{30|\cdot 07}$) for later use in the MFSA.

$$\begin{aligned}
 (\text{G/L}) / \ddot{a}_{5|\cdot 07} &= [80,000 - (\ddot{a}_{22|\cdot 07} * 15,063)] / \ddot{a}_{2|\cdot 07} \\
 &= -50,800
 \end{aligned}$$

The negative result means that there was a gain base established at 01/01/2000. Now you can calculate the 12/31/2003 minimum contribution:

2003 Minimum Funding Standard Account			
Charges		Credits	
Normal Cost	65,000	Credit Balance	10,000
IAL amortization	15,063	Gain amortization	50,800
		12/31/03 contribution	x
7% interest	5,604	7% interest	4,256
Total charges	85,667	Total credits	x + 65,056

You should think about the Full Funding Limitation:

$$\begin{aligned}
 \$412 \text{ "ERISA" FFL} &= (1+i) * (\text{NC} + \text{AL}) - (1+i) * [(\text{lesser MVA, AAV}) - \text{CB}] \\
 &= 1.07 * (65,000 + 595,000 - [525,000 - 10,000])
 \end{aligned}$$

The FFL clearly exceeds the AFD, so it will have no effect. The minimum contribution at 12/31/03 is $20,611 = 85,667 - 65,056$.

Answer is C

Fall 2003 EA-2A Exam Solutions

Problem 32

I. TRUE

For a plan to be subject to the liquidity requirement, it must meet both requirements:

- Subject to the quarterly contribution requirement, and
- More than 100 participants on any day of the prior plan year

Plans are exempt from quarterly contributions if

- Plan is a multiemployer plan, or
- Prior year Gateway FCL% 100%

So that means that plans are exempt from the liquidity requirements if

- Plan is a multiemployer plan, or
- Prior year Gateway FCL% 100%, or
- 100 or less participants on every day in the prior plan year

II. TRUE

This is true, based on item I.

III. TRUE

"412(m)(5)(D)

If the amount of any required installment is increased by reason of subparagraph (A), in no event shall such increase exceed the amount which, when added to prior installments for the plan year, is necessary to increase the funded current liability percentage (taking into account the expected increase in current liability due to benefits accruing during the plan year) to 100 percent."

I and II and III are true

Answer is D

Fall 2003 EA-2A Exam Solutions

Problem 33 - Page 1

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

The deductible limit for the taxable year ending 06/30/03 is based on the valuation for the plan year beginning in that tax year. The 01/01/03 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. In this problem, you are given the limit adjustments as "404 net amortization charges". The deductible limit is the normal cost plus limit adjustments brought forward with interest to the earlier of the end of the plan year, or the end of the tax year, which is 12/31/03.

$$\begin{aligned}\text{Deductible limit} &= (52,000 + 17,500) * [1 + (6/12) * .07] \\ &= 71,933\end{aligned}$$

You are told that the 10,000 contribution will be deducted in the tax year ending 06/30/03. If you were given asset values in the problem, then you would have to exclude the 10,000 as a non-deducted contribution. The reason is that the general exam conditions state that the asset values given are correct for 412 purposes, so the 10,000 would be included. But the non-deducted contribution does not affect the calculation of the normal cost (or the deductible limit) under Entry Age Normal.

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 is calculation of the minimum contribution required under §412. You must set up the MFSA for 2002 to calculate the credit balance at 12/31/02:

2002 Minimum Funding Standard Account			
Charges		Credits	
Normal Cost	50,000	Credit Balance	5,000
Net amortizations	10,000	06/30/02 contribution	50,000
		12/31/02 contribution	10,000
7% interest	4,200	7% interest	2,100
Total charges	64,200	Total credits	67,100

You have no information to calculate the §412 Full Funding Limitation. The interest was calculated as $2,100 = (.07)(5,000) + (.07)(5/12)(50,000)$. The 12/31/02 credit balance is $2,900 = 67,100 - 64,200$.

Now you might be tempted to assume the final answer is 71,933. It should be clear that the minimum contribution for 2003 can't exceed 71,933.

Fall 2003 EA-2A Exam Solutions

Problem 33 - Page 2

Revised 08/21/06

2003 Minimum Funding Standard Account			
Charges		Credits	
Normal Cost	52,000	Credit Balance	2,900
Net amortizations	13,000	12/31/03 contribution	x
7% interest	4,550	7% interest	203
Total charges	<u>69,550</u>	Total credits	<u>x + 3,103</u>

You have no information to calculate the §412 Full Funding Limitation. The minimum contribution payable 12/31/03 is $69,550 - 3,103 = 66,447$.

The key to this problem is realizing that you can increase the 2003 minimum contribution by part of the 10,000 before comparing it to the normal cost plus limit adjustments of 71,933. This problem is the second includible employer contribution problem asked on the EA-2 exams so far.

At the beginning of the solutions for this year's exam is a list of steps to follow for problems involving the deductible limit. Here is step 3:

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."

The regulation at §1.404(a)-14(e)(1)(ii) states that includible employer contributions are contributions required under 412 that were not deducted under 404 due to a problem in contribution timing. The 12/31/02 contribution of 10,000 was not deducted for the prior tax year. The part of it that is required to avoid a deficiency is an includible employer contribution.

