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# FALL 2001 EA-2A EXAM SOLUTIONS

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## Fall 2001 EA-2A Exam Solutions

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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, 2001, but excluding the provisions of EGTRRA.

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 and the plan has more than 100 participants, then the final deductible limit will be the UCL. This UCL limit is only available to non-multiemployer plans. **NOTE: this is the pre-EGTRRA provision.**

Revision History:

October 13, 2006	Corrected solution for problem 15
July 14, 2006	Corrected solutions for problems 8, 15, 19, 27, 28, 35 and 42
June 20, 2006	Corrected solution for problem 18, clarified solution for problems 3, 26, and 27
October 17, 2005	Added note for problems 5 and 33 - no longer on EA-2A syllabus
July 8, 2005	Clarified solution for problem 39
June 20, 2005	Clarified solution for problem 24
June 22, 2004	Corrected solutions for problems 9 and 10
October 14, 2003	Corrected solutions for problems 3, 4, 5, 8, 12, 15, 16, 18, 20, 23, 28, 31, 32, 34, 36 and 38
June 19, 2003	Edited final note for problem 24
December 19, 2002	Corrected solutions for problems 6 and 14
October 29, 2002	Corrected solution for problem 39
October 12, 2002	Corrected solution for problem 4
August 19, 2002	Original solutions

## **Fall 2001 EA-2A Exam Solutions**

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### **NOTES on 2001**

The 2001 exam was the first EA-2A exam given. Due to the recent passage of EGTRRA in May of 2001, the conditions for this exam specifically excluded the impact of EGTRRA.

This was the first exam with no true/false questions. Instead, the questions varied in value from two points to five points. The two point questions are fairly easy, but the five point questions are very difficult.

Most students reported that it was impossible to finish all the problems in the allotted time. For 2001, many of the five point questions were TOO long. But they were not so bad in the 2002 exam.

There were far fewer questions involving FFL calculations than in prior years. This could be due to the fact that EGTRRA eliminates the OBRA FFL in 2004.

## Fall 2001 EA-2A Exam Solutions

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### Problem 1

The key to this problem is knowledge of the formulas for the experience gain / loss, and the expected unfunded liability:

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

$$\begin{aligned} U\bar{A}L_1 &= A\bar{L}_1 - A\bar{A}V_1 \\ &= 950,000 - 500,000 \\ &= 450,000 \end{aligned}$$

$$\begin{aligned} {}_eU\bar{A}L_1 &= (1+i)(NC_0 + U\bar{A}L_0) - (\text{contribution} + \text{interest}) \\ &= 1.07(50,000 + 400,000) - 54,000 \\ &= 427,500 \end{aligned}$$

$$\begin{aligned} G/L &= 427,500 - 450,000 \\ &= (22,500) \end{aligned}$$

The net result is a loss of 22,500.

**Answer is A**

## Fall 2001 EA-2A Exam Solutions

### Problem 2

Similar to EA-2 1999 #22

The key point to this problem is knowing how to use the §412(m) charge for late quarterly contributions. In the absence of any waiver base amortization, you would use this formula to calculate the accumulated reconciliation account (ARA) at 01/01/2001:

$$01/01 \text{ ARA} = 1.07(01/00 \text{ ARA}) + [ \$412(l) \text{ charge} + \$412(m) \text{ charge} ] \text{ for 2000}$$

Based on the general conditions, the §412(l) AFC and the §412(d) item for waivers are both equal to zero. Now you can calculate the 01/01 ARA:

$$01/01 \text{ ARA} = 1.07(0) + 4,200 \text{ for } \$412(m) = 4,200$$

You need to use the “equation of balance” to determine the amount of the credit balance at 01/01/2001:

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

$$100,000 = \text{O/S } \$412 \text{ bases} - \text{CB} - 4,200$$

$$\text{CB} = \text{O/S } \$412 \text{ bases} - 104,200$$

Now use the given annual amortization amounts to derive the outstanding §412 bases. One point of confusion is that no IAL base is given. Since there was a method change at 01/01/99, it is likely the prior funding method was the Aggregate method, and there was no IAL base.

Amortization base	Amortization amount	Remaining years	Outstanding base
1-1-1999 Method chg	20,000	8 = 10-(2001-1999)	$127,786 = 20,000 * \ddot{a}_{8 .07}$
1-1-2000 Loss base	5,000	4 = 5-(2001-2000)	$18,122 = 5,000 * \ddot{a}_{4 .07}$
1-1-2001 Gain base	-4,000	5 = 5-(2001-2001)	$-17,549 = -4,000 * \ddot{a}_{5 .07}$
All Total			128,359

$$\begin{aligned}\text{CB} &= 128,359 - 104,200 \\ &= 24,159\end{aligned}$$

**Answer is B**

## Fall 2001 EA-2A Exam Solutions

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### Problem 3 - Page 1

Revised 06/20/06

The key point to this problem is the calculation of the liquidity shortfall. This is the first time that calculation was tested on the exam.