The 10,000 contribution at 12/31/02 produces a credit balance of 2,900. That means that 7,100 of the contribution is the remainder of the required minimum for 2002. That is also the amount of the includible employer contribution.

For step 3, you calculate the 412 minimum as $73,547 = 66,447 + 7,100$. For step 4, you compare the 71,933 (from step 1) to 73,547. Since you have no information on current liability, you can't check the §404 unfunded current liability. The final deductible limit equals 73,547.

Answer is B

You could have worked the problem with compound interest:

2002 MFSA interest	=	2,070
12/31/02 MFSA CB	=	2,870
Includible ER contrib	=	7,130
2003 MFSA interest	=	201
12/31/03 minimum	=	66,479
2003 deductible limit	=	73,608

Fall 2003 EA-2A Exam Solutions

Problem 34

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

Age 40 at 01/01/03

Past service 10

$$AB = 10(12)(100)$$

$$AB = (12)(100)$$

I. TRUE

$$\begin{aligned} NC &= \text{PV of } (AB) \\ &= 1,200(D_{65} / D_{40}) \ddot{a}_{65}^{(12)} \\ &= 1,200(1+i)^{-25} {}_{25}p_{40} \ddot{a}_{65}^{(12)} \end{aligned}$$

If the interest rate is increased from 7% to 8%, then the interest discount factor and the life annuity at 65 will both decrease. As a result, the normal cost will decrease.

II. TRUE

$$\begin{aligned} AL &= \text{PV of } AB \\ &= 12,000(D_{65} / D_{40}) \ddot{a}_{65}^{(12)} \\ &= 12,000(1+i)^{-25} {}_{25}p_{40} \ddot{a}_{65}^{(12)} \end{aligned}$$

If $q_x^{\text{UP84}} > q_x^{\text{GAM83}}$, then it is true that $p_x^{\text{UP84}} < p_x^{\text{GAM83}}$. If the mortality table is changed from UP84 to GAM83, then the probability of survival will increase, and the life annuity at 65 will increase. As a result, the accrued liability will increase.

III. TRUE

Since $AL = 10 \cdot NC$, both the accrued liability and the normal cost will be affected the same by any change in the assumptions.

I and II and III are true

Answer is D

Fall 2003 EA-2A Exam Solutions

Problem 35 - Page 1

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). You need to calculate the value based on the AAV before and after the method change at 01/01/2003.

$$\text{Gateway \%} = (\text{AAV} - 0) / (\text{CL at highest permissible rate})$$

$$\begin{aligned}\text{Old Gateway \%} &= 400,000 / 460,000 \\ &= 86.96\%\end{aligned}$$

$$\begin{aligned}\text{New Gateway \%} &= 420,000 / 460,000 \\ &= 91.30\%\end{aligned}$$

The point of the problem is that there is no 412(l) AFC after the plan's AAV method changes at 01/01/2003. The answer to the problem equals the amount of the 412(l) AFC before the plan's AAV method changes.

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

$$\begin{aligned}\text{UCL} &= \text{CL} - (\text{AAV} - \text{CB}) \\ &= 460,000 - (400,000 - 10,000) \\ &= 70,000\end{aligned}$$

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 the UOL, and you must calculate the UNL:

$$\begin{aligned}\text{UOL} &= 0 \text{ (given)} \\ \text{UNL} &= \text{UCL} - \text{UOL} - \text{UCEL} \\ &= 70,000 - 0 - 0 \\ &= 70,000\end{aligned}$$

Fall 2003 EA-2A Exam Solutions

Problem 35 - Page 2

Revised 08/21/06

The UOLA equals the amortization of the remaining portion of the unfunded old liability over a period that was 18 years at 1-1-89. In this problem the UOLA is zero.

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 the formula, and you must calculate the FCL%.

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%.

$$\begin{aligned}\text{FCL\%} &= (\text{AAV} - \text{CB}) / \text{CL} \\ &= 390,000 / 460,000 \\ &= 84.78\%\end{aligned}$$

$$\begin{aligned}\text{APP\%} &= .30 - .40 [.8478 - .60] \\ &= 20.09\%\end{aligned}$$

$$\begin{aligned}\text{UNLA} &= 70,000 * .2009 \\ &= 14,062\end{aligned}$$

$$\begin{aligned}\text{DRC} &= \text{UOLA} + \text{UNLA} + \text{CLNC} \\ &= 0 + 14,062 + 50,000 \\ &= 64,062\end{aligned}$$

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.

$$\begin{aligned}01/01/03 \text{ §412(l) charge} &= 64,062 - (50,000 + 10,000) \\ &= 4,062 \\ 12/31/03 \text{ §412(l) charge} &= 4,062 * 1.0665 \\ &= 4,332\end{aligned}$$

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.

With less than 150 plan participants, you need to pro-rate the additional §412(l) charge:

$$\begin{aligned}\text{Final §412(l) charge} &= 4,332 * [1 - 2\%(150 - 140)] \\ &= 3,465\end{aligned}$$

Answer is D

Fall 2003 EA-2A Exam Solutions

Problem 36 - Page 1

Revised 08/21/06

This is the first problem on split funding since 1998 EA-1B exam. This is also the first time that the concept of minimum funding has been tested with a split funded plan.