To calculate the required quarterly contribution for 2001, 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 minimum contributions for 2000 and 2001, both as of 01/01/2001. The 12/31/00 minimum represents \$412 NC + \$412 amortizations - credit balance, all increased with one year's interest. Since the credit balances at 12/31/99 and 12/31/00 are both zero, you don't need to make any special adjustments to the minimum contributions for calculating the RAP.

$$\begin{array}{lcl} 12/31/00 \text{ "MFSA excluding CB"} & = & (\$412 \text{ NC} + \$412 \text{ amort} - 0) * 1.07 = 120,000 \\ 01/01/01 \text{ "MFSA excluding CB"} & = & (\$412 \text{ NC} + \$412 \text{ amort} - 0) = 125,000 \end{array}$$

$$\text{Lesser of 2000 or 90\% of 2001} = \text{Lesser of } (120,000 \text{ or } .90 * 125,000) = 112,500$$

The required quarterly installment is based on the applicable percentage multiplied by the RAP, which is  $25\%(112,500) = 28,125$ .

In the absence of the liquidity shortfall, the answer would be 28,125. If you had a credit balance at 12/31/00, you could use it like an employer contribution for a required quarterly installment. This is only allowed if the contribution that creates the credit balance is actually in the trust fund at the installment date.

You have to calculate the amount of the liquidity shortfall. If it were greater than the 28,125, then the required payment at 04/15/2001 would equal the liquidity shortfall. This is based on the definition of the "required installment" in §412(m)(5)(A), which is actually a bit more precise:

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

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

## Fall 2001 EA-2A Exam Solutions

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### Problem 3 - Page 2

Revised 10/14/03

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

Adjusted disbursements equal all disbursements from plan less the FCL% times the sum of annuity purchases, lump sums, and other accelerated payments. The FCL% is calculated without reducing the actuarial asset value by the credit balance.

$$\begin{aligned}\text{All Disbursements} &= 150,000 + 25,000 + 10,000 + 10,000 \\ &= 195,000 \\ \text{Accelerated Pmts} &= 25,000 + 10,000 \\ &= 35,000\end{aligned}$$

$$\begin{aligned}\text{FCL\%} &= 400,000 / 900,000 = 44.44\% \\ \text{Base amount} &= 3 * (195,000 - 44.44\%(35,000)) \\ &= 538,333\end{aligned}$$

$$\begin{aligned}\text{Liquid assets} &= 420,000 \text{ market value} \\ \text{Liquidity Shortfall} &= 538,333 - 420,000 \\ &= 118,333\end{aligned}$$

The required installment at 04/15/2001 is the greater of the quarterly requirement of 28,125 and the liquidity shortfall of 118,333.

**Answer is C**

The cap on the liquidity shortfall is the amount to increase the FCL% to 100%. This is an amount larger than the 500,000 unfunded current liability at 01/01/2001. This has no impact, since it is much greater than the liquidity shortfall.

## Fall 2001 EA-2A Exam Solutions

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### Problem 4

Revised 10/14/03

The key to this problem is knowing how to calculate the normal cost under the Frozen Initial Liability (FIL) cost method. The final step in the problem is calculation of the deductible limit. The remainder of the problem is determining the normal cost under the FIL method.

$$\begin{aligned} \text{PVNC} &= \text{PVB} - \text{AAV} - \text{UAL} \\ \text{UAL} &= \text{O/S } \$412 \text{ bases} - \text{CB} - \text{ARA} \\ &= 100,000 * \ddot{a}_{\overline{24}|.07} - 150,000 \\ &= 1,077,219 \end{aligned}$$

$$\begin{aligned} \text{PVNC} &= 8,500,000 - 1,077,219 - 1,750,000 \\ &= 5,672,781 \end{aligned}$$

$$\begin{aligned} \text{PVE} / \text{E} &= 30,000,000 / 1,500,000 \\ &= 20.00 \end{aligned}$$

$$\text{NC} = 283,639$$

### Deductible Limit

$$\text{Deductible limit} = (1+i)(\text{Normal cost} + \text{Limit adjustment})$$

$$\text{Limit adjustment} = \text{IAL} / \ddot{a}_{\overline{10}|.07}$$

You can calculate the IAL based on the given §412 amortization:

$$\begin{aligned} \text{IAL} &= 100,000 * \ddot{a}_{\overline{30}|.07} \\ &= 1,327,767 \end{aligned}$$

$$\begin{aligned} \text{Limit adjustment} &= 1,327,767 / \ddot{a}_{\overline{10}|.07} \\ &= 176,677 \end{aligned}$$

$$\begin{aligned} \text{Deductible limit} &= 1.07 * (283,639 + 176,677) \\ &= 492,538 \end{aligned}$$

**Answer is E**

You don't have sufficient information to check the Full Funding Limitation. With only a single base, the §412 minimum would be lower than the 492,538. You don't have any information to calculate the unfunded current liability, nor do you know if you are eligible to use it for the deductible limit.



## Fall 2001 EA-2A Exam Solutions

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### NOTE:

**This topic is no longer on the EA-2A exam. It was moved to the EA-2B exam in 2002.**

#### Problem 5 - Page 1

Similar to EA-2 1996 #26
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Revised 10/14/03

Revenue Ruling 81-212 contains acceptable methods used to allocate Minimum Funding Standard Account items when a plan is spun off into two or more plans. This problem tests the method used to allocate the outstanding amortization bases upon spinoff. Revenue Ruling 86-47 contains different rules which must be used when the market value of assets exceeds the present value of benefits on a termination basis (before the plan is spun off), and when one of the spun off plans has a zero UAL.

The method of allocation is based on the fact that, for a plan with a non-zero UAL, the outstanding §412 amortization bases less the credit balance equals the UAL. At the date of spinoff, the present value of benefits on a termination basis is used to allocate the market value of assets to the spun off plans. The Accrued Liability under the cost method is calculated for each of the plans. In this problem, you are given the market value minus the credit balance allocated between the plans. You must allocate the outstanding §412 amortization bases between the plans.

Under the FIL method, the UAL is written down each year based on the formula for the expected UAL. At plan spinoff, the Entry Age Normal accrued liability is used to develop an allocation weight. This takes the accumulated experiences gains and losses of the spun off populations into account. The EAN AL is used to allocate the sum of the UAL and AAV, which is termed the "FIL accrued liability" in the revenue ruling. The market value of assets is used to allocate the AAV between the two plans. The difference between the allocated "FIL AL" and the allocated AAV is the allocated UAL. The O/S §412 amortization bases must equal the sum of the allocated UAL and the allocated credit balance.

Before you can allocate the bases, you must derive a few items for Plan A based on the information given in the problem.

$$\begin{aligned}\text{UAL} &= \text{O/S } \$412 \text{ bases} - \text{CB} - \text{ARA} \\ &= (150,000 + 60,000) - 20,000 \\ &= 190,000\end{aligned}$$

$$\begin{aligned}\text{AAV} &= (\text{AAV} - \text{CB}) + \text{CB} \\ &= 385,000 + 20,000 \\ &= 405,000\end{aligned}$$

$$\begin{aligned}\text{"FIL AL"} &= \text{UAL} + \text{AAV} \\ &= 190,000 + 405,000 \\ &= 595,000\end{aligned}$$

## Fall 2001 EA-2A Exam Solutions

### Problem 5 - Page 2

		Total Plan A	Plan B	Plan C
(1) Given	EAN AL	600,000	250,000	350,000
(2) Given	Allocated AAV-CB	385,000	128,000	257,000
(3) Given	Credit balance	20,000	8,300	11,700
(4) (2) plus (3)	Allocated AAV	405,000	136,300	268,700
(5) Given	FIL UAL	190,000	0	0
(6) (4) plus (5), Allocated by (1)	"FIL AL"	595,000	247,917	347,083
(7) (6) minus (4)	UAL = AL - AAV	190,000	111,617	78,383
(8) (3) plus (7)	O/S §412 bases	210,000	119,917	90,083
(9) Given, allocated by (8)	IAL base	150,000	85,655	64,345
(10) Given, allocated by (8)	ASSM base	60,000	34,262	25,738

The calculations for Plan B are not strictly necessary, but they do allow you to check that the figures add to the correct total.

Now you must calculate the minimum funding amortization payments for Plan C.  
 The amortization period for the Initial Accrued Liability is 19 years = 30 - (2001 - 1990).  
 The amortization period for the Assumption change base is 4 years = 10 - (2001 - 1995).

$$\text{IAL amortization} = 64,345 / \ddot{a}_{19|.07} = 5,818$$

$$\text{ASSM amortization} = 25,738 / \ddot{a}_{4|.07} = 7,102$$

The sum of the amortization payments for Plan C equals 12,920.

**Answer is B**

### Problem 6 - Page 1

Revised 12/19/02

The key to this problem is knowledge of the 1.412(c)(2)-1 regulation on reasonable asset valuation methods. There are several basic requirements of the regulation for reasonable asset valuation methods:

- Must reflect market value of assets (MVA)
- Calculate actuarial asset value (AAV) based on a formula
- AAV result can't be consistently above MVA, or consistently below MVA
- Non-multiemployer plan corridor limits:  $80\% \text{ MVA} < \text{final AAV} < 120\% \text{ MVA}$

You are told that each method's resulting AAV will be constrained to fall within the 80% to 120% corridor around the market value.

### I. VALID

This is the method that is least clear of the three to rationalize as a reasonable method. The key is interpretation of "adjusted for contributions and benefit payments ... during the previous year."

If you start with 60% of market value, then you are including 60% of contributions and benefit payments for the prior year. When you add 40% of the prior year's AAV, you should also add in 40% of contributions and benefit payments for the prior year. Anything else would NOT be reasonable, since it would systematically overstate (or understate) the assets, and it would tend to be above (or below) the MVA

### II. VALID

This method is a simpler version of the one shown in example 1 from the regulation. It is a simple write up of the assets, and it seems to meet the requirements shown above.