Without split funding, the Aggregate cost method definitions are:

$$\begin{aligned}\$412 \text{ PVNC} &= \text{PVB} - \text{AAV} - (\text{O/S } \$412 \text{ bases} - \text{CB}) && \text{NOTE: no ARA under Aggregate} \\ \text{AGG NC} &= \text{PVNC} / \left(\text{average } \ddot{a}_{\overline{X:RA-X}|} \right)\end{aligned}$$

The basic idea of a split funded plan is that the plan purchases insurance contracts to provide the death benefits under the plan. All other plan benefits are funded through the normal cost. When you determine the normal cost, you can use the cash surrender value (CSV) of the insurance contract at retirement age as an asset.

Prior exam questions asked for the calculation of the side fund normal cost, or the total normal cost. The side fund normal cost refers to the normal cost calculated by applying the cost method. The total cost of the plan is the sum of the side fund normal cost and the insurance premium.

In this problem, the key point is that you need to calculate the total normal cost. Without the insurance premium, the death benefits won't be funded at all.

$$\begin{aligned}\text{Age 62 at } & 01/01/03 \\ \text{Past service} & 1 \\ \text{Total service} & 4 \\ \text{Projected benefit at 65} &= 4(5\%)(60,000) \\ &= 12,000\end{aligned}$$

You are given the pre-retirement death benefit as 100,000. The premium for this policy is 5,000, which equals 100×50 . The CSV at 65 is 7,500, which equals 100×75 .

$$\begin{aligned}\text{PVB at 65} &= 12,000 \ddot{a}_{65}^{(12)} \\ &= 12,000(9.24) \\ &= 110,880\end{aligned}$$

$$\begin{aligned}\text{Net PVB}_{65} &= 110,880 - 7,500 \\ &= 103,380\end{aligned}$$

$$\begin{aligned}\text{PVB at 62} &= 103,380(D_{65} / D_{62}) \\ &= 103,380(v^3)_3 p_{62} \\ &= 103,380(1.07)^{-3}(1-.011)(1-.012)(1-.013) \\ &= 81,387\end{aligned}$$

Fall 2003 EA-2A Exam Solutions

Problem 36 - Page 2

$$\begin{aligned}\text{AAV} &= \text{Zero} \\ \text{PVNC} &= 81,387\end{aligned}$$

You must determine the average temporary annuity to use in the normal cost calculation. Since you have no salary scale, the weighted average is based on the number of participants. With only one participant, the average annuity equals their temporary annuity:

$$\begin{aligned}\text{Avg annuity} &= \ddot{a}_{62:3} \\ &= 1 + (v^1)_1p_{62} + (v^2)_2p_{62} \\ &= 1 + (1.07)^{-1}(1-.011) + (1.07)^{-2}(1-.011)(1-.012) \\ &= 1 + .9243 + .8535 \\ &= 2.7778\end{aligned}$$

$$\begin{aligned}\text{Side fund NC} &= \text{PVNC} / \ddot{a}_{62:3} \\ &= 81,387 / 2.7778 \\ &= 29,300\end{aligned}$$

The total normal cost at 01/01/2003 is $34,300 = 29,300$ side fund normal cost + 5,000 insurance premium.

Since there are no MFSA amortizations in this problem, the minimum contribution at 01/01/2003 also equals 34,300.

Answer is C

Fall 2003 EA-2A Exam Solutions

Problem 37 - Page 1

With an individual cost method, there are two things to be aware of. One is that you should check the Full Funding Limitation if you have sufficient information. The other is that you should remember to check for experience gain / loss.

In this problem, you have a change in cost method. You are given information for all the MFSA bases except for the method change. That means that you don't need to worry about any other experience G/L.

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. 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.

$$\begin{aligned} \text{UC UAL} &= \text{O/S §412 bases} - \text{CB} - \text{ARA} \\ 10,000 &= 90,000 + 30,000 + 50,000 + 25,000 + \text{METHOD} - \text{CB} - 0 \end{aligned}$$

The method change base is -180,000, which equals the 800,000 UC AL - 980,000 EAN AL. You can use that to derive the value of the credit balance:

$$\begin{aligned} \text{CB} &= 90,000 + 30,000 + 50,000 + 25,000 - 180,000 - 10,000 \\ &= 5,000 \end{aligned}$$

Fall 2003 EA-2A Exam Solutions

Problem 37 - Page 2

Revised 07/14/06

Now calculate the amortization payments for all the MFSA bases:

Original Date	Base Type	O/S Base	Original Years	Remaining Years	Amortization amount
01/01/1998	Initial AL	90,000	30	30 - (103-98) = 25	7,218 = $90,000 / \ddot{a}_{25 0.07}$
01/01/1999	Assump chg	30,000	10	10 - (103-99) = 6	5,882 = $30,000 / \ddot{a}_{6 0.07}$
01/01/2001	Plan change	50,000	30	30 - (103-101) = 28	3,850 = $50,000 / \ddot{a}_{28 0.07}$
01/01/2003	Actuarial loss	25,000	5	5 - (103-103) = 5	5,698 = $25,000 / \ddot{a}_{5 0.07}$
01/01/2003	Method chg	-180,000	30	10 - (103-103) = 10	-23,951 = $-180,000 / \ddot{a}_{10 0.07}$

Now you can calculate the 12/31/2003 minimum contribution:

2003 Minimum Funding Standard Account			
Charges		Credits	
Normal Cost	37,000	Credit Balance	5,000
IAL amortization	7,218	Method chg amortization	23,951
Assm amortization	5,882		
Plan amortization	3,850	12/31/03 contribution	x
Loss amortization	5,698		
7% interest	4,175	7% interest	2,027
Total charges	63,823	Total credits	x + 30,978

You should check the Full Funding Limitation:

$$\begin{aligned}
 \$412 \text{ "ERISA" FFL} &= (1+i) \cdot (\text{NC} + \text{AL}) - (1+i) \cdot [(\text{lesser MVA, AAV}) - \text{CB}] \\
 &= 1.07 \cdot (37,000 + 800,000 - [790,000 - 5,000]) \\
 &= 55,640
 \end{aligned}$$

The §412 FFL credit is defined as the excess of the Accumulated funding deficiency (AFD) based on zero contribution and zero credit balance over the FFL. The AFD equals the previously calculated charges of 63,823 minus $1.07 \cdot (23,951)$, or 38,195. Since this does not exceed the FFL, there is no FFL credit in the MFSA.

The minimum contribution at 12/31/03 is $32,845 = 63,823 - 30,978$.

Answer is C

Fall 2003 EA-2A Exam Solutions

Problem 38 - Page 1

Similar to 1999 #21

Revised 06/20/06

With an individual cost method, there are two things to be aware of. One is that you should check the Full Funding Limitation (FFL) if you have sufficient information. The other is that you should check for experience gains or losses each year.

The first thing you should do is calculate the 01/01/2003 valuation results using the new plan formula:

Description	Old Plan - 5%	New Plan - 7%
Accrued liability	3,300,000	4,620,000 = (7/5)*3,300,000
Normal cost	364,000	509,600 = (7/5)* 364,000

Since the plan was just established in 2002, and it grants credit for past service, it should be clear that the FFL will not apply. You have to calculate the experience G/L during 2002. You must determine the expected UAL at 01/01/03, as well as the actual UAL at 01/01/03 before the plan amendment. The difference between those two values is the experience gain or loss base.

Based on the information given, the actuarial asset value at 12/31/2002 is 745,000. This is the sum of the 700,000 contribution and the 45,000 of investment earnings.

$$\begin{aligned}
 \text{Loss base} &= \text{UAL}_1 - {}_e\text{UAL}_1 \\
 01/01/03 {}_e\text{UAL} &= (1+i) * (\text{NC}_0 + \text{UAL}_0) - (\text{contribution} + \text{interest}) \\
 &= 1.07 * (340,800 + 2,500,000) - 1.035 * 700,000 \quad (\text{using simple interest}) \\
 &= 2,315,156
 \end{aligned}$$

$$01/01/03 \text{ UAL} = 4,620,000 - 745,000 = 3,875,000$$

$$\text{Old plan UAL} = 3,300,000 - 745,000 = 2,555,000$$

$$\text{Loss base} = 2,555,000 - 2,315,156 = 239,844$$

$$\text{Loss amort} = 54,669 = 239,844 \div \ddot{a}_{\overline{5}|.07}$$

$$\text{Plan change} = 3,875,000 - 2,555,000 = 1,320,000$$

$$\text{Plan amort} = 99,415 = 1,320,000 \div \ddot{a}_{\overline{30}|.07}$$

$$\text{IAL amort} = 188,286 = 2,500,000 \div \ddot{a}_{\overline{30}|.07}$$

Fall 2003 EA-2A Exam Solutions

Problem 38 - Page 2

Revised 07/09/05

To complete the MFSA for 2003, you must determine the credit balance at 12/31/2002. To do this, you have to use the 2002 MFSA results:

2002 Minimum Funding Standard Account			
Charges		Credits	
Normal Cost	340,800	Credit Balance	0
IAL amortization	188,286	07/01 contribution	700,000
7% interest	37,036	7% interest	24,500
Total charges	566,122	Total credits	724,500

You have no information to calculate the §412 Full Funding Limitation. The interest was calculated as $24,500 = (.07)(6/12)(700,000)$. The 12/31/02 credit balance is $724,500 - 566,122 = 158,378$. Now you have enough information to complete the 2003 MFSA:

2003 Minimum Funding Standard Account			
Charges		Credits	
Normal Cost	509,600	Credit Balance	158,378
IAL amortization	188,286		
PLAN amortization	99,415	12/31/03 minimum	x
LOSS amortization	54,669		
7% interest	59,638	7% interest	11,086
Total charges	911,608	Total credits	169,464 +x

The 12/31/03 minimum contribution is $911,608 - 169,464 = 742,144$.

Answer is D

You could have worked the problem with compound interest:

2002 eUAL	=	2,315,570
2002 Loss	=	239,430
Loss amortization	=	54,574
12/31/02 credit bal	=	157,964
2003 MFSA charges	=	911,507
12/31/03 minimum	=	742,486

Fall 2003 EA-2A Exam Solutions

Problem 39

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 should assume that the plan has at least 150 participants.

The Gateway FCL% is calculated as $(AAV - \text{zero}) / (\text{CL at highest i})$. The 2003 gateway FCL% is $74.03\% = (30,500,000 - 0) / 41,200,000$.