### Problem 6 - Page 2

#### III. TRUE

This one may be hard to believe, but it is a valid AAV method. In example 6 of the regulation, there is a complicated illustration of how to calculate the average market value of assets.

You can demonstrate that the four year average in example 6 can also be calculated as follows:

$$4 \text{ year Average market value} = MV_4 - \frac{3}{4} (RG_4 + UG_4) - \frac{2}{4} (RG_3 + UG_3) - \frac{1}{4} (RG_2 + UG_2)$$

$RG_t$  is the realized gain in year "t", and  $UG_t$  is the unrealized gain in year "t". Together, the terms are the "capital appreciation" referred to in this third asset valuation method:

$$3 \text{ year Average market value} = MV_3 - \frac{2}{3} (RG_3 + UG_3) - \frac{1}{3} (RG_2 + UG_2)$$

I, II and III are all valid

**Answer is E**

## Fall 2001 EA-2A Exam Solutions

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### Problem 7 - Page 1

This is the first time that a problem on the exam had a salary scale, and a cost method given as Unit Credit. The key to this problem is knowing that the calculations must be performed using Projected Unit Credit, otherwise you don't have a reasonable funding method.

In order to be a reasonable funding method, the cost method must meet the requirements of the regulation at 1.412(c)(3)-1. Paragraph (c)(4)(ii) requires projection (not protection) of pay to ages at which payment of benefits begins. Example (4) clarifies that traditional Unit Credit would not be a legal funding method when benefits are based on final average pay.

Example (5) attempts to show the correct calculation under Unit Credit when benefits are based on final average pay. This is commonly known as Projected Unit Credit. There is a typographical error in the calculation shown. The minus sign in the denominator of the fraction should be a plus sign.

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

The problem requires calculation of the mortality G/L and the compensation G/L, both of which are non-investment G/L. You also must calculate the investment G/L. The first step is calculation of the expected actuarial value of assets:

$$\begin{aligned} {}_eAAV_1 &= (1+i)(AAV_0) - (\text{actual benefit payments} + i) + (\text{contributions} + i) \\ &= 1.07(225,000) - 1.07(20,000) + 8,000 \\ &= 227,350 \end{aligned}$$

$$AAV_1 = 226,000 \text{ (given)}$$

$$\begin{aligned} \text{Loss} &= {}_eAAV_1 - AAV_1 \\ &= 1,350 \end{aligned}$$

The next easiest calculation is the mortality G/L. Since there are no pre-retirement mortality decrements, only Jones is a source of mortality loss, since they survived 2000.

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

For an active employee, the benefit payments in the  ${}_eAL_1$  formula are zero. For a non-active employee, the normal cost in the  ${}_eAL_1$  formula is zero.

## Fall 2001 EA-2A Exam Solutions

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### Problem 7 - Page 2

$$\begin{aligned} {}_eAL_1 &= 1.07(20,000)(\text{zero} + \ddot{a}_{65}) - 1.07(20,000) \\ &= 1.07(20,000)(8.578-1.0) \\ &= 162,169 \end{aligned}$$

$$\begin{aligned} AL_1 &= 164,000 \text{ (given)} \\ \text{Loss} &= AL_1 - {}_eAL_1 \\ &= 1,831 \end{aligned}$$

Now you need to calculate the compensation G/L for Smith. This is the difference in the accrued liability under Projected Unit Credit (PUC), based on actual versus expected compensation. Under PUC, the accrued liability is defined as the present value of the "funding accrued benefit" (FAB). The Unit Credit method simply uses the actual accrued benefit.

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.

$$\begin{aligned} \text{Age 56 at } &01/01/00 \\ \text{Age 56 pay } &75,000 \\ \text{Age 64 pay } &119,539 = 75,000 (1.06)^8 \\ \text{FAE3 at 65 } &112,900 = 119,539 (\ddot{a}_{\overline{3}|.06} / 3) \end{aligned}$$

The FAE3 shown above is calculated based on last year's pay. If Smith's pay increased by 6% during 2000, you would have the same FAE3 at 01/01/01. You can use the FAE3 to determine the expected FAB, and the expected AL at 01/01/01:

$$\begin{aligned} \text{Age 57 at } &01/01/01 \\ \text{Svc 21 at } &01/01/01 \\ {}_eFAB &= 1\%(21)(112,900) \\ &= 23,709 \end{aligned}$$

## Fall 2001 EA-2A Exam Solutions

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### Problem 7 - Page 3

$$\begin{aligned} {}_eAL_1 &= PV({}_eFAB) \\ &= 23,709 (D_{65} / D_{57}) \ddot{a}_{65} && \text{(remember - annual benefit)} \\ &= 23,709 (8.578)(1.07)^{-8} \\ &= 118,367 \end{aligned}$$

With no pre-retirement decrements, the  $D / D$  term is interest only.

$$\begin{aligned} AL_1 &= 119,500 \text{ (given)} \\ \text{Loss} &= AL_1 - {}_eAL_1 \\ &= 1,133 \end{aligned}$$

Finally, you can rank the absolute values of the various G/L:

Compensation	1,133
Investments	1,350
Mortality	1,831

**Answer is D**

## Fall 2001 EA-2A Exam Solutions

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### Problem 8 - Page 1

Similar to EA-2 2000 #35

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.

$$\begin{aligned} \text{EAN UAL} &= \text{O/S §412 bases} + \text{Method base} - \text{CB} - \text{ARA} \\ \text{EAN UAL} &= 202,000 - 123,000 = 79,000 \end{aligned}$$

Under the Aggregate method, the O/S §412 bases are usually zero.

$$\begin{aligned} 79,000 &= \text{Zero O/S bases} + \text{Method base} - 5,000 - 0 \\ \text{Method} &= 79,000 + 5,000 = 84,000 \end{aligned}$$

The amortization period for all cost method change amortization bases specified in Revenue Procedure 2000-40 is 10 years.

$$\text{Method amortization} = 84,000 / \ddot{a}_{\overline{10}|.07} = 11,177$$

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

$$\begin{aligned} \text{PVNC} &= \text{PVFB} - \text{AAV} - \text{UAL} \\ &= \text{PVFB} - \text{AAV} - \text{O/S bases} + \text{CB} + \text{ARA} \end{aligned}$$

$$\begin{aligned} \text{PVNC} &= 241,000 - 123,000 - 79,000 \\ &= 39,000 \end{aligned}$$

$$\begin{aligned} \text{PVE/E} &= 494,000 / 60,000 \\ &= 8.2333 \end{aligned}$$

$$\begin{aligned} \text{NC} &= 39,000 / 8.2333 \\ &= 4,737 \end{aligned}$$



## Fall 2001 EA-2A Exam Solutions

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### Problem 8 - Page 2

Revised 07/14/06

#### 2001 Minimum Funding Standard Account

Charges		Credits	
Normal Cost	4,737	Credit Balance	5,000
Method amortization	11,177	12/31 contribution	x
7% interest	1,114	7% interest	350
Total charges	<u>17,028</u>	Total credits	<u>x + 5,350</u>

You should at least think about the §412 Full Funding Limitation. Since the UAL equals 79,000, it should be clear that the Full Funding Limitation will have no impact.

The minimum contribution at 12/31/01 is  $17,028 - 5,350 = 11,678$ .

**Answer is C**

## Fall 2001 EA-2A Exam Solutions

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### Problem 9 - Page 1

Revised 06/22/04

There are two keys to this problem. One is knowing the formulas for non-investment G/L calculations. The other is carefully handling the effect of the beginning of the year withdrawal decrement assumption.

There is an easier and a harder way to work this problem. First we'll look at the easier way. You are given 200 participants, and a 5% withdrawal decrement at age 40. If all experience matched the assumptions, you would have 10 exits due to withdrawal at 01/01/2000.

You are told there were only 3 withdrawals, which is 7 less than expected. You can determine the G/L by looking at the 7 participants, and compare their liability as an active to their liability as a withdrawal. For the other 190 participants, we can say that the experience matched the assumptions.

Under the Unit Credit method, the accrued liability is calculated as the present value of the accrued benefit. This is true for active participants, and for vested terminations:

$$\text{Active AL}_0 = (10 \text{ years})(12)(\$40)(D_{65} / D_{40}) \ddot{a}_{65}^{(12)}$$

$$\text{Active AL}_1 = (11 \text{ years})(12)(\$40)(D_{65} / D_{41}) \ddot{a}_{65}^{(12)}$$

$$\text{Vested AL}_1 = (10 \text{ years})(12)(\$40)(D_{65} / D_{41}) \ddot{a}_{65}^{(12)}$$

For the liability as an active, you use the accrued benefit at 1-1-2001. The accrued benefit at 1-1-2000 is used when calculating the liability as an exit. The reason is that the decrement is assumed to occur at the beginning of the year, so exits do not accrue an additional year of benefit service. Another way to think about this is that there is no normal cost for the exits.

The G/L is the difference between the two accrued liabilities at time 1 for the seven actives who did not terminate. With no pre-retirement decrements, the  $D_{65} / D_{41}$  term is interest only:

$$\begin{aligned} 7 \text{ Exits Loss} &= 7(1)(480)(1.07)^{-24}(10.0) \\ &= 6,624 \end{aligned}$$

**Answer is B**

The 1998 EA-1B exam #8 was a somewhat similar problem. It involved deaths at multiple ages. But it was an easier problem, since it had no death benefit, so there was no accrued liability for the exits.

## Fall 2001 EA-2A Exam Solutions

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### Problem 9 - Page 2

The harder way to work the problem is using the standard formulas for non-investment G/L. This requires you to calculate the accrued liability for the actives at 1-1-2000 and 1-1-2001, as well as for the vested terminations at 1-1-2001.

$$\begin{aligned}\text{Non-inv G/L} &= {}_e\text{AL}_1 - \text{AL}_1 \\ {}_e\text{AL}_1 &= (1+i)(\text{NC}_0 + \text{AL}_0) - (\text{actual benefit payments} + i)\end{aligned}$$

For an active employee, the benefit payments in the  ${}_e\text{AL}_1$  formula are zero. For a non-active employee, the normal cost in the  ${}_e\text{AL}_1$  formula is zero.