If this value was at least 80%, then the plan would not be subject to the 412(l) AFC for 2003. The reason is that the prior two years' FCL% are at least 90%.

If additional contributions are paid for 2002, then the 01/01/2003 AAV would be larger. You would add any outstanding contributions for 2002 to the AAV, and also include them in the write down of the UAL. This is consistent with the way such contributions are handled under the MFSA; you should not add the discounted value of the contributions.

You can solve for the amount of the contribution needed to increase the Gateway FCL% to 80%:

$$\begin{array}{ll} 80.0\% & (30,500,000 + X - 0) / 41,200,000 \\ X & .80 * 41,200,000 - 30,500,000 \\ X & 2,460,000 \end{array}$$

Answer is A

Fall 2003 EA-2A Exam Solutions

Problem 40 - Page 1

Individual Level Premium (ILP) is an individual cost method. The key point of this problem is that you must derive the amount of the experience gain / loss for 2002, and set up that base at 01/01/2003.

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

In this problem, you have no prior year information, so you can't calculate the expected UAL. Under the ILP method, the IAL starts at zero. In general, the only time the UAL is non-zero is due to past experience losses. This means that the 01/01/2003 Loss base is equal to the UAL.

$$\begin{aligned}\text{UAL} &= \text{AL} - \text{AAV} \\ \text{AL} &= \text{PVB} - \text{PVNC}\end{aligned}$$

$$\begin{aligned}\text{PVNC} &= \text{NC} * \ddot{a}_{\overline{x:\text{RA-X}}|} \\ &= 6,500 * \ddot{a}_{\overline{42:23}|}\end{aligned}$$

With no pre-retirement decrements, the temporary annuity is an interest only calculation.

$$\begin{aligned}\text{PVNC} &= 6,500 * \ddot{a}_{\overline{23}|.07} \\ &= 78,398\end{aligned}$$

$$\begin{aligned}\text{AL} &= 100,000 - 78,398 \\ &= 21,602\end{aligned}$$

$$\begin{aligned}\text{UAL} &= 21,602 - 12,000 \\ &= 9,602 \\ \text{Loss base} &= 9,602\end{aligned}$$

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. The limit adjustment is based on a ten year amortization of the loss base:

$$\begin{aligned}\text{Deductible limit} &= 1.07 * (6,500 + 9,602 \div \ddot{a}_{\overline{10}|.07}) \\ &= 8,322\end{aligned}$$

Fall 2003 EA-2A Exam Solutions

Problem 40 - Page 2

The second step is to check the Full Funding Limitation under 404. For 2003, the OBRA FFL calculation uses 170% of the current liability.

$$\begin{aligned}\text{\$404 "ERISA" FFL} &= (1+i)(\text{NC} + \text{AL}) - (1+i)(\text{lesser MVA, AAV}) \\ &= 1.07 * (6,500 + 21,602 - 12,000) \\ &= 17,229\end{aligned}$$

$$\begin{aligned}\text{\$404 "OBRA" FFL} &= 1.70 (12/31 \text{ CL}) - (1+i)(\text{lesser MVA, AAV}) \quad (\text{if no benefit payments}) \\ &= 1.70 * (18,000) - 1.07 * (12,000) \\ &= 17,760\end{aligned}$$

$$\begin{aligned}\text{\$404 "RPA 94" FFL} &= .90 (12/31 \text{ CL}) - (1+i)(\text{AAV}) \quad (\text{if no benefit payments}) \\ &= .90 * (18,000) - 1.07 * (12,000) \\ &= 3,360\end{aligned}$$

Note that the end of year asset value (if any) should be used in calculating the OBRA '87 and 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.

The final §404 FFL value is the greater of the RPA '94 floor, and the lesser of the ERISA and OBRA FFL values, or 17,229. The §404 FFL of 17,229 does not affect the deductible limit.

Now you must check the §412 minimum contribution to see if it is greater. One reason this may happen is the loss base at 01/01/03. This is amortized over 10 years for the deductible limit, but over 5 years for the MFSAs:

$$\text{Loss Amort} = 2,189 = 9,602 \div \ddot{s}_{\overline{5}|.07}$$

2003 Minimum Funding Standard Account			
Charges		Credits	
Normal Cost	6,500	Credit Balance	0
Loss amortization	2,189	12/31 minimum	x
7% interest	608	7% interest	0
Total charges	<u>9,297</u>	Total credits	<u>x</u>

At this point, the minimum contribution appears to be 9,297. You must still check to see if the §412 FFL applies. With a zero credit balance, the §412 FFL is equal to the §404 FFL of 17,229, so it has no effect on the minimum contribution.

Fall 2003 EA-2A Exam Solutions

Problem 40 - Page 3

The deductible limit is the lesser of the 404 FFL of 17,229, or the greater of [the normal cost plus limit adjustments of 8,322 and the minimum contribution of 9,297]. The final result is 9,297.

The final calculation 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:

$$\begin{aligned}\text{\$404 "RPA 94" UCL} &= 1.00 (12/31 \text{ CL}) - (1+i) * (\text{AAV}) && \text{(if no benefit payments)} \\ &= 18,000 - 1.07 * (12,000) \\ &= 5,160\end{aligned}$$

The 404 UCL does not affect the deductible limit. The final deductible limit is still the §412 minimum of 9,297.

Answer is E

Fall 2003 EA-2A Exam Solutions

Problem 41 - Page 1

Similar to 1999 #21

Revised 06/20/06

With an individual cost method, there are two things to be aware of. One is that you should check the Full Funding Limitation (FFL) if you have sufficient information. The other is that you should check for experience gains or losses each year.

The first thing you should do is calculate the 01/01/2003 valuation results using the old plan formula:

Description	New Plan - \$80	Old Plan - \$60
Accrued liability	864,000	$648,000 = (6/8) * 864,000$
Normal cost	116,000	$87,000 = (6/8) * 116,000$

Since the plan was just established in 2002, and it grants credit for past service, it should be clear that the FFL will not apply. You have to calculate the experience G/L during 2002. You must determine the expected UAL at 01/01/03, as well as the actual UAL at 01/01/03 before the plan amendment. The difference between those two values is the experience gain or loss base.

Since there were no investment gains or losses during 2002, you can directly calculate the non-investment G/L:

$$\begin{aligned}
 \text{Non-inv Loss} &= AL_1 - {}_eAL_1 \\
 01/01/03 \text{ } {}_eAL_1 &= (1+i) * (NC_0 + AL_0) - (\text{benefit payments} + \text{interest}) \\
 &= 1.07 * (100,000 + 600,000) - 0 \\
 &= 749,000
 \end{aligned}$$

$$\begin{aligned}
 \text{Non-inv Gain} &= 749,000 - 648,000 = 101,000 \\
 \text{Gain amort} &= 23,021 = 101,000 \div \ddot{a}_{\overline{5}|.07}
 \end{aligned}$$

$$\begin{aligned}
 \text{Plan change} &= 864,000 - 648,000 = 216,000 \\
 \text{Plan amort} &= 16,268 = 216,000 \div \ddot{a}_{\overline{30}|.07}
 \end{aligned}$$

$$\text{IAL amort} = 45,189 = 600,000 \div \ddot{a}_{\overline{30}|.07}$$

To complete the MFSA for 2003, you must determine the credit balance at 12/31/2002. To do this, you have to use the 2002 MFSA results:

2002 Minimum Funding Standard Account			
Charges		Credits	
Normal Cost	100,000	Credit Balance	0
IAL amortization	45,189	04/01 contribution	170,000
7% interest	10,163	7% interest	8,925
Total charges	155,352	Total credits	178,925

Fall 2003 EA-2A Exam Solutions

Problem 41 - Page 2

You have no information to calculate the §412 Full Funding Limitation. The interest was calculated as $8,925 = (.07)(9/12)(170,000)$. The 12/31/02 credit balance is $178,925 - 155,352 = 23,573$. Now you have enough information to complete the 2003 MFSA:

2003 Minimum Funding Standard Account			
Charges		Credits	
Normal Cost	116,000	Credit Balance	23,573
IAL amortization	45,189	12/31/03 minimum	x
PLAN amortization	16,268	GAIN amortization	23,021
7% interest	12,422	7% interest	3,262
Total charges	189,879	Total credits	49,856 + x

The 12/31/03 minimum contribution is $189,879 - 49,856 = 140,023$.

Answer is A

NOTES:

- You could have worked the problem with compound interest:
2002 MFSA interest = 8,849
2002 MFSA credits = 178,849
12/31/02 CB = 23,497
2003 MFSA interest = 3,256
2003 MFSA credits = $x + 49,775$
12/31/03 minimum = 140,104
- If you used the formula for the total G/L (${}_e\text{UAL}_1 - \text{UAL}_1$), then you need to calculate the AAV. Based on the information given, you can calculate the actuarial asset value at 12/31/2002, using expected interest at the valuation rate:

$$\begin{aligned} 01/03 \text{ AAV} &= 170,000 * [1 + (9/12)(.07)] \\ &= 178,925 \end{aligned}$$

$$\begin{aligned} \text{UAL} &= \text{AL} - \text{AAV} \\ {}_e\text{UAL} &= (1+i) * (\text{NC}_0 + \text{UAL}_0) - (\text{contribution} + \text{interest}) \end{aligned}$$

You would produce the same answer as shown above, but it takes a little more work.

Fall 2003 EA-2A Exam Solutions

Problem 42 - Page 1

Similar to 2001 #32

The key to this problem is knowing how to calculate costs under the Attained Age Normal method (AAN). The initial accrued liability (IAL) is defined under the Unit Credit method. In subsequent years, the UAL is defined equal to the expected unfunded liability, based on the standard formula:

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

You have to do a Unit Credit valuation at 01/01/2002 to determine the IAL. Then you need to do the AAN valuation, and calculate the normal cost. The Unit Credit accrued liability is defined as the present value of the actual accrued benefit.