Under the Unit Credit method, the normal cost and accrued liability are defined as follows:

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

There is one trick in the calculation of both the accrued liability and the normal cost at age 40. There is one withdrawal decrement assumed to occur at age 40. That means that the present value factors have two pieces. One piece reflects the 95% of each participant that is assumed to remain in service to age 65, and the other piece reflects the 5% of each participant assumed to exit, and then survive to age 65.

$$\text{AL}_0 = 200(10 \text{ years})(12)(\$40)[.95(D_{65} / D_{40}) \ddot{a}_{65}^{(12)} + .05(D_{65} / D_{40}) \ddot{a}_{65}^{(12)}]$$

For the accrued liability, the two terms collapse down to  $(D_{65} / D_{40}) \ddot{a}_{65}^{(12)}$ :

$$\begin{aligned}\text{AL}_0 &= 200(10)(480)(1.07)^{-25}(10.0) \\ &= 1,768,792\end{aligned}$$

Under the Unit Credit method, the normal cost is calculated as the present value of the change in the accrued benefit. The trick to the problem is that there is NO increase for the 5% of each participant that is assumed to exit at age 40:

$$\begin{aligned}\text{NC}_0 &= 200(1 \text{ year})(12)(\$40)[.95(D_{65} / D_{40}) \ddot{a}_{65}^{(12)} + .05(\text{zero})] \\ &= 200(480)(.95)(1.07)^{-25}(10.0) \\ &= 168,035\end{aligned}$$

You can now calculate the expected accrued liability:

$$\begin{aligned}{}_e\text{AL}_1 &= 1.07(168,035 + 1,768,792) - \text{zero} \\ &= 2,072,405\end{aligned}$$

## Fall 2001 EA-2A Exam Solutions

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### Problem 9 - Page 3

The next step is calculation of the actual accrued liability at 1-1-2001. There are slightly different calculations for the 197 actives, and the three vested terminations.

$$\text{Actives } AL_1 = 197(11 \text{ years})(12)(\$40)(D_{65} / D_{41}) \ddot{a}_{65}^{(12)}$$

$$\text{Exits } AL_1 = 3(10 \text{ years})(12)(\$40)(D_{65} / D_{41}) \ddot{a}_{65}^{(12)}$$

$$\begin{aligned} AL_1 &= [197(11)+3(10)] (12)(\$40)(D_{65} / D_{41}) \ddot{a}_{65}^{(12)} \\ &= 2197(480)(1.07)^{-24}(10.0) \\ &= 2,079,029 \end{aligned}$$

$$\begin{aligned} \text{Loss} &= AL_1 - {}_eAL_1 \\ &= 6,624 \end{aligned}$$

As expected, you get exactly the same result for the G/L. The advantage of the first solution shown is that you can avoid some (but not all) of the complications that result from the beginning of the year assumption for withdrawal decrements.

## Fall 2001 EA-2A Exam Solutions

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### Problem 10

Revised 06/22/04

In general, a plan is exempt from the §412(l) Additional Funding Charge (AFC) if it satisfies the Gateway test. For the gateway test, you determine the funded current liability percentage (FCL%) using the high end of the interest rate range and the actuarial value of assets with no reduction for the credit balance:

$$\text{FCL\%} = (\text{AAV}-0) / \text{CL}.$$

Under the Gateway test, a plan can be exempt if

FCL%  $\geq$  90%, or

FCL%  $\geq$  80%, and FCL%  $\geq$  90% for 2 consecutive years of the last 3.

A plan can also be exempt from the §412(l) AFC based on a participant count less than 101. This uses the highest number of participants on any day in the prior plan year. This problem gives you the participant count for each day of the 2001 plan year, which is not the correct value. You should have been given the highest number on any day during the 2000 plan year.

The key to this question is knowledge of a small detail of the participant count under §412(l). There is a plan aggregation rule that requires you to aggregate all DB plans in the controlled group. For the participant count, you only include employees of the employer.

In this problem, you are told that the same employer maintains all the plans. As a result, Plan D is NOT exempt from the AFC based on having only 9 participants. The aggregated participant count (more than 300) would be used for each of the four plans.

	Plan A	Plan B	Plan C	Plan D
Actuarial Asset	790,000	890,000	850,000	74,000
Current Liability	1,000,000	1,000,000	1,040,000	100,000
Gateway FCL%	79%	89%	82%	74%

Plans A and D are not exempt under the gateway test. As described earlier, none of the plans can be exempt based on participant count.

With a FCL% that exceeds 80%, Plans B and C may be exempt based on the FCL% for prior years. Plan B is not exempt because the two years of the prior three that exceed 90% are not consecutive. Only Plan C has two years of the prior three that exceed 90%, and that are also consecutive.