Valuation date	1/1/2002
Age	45
Past service	10
Total service	30

$$\begin{aligned}\text{Accrued Benefit} & 10(\$1,000) \\ & = 10,000\end{aligned}$$

$$\begin{aligned}\text{Unit Credit} \\ \text{Accrued Liability} & 10,000 (D_{65} / D_{45}) \ddot{a}_{65}^{(12)} \\ & 10,000 (1.07)^{-20} (9.24) \\ & = 23,878\end{aligned}$$

$$\text{Projected Benefit} \quad 30(\$1,000)$$

$$\begin{aligned}\text{Projected Liability} & (30/10)(23,878) \\ & = 71,634\end{aligned}$$

The next step is the AAN valuation at 01/01/2002:

$$\begin{aligned}\text{PVNC} & = \text{PVB} - \text{UAL} - \text{AAV} \\ & = 71,634 - 23,878 - 0 \\ & = 47,756\end{aligned}$$

$$\begin{aligned}\text{AAN NC} & = \text{PVNC} / (\text{PVL}/L) \\ & = 47,756 / \ddot{a}_{45:\overline{20}|} \\ & = 4,213 = 47,756 / \ddot{a}_{20|.07}\end{aligned}$$

Fall 2003 EA-2A Exam Solutions

Problem 42 - Page 2

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. The limit adjustment is based on a ten year amortization of the IAL:

$$\begin{aligned}\text{Deductible limit} &= 1.07 * (4,213 + 23,878 \div \ddot{a}_{10|.07}) \\ &= 7,907\end{aligned}$$

You can ignore the other four steps typically used to calculate the deductible limit. You are told that the full funding limitation does not apply. With no amortization bases other than the IAL, the minimum contribution will be less than the deductible limit of 7,907.

Note that the deductible limit can be contributed at any date. In this problem, you are told that the deductible limit was contributed on 01/01/2002.

01/01/2003 Valuation

You need to write down the UAL from 2002 to 2003 to calculate the normal cost at 01/01/2003:

$$\begin{aligned}01/03 \text{ UAL} &= {}_e\text{UAL} \\ &= (1+i)(\text{NC}_0 + \text{UAL}_0) - (\text{contribution} + \text{interest}) \\ &= 1.07(4,213 + 23,878) - (1.07)(7,907) \\ &= 21,597\end{aligned}$$

You can calculate the 12/31/02 credit balance using the equation of balance:

$$\begin{aligned}\text{UAL} &= \text{O/S } \$412 \text{ bases} - \text{CB} - \text{ARA} \\ &= 23,878 \left(\ddot{a}_{29|.07} / \ddot{a}_{30|.07} \right) - \text{CB} - 0 \\ \text{CB} &= 23,625 - 21,597 \\ &= 2,028\end{aligned}$$

$$\begin{aligned}01/03 \text{ PVB} &= {}_e\text{PVB} && \text{(only had investment G/L)} \\ &= (1+i)(\text{PVB}_0) - (\text{actual BP} + \text{interest}) \\ &= 1.07(71,634) - 0 \\ &= 76,648\end{aligned}$$

$$\begin{aligned}\text{PVNC} &= \text{PVB} - \text{UAL} - \text{AAV} \\ &= 76,648 - 21,597 - 11,000 \\ &= 44,051\end{aligned}$$

Fall 2003 EA-2A Exam Solutions

Problem 42 - Page 3

$$\begin{aligned} \text{AAN NC} &= \text{PVNC} / (\text{PVL/L}) \\ &= 44,051 / \ddot{a}_{46:19|} \\ &= 3,983 = 44,051 / \ddot{a}_{19|.07} \end{aligned}$$

The last step is to calculate the amortization of the IAL for the minimum contribution:

$$\begin{aligned} \text{IAL amort} &= 23,878 / \ddot{a}_{30|.07} \\ &= 1,798 \end{aligned}$$

Now you can complete the 2003 MFSA:

2003 Minimum Funding Standard Account			
Charges		Credits	
Normal Cost	3,983	Credit Balance	2,029
IAL amortization	1,798	12/31/03 minimum	x
7% interest	405	7% interest	142
Total charges	<u>6,186</u>	Total credits	<u>2,171 +x</u>

The 12/31/03 minimum contribution is $6,186 - 2,171 = 4,015$.

Answer is B

Fall 2003 EA-2A Exam Solutions

Problem 43 - Page 1

You need to determine the Limit Adjustments for the maximum deductible limit. You have to determine the remaining amortization period for the IAL base, and set up a new amortization base for the change in interest rate.

The regulation at §1.404(a)-14(h) contains rules for maintenance of 10-year amortization bases used to calculate the deductible limit. The limit adjustment on any "old" bases must be recalculated on the new 7% interest rate. The regulation specifies these steps:

1. Calculate the outstanding amount of each §404 base
2. Calculate the limit adjustment on the old interest rate for each base
3. Divide (2) into (1), which produces $\ddot{a}_{n|.08}$
4. Solve for "n", which can be left exact, or rounded to integer value
5. Calculate $\ddot{a}_{n|.07}$
6. Divide (5) into (1), giving the limit adjustment on the new interest rate for each base

You could follow steps 1-4 above, but it is not necessary. Since the deductible limit has been paid at the end of each prior plan year, the 12/31/02 UAL represents 7 remaining years for amortization of the §404 IAL base.

$$\begin{aligned} 8\% \text{ UAL} &= \text{O/S } \$404 \text{ bases} \\ &= \text{IAL} * (\ddot{a}_{7|.08} / \ddot{a}_{10|.08}) \\ &= 220,000 * (5.6229/7.2469) \\ &= 170,699 \end{aligned}$$

The change in interest rate produces a new §404 base at 01/01/03:

$$\begin{aligned} \text{Assm chg} &= 160,000 - 140,000 \\ &= 20,000 \end{aligned}$$

Steps #5 and #6 are shown on the next page.