Only one plan is exempt

**Answer is B**

## Fall 2001 EA-2A Exam Solutions

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### Problem 11

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

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

$$\begin{aligned} {}_eAAV_1 &= (1+i)(AAV_0) - (\text{actual benefit payments} + i) + (\text{contributions} + i) \\ &= 1.07(385,000) - \text{zero} + 1.07(3,000) \\ &= 1.07(388,000) \end{aligned}$$

$$AAV_1 = (1.04)(388,000) \quad \text{based on the 4\% actual rate of return for 2000}$$

$$\begin{aligned} \text{Loss} &= {}_eAAV_1 - AAV_1 \\ &= (.07-.04)(388,000) \\ &= 11,640 \end{aligned}$$

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

$$\begin{aligned} PVE/E &= 12,000,000 / 1,000,000 \\ &= 12.0 \end{aligned}$$

$$\Delta PVNC = 11,640$$

$$\begin{aligned} \Delta NC &= 11,640 / 12.0 \\ &= 970 \end{aligned}$$

There is one final chance to go wrong by NOT setting up the funding standard account. The effect on the minimum contribution must reflect a full year of interest credited on the normal cost:

$$\begin{aligned} \Delta \text{Min} &= 1.07 * 970 \\ &= 1,035 \end{aligned}$$

**Answer is B**

## Fall 2001 EA-2A Exam Solutions

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### Problem 12 - Page 1

Revised 10/14/03

It is surprising how little is "hidden" in this problem. You must calculate the Full Funding Limitation (FFL) for 2001. The key point of the problem is that, under all aggregate type cost methods, the ERISA FFL is calculated using the Entry Age Normal cost method. You have to do numerous calculations for the Entry Age normal cost and accrued liability.

Age 54 at 01/01/01

Past service 16

Future service 11

Total service 27

Entry age 38

Projected benefit  $27(12)(\$50) = 16,200$

$$\begin{aligned}\text{Total PVB} &= \text{PV of Projected benefit} \\ &= (16,200)(D_{65} / D_{54}) \ddot{a}_{65}^{(12)} \\ &= (16,200)(1.07)^{-11}(10.0) \\ &= 76,965\end{aligned}$$

With no pre-retirement decrements, the  $D / D$  term is interest only. The next step is calculation of the EAN accrued liability. This can be done using a formula that does not require you to separately calculate the EANC:

$$\begin{aligned}\text{EAN AL} &= \text{PVB}_{\text{CA}} * \left( \ddot{a}_{\overline{\text{EA:CA-EA}}} / \ddot{a}_{\overline{\text{EA:RA-EA}}} \right) && \text{(for level \$ EANC )} \\ &= 76,965 * \left( \ddot{a}_{38:16} / \ddot{a}_{38:27} \right) \\ &= 76,965 * \left( \ddot{a}_{16|.07} / \ddot{a}_{27|.07} \right) && \text{(no pre-retirement decrements)} \\ &= 60,656\end{aligned}$$

$$\begin{aligned}\text{EA NC} &= \text{PVB}_{\text{EA}} / \ddot{a}_{\overline{\text{EA:RA-EA}}} && \text{(for level \$ EANC )} \\ &= 76,965 * (1.07)^{-16} / \ddot{a}_{27|.07} && \text{(no pre-retirement decrements)} \\ &= 2,033\end{aligned}$$

You could have determined the normal cost first, and then used the typical retrospective formula for the accrued liability:

$$\text{EAN AL} = \text{EA NC} * \ddot{s}_{\overline{\text{EA:CA-EA}}} \quad \text{(for level \$ EANC )}$$

## Fall 2001 EA-2A Exam Solutions

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### Problem 12 - Page 2

Revised 10/14/03

Now that you have the normal cost and accrued liability, you can calculate the ERISA FFL. In 2001, the OBRA 87 FFL current liability is multiplied by 160%. You are given the OBRA and RPA current liability values at the end of the year.

$$\begin{aligned}\$412 \text{ "ERISA" FFL} &= (1+i)*(EA_{NC} + EAN_{AL}) - (1+i)*[\text{lesser}(MVA, AAV) - CB] \\ &= 1.07 * (2,033 + 60,656 - (57,000 - 0)) \\ &= 6,087\end{aligned}$$

$$\begin{aligned}\$412 \text{ "OBRA" FFL} &= 1.60 (12/31 CL) - (1+i)*[\text{lesser}(MVA, AAV) - CB] \quad (\text{if no benefit payments}) \\ &= 1.60 * (72,000) - 1.07 * (57,000 - 0) \\ &= 54,210\end{aligned}$$

$$\begin{aligned}\$412 \text{ "RPA '94" FFL} &= .90 (12/31 CL) - (1+i)*(AAV) \quad (\text{if no benefit payments}) \\ &= .90 * (75,000) - 1.07 * (60,000) \\ &= 3,300\end{aligned}$$

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.

The final §412 FFL value is the greater of the RPA '94 floor, and the lesser of the ERISA and OBRA FFL values, or 6,087. The RPA floor has no effect in this problem.