Fall 2003 EA-2A Exam Solutions

Problem 43 - Page 2

The following table summarizes the calculation of the new 7% limit adjustments for the outstanding 404 bases:

	IAL Base	Assumption Change base
01/01/03 O/S §404 base	170,699	20,000
Years for annuity	7	10
7% annuity value	5.7665	7.5152
7% limit adjustment	29,602	2,661

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:

$$\begin{aligned}\text{Deductible limit} &= 1.07 * [21,000 + (29,602 + 2,661)] \\ &= 56,991\end{aligned}$$

Answer is D

Fall 2003 EA-2A Exam Solutions

Problem 44

The key to this problem is handling the multiple retirement decrements correctly in calculating the accrued liability. The Unit Credit accrued liability is defined as the present value of the actual accrued benefit.

Age 50 at 01/01/03

Service is 18 years

Accrued benefit $8,640 = 18(12)(40)$

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

$$UC\ AL = \sum_{t=0}^{15} v^t {}_tP_{50}^{(T)} q_{50+t}^{(r)} ERB_{50+t} \ddot{a}_{50+t}^{(12)}$$

The unreduced benefit is available at retirement ages 62 and above. You must calculate the reduced benefit available at age 55:

ER ben at 55 $5,011 = 8,640[1-7(6\%)]$

Now you can evaluate the summation shown previously:

	(1)	(2)	(3)		(4)	(5)	(6)
<u>t</u>	<u>50+t</u>	<u>v^t</u>	<u>{}_tP_{50}^{(T)}</u>	<u>q_{50+t}^{(r)}</u>	<u>P_{50+t}^{(T)}</u>	<u>ERB_{50+t}</u>	<u>\ddot{a}_{50+t}^{(12)}</u>
5	55	.7130	1.000	0.50	0.50	5,011	10.38
12	62	.4440	0.500	0.75	0.25	8,640	9.95
15	65	.3624	0.125	1.00	0.00	8,640	9.24
							<u>3,617</u>
							36,474

Answer is B

NOTES:

1. The answer ranges seem VERY wide for this problem.
2. For much harder problems that require calculation of temporary annuities with multiple retirement decrements, see EA-1B 1999 #09 and EA-1B 1994 #15.

Fall 2003 EA-2A Exam Solutions

Problem 45 - Page 1

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 are told that the limit adjustment is based on the fresh start alternative:

$$NC + \text{Limit adj} = 1.07 * (NC + UAL / \ddot{a}_{10|.07})$$

One point of the problem is that you are given asset values at the end of the year. You should adjust the AAV to the beginning of the year to calculate the UAL:

$$UAL = AL - AAV$$

$$\begin{aligned} AAV &= 201,000/1.07 \\ &= 187,850 \end{aligned}$$

$$\begin{aligned} NC + \text{Limit adj} &= 1.07 * [74,000 + (200,000 - 187,850)/7.5152] \\ &= 80,910 \end{aligned}$$

Next, you should calculate the Full Funding Limitation (FFL). For 2003, the OBRA FFL calculation uses 170% of the current liability:

$$\begin{aligned} \text{\$404 "ERISA" FFL} &= (1+i)*(NC + AL) - (1+i)*(\text{lesser MVA, AAV}) \\ &= 1.07 * (74,000 + 200,000 - 187,850) \\ &= 92,180 \end{aligned}$$

$$\begin{aligned} \text{\$404 "OBRA" FFL} &= 1.70 (12/31 \text{ CL}) - (1+i)*(\text{lesser MVA, AAV}) \quad (\text{if no benefit payments}) \\ &= 1.70 * (283,000) - 201,000 \\ &= 280,100 \end{aligned}$$

$$\begin{aligned} \text{\$404 "RPA 94" FFL} &= .90 (12/31 \text{ CL}) - (1+i)*(AAV) \quad (\text{if no benefit payments}) \\ &= .90 * (283,000) - 201,000 \\ &= 53,700 \end{aligned}$$

Note that the end of year asset value (if any) should be used in calculating the OBRA '87 and 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 value.

In this problem, you are told that the expected benefit payments for the year are zero. It does not matter whether you use the end of year asset values, or the adjusted asset values at the beginning of the year.

Fall 2003 EA-2A Exam Solutions

Problem 45 - Page 2

The final §412 FFL value is the greater of the RPA '94 floor, and the lesser of the ERISA and OBRA FFL values, or 92,180. The Full Funding Limitation does not apply under §404. The deductible limit will be the greater of the normal cost plus limit adjustments, or the minimum under §412.

You are given the §412 minimum contribution as 71,000. The deductible limit is still the normal cost plus limit adjustments of 80,910.

The final comparison is to the unfunded current liability, which is available to all plans (including multiemployer) under EGTRRA. There are no specific details of how to calculate this value in §404, but it is generally done on an end of year basis:

$$\begin{aligned}\$404 \text{ UCL} &= 12/31 \text{ RPA CL} - 12/31 \text{ AAV} \\ &= 283,000 - 201,000 \\ &= 82,000\end{aligned}$$

Since this exceeds the normal cost plus limit adjustments, the final deductible limit is 82,000.

Answer is C

The main point of the problem is that this is a multiemployer plan, and the deduction can still be based on the unfunded current liability.