**Answer is D**



## Fall 2001 EA-2A Exam Solutions

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### Problem 13 - Page 1

The key to this problem is simply figuring out a technique for efficiently working the problem. The Entry Age Normal accrued liability is not used in the solution. Under the Attained Age Normal method, the change in the unfunded accrued liability (UAL) will equal the change in the Unit Credit accrued liability.

When you change the plan benefits, it will affect both the PVNC and the UAL:

$$\Delta \text{PVB} = \Delta \text{PVNC} + \Delta \text{UAL}$$

When you calculate the change in the minimum contribution, it will look like this:

$$\Delta \text{Minimum} = (1+i)*[(\Delta \text{PVNC}) / (\text{PVL}/\text{L}) + (\Delta \text{UAL}) / \ddot{a}_{\overline{30}|.07}]$$

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

$$\begin{aligned} \text{PVL} / \text{L} &= 2,500 / 300 \\ &= 8.3333 \end{aligned}$$

The values shown in the following table for Plan A should be clear. Since you are changing the benefit rate to \$65 for all years, the PVB and the PVAB are simply (65/50) times the values for the original \$50 plan.

It is less clear for Plan B, since the benefit rate only changes to \$X for future years. The original PVB must be broken into two pieces. The 5,000,000 for past service will not change, and the remaining 2,000,000 will increase pro-rata.

	<b>\$50 Plan</b>	<b>\$65 Plan A</b>	<b>(\$50 / \$X) Plan B</b>
PVB	7,000,000	(65/50)*7,000,000 = 9,100,000	(X/50) * 2,000,000 + 5,000,000
$\Delta$ PVB	0	2,100,000	(X/50-1)* 2,000,000
PV of AB	5,000,000	(65/50)*5,000,000 = 6,500,000	5,000,000
$\Delta$ UAL	0	1,500,000	0
$\Delta$ PVNC	0	600,000	(X/50-1)* 2,000,000

In the table above, the  $\Delta$  PVNC is calculated as  $\Delta$  PVB minus  $\Delta$  UAL.

## Fall 2001 EA-2A Exam Solutions

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### Problem 13 - Page 2

Now you can set up expressions for the increase in the minimum contribution under Plan A and Plan B. Then you can set them equal, and solve for the value of X. At this point, the problem is an algebra exercise.

$$\Delta \text{ Minimum} = (1+i)*[(\Delta \text{ PVNC}) / (\text{PVL}/L) + (\Delta \text{ UAL}) / \ddot{a}_{30|.07}]$$

$$\Delta \text{ Min A} = (1.07)*[600,000 / 8.3333 + 1,500,000 / \ddot{a}_{30|.07}]$$

$$\Delta \text{ Min B} = (1.07)*[(X/50 - 1)(2,000,000) / 8.3333]$$

$$(X/50 - 1)(2,000,000) / 8.3333 = 600,000 / 8.3333 + 1,500,000 / \ddot{a}_{30|.07}$$

$$(X/50 - 1)(2,000,000) = 600,000 + (8.3333)(1,500,000) / \ddot{a}_{30|.07}$$

$$40,000X - 2,000,000 = 600,000 + 941,430$$

$$X = 88.53$$

**Answer is B**

## Fall 2001 EA-2A Exam Solutions

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### Problem 14 - Page 1

Similar to EA-2 1999 #41
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The question asks for the 01/01/2002 Accumulated reconciliation account (ARA) balance. In the absence of any waiver base amortization, you would use this formula:

$$01/01/02 \text{ ARA} = 1.07(01/01/01 \text{ ARA}) + 2001 \text{ §412(l) charge} + 2001 \text{ §412(m) charge}$$

See problem 20 for an example of how to calculate the ARA with plan waivers.

This problem gives you the §412(m) charge for late quarterly penalties. It also gives the values needed to calculate the Deficit Reduction Contribution (DRC) and the §412(l) additional funding charge (AFC). The key to this problem is knowing how to calculate the §412(l) charge.

Based on the exam conditions, when you are told nothing about the Optional or Transition Rules, you can ignore both. If the plan had elected the Optional Rule, the amount of the §412(l) AFC should be the greater of the values calculated under the post-GATT and pre-GATT rules.

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

$$\begin{aligned} \text{Gateway \%} &= (\text{AAV} - 0) / (\text{CL at highest permissible rate}) \\ &= (975,000 - 0) / 1,250,000 = 78.0\% \end{aligned}$$

The §412(l) AFC equals the Unpredictable Contingent Event amount plus the excess, if any, of the DRC over the §412(b) normal cost plus all amortization charges and credits. 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.

$$\begin{aligned} \text{UCL} &= \text{CL} - (\text{AAV} - \text{CB}) \\ &= 1,300,000 - (975,000 - 25,000) \\ &= 350,000 \end{aligned}$$

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 UNL, and you must calculate the UOL.

## Fall 2001 EA-2A Exam Solutions

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### Problem 14 - Page 2

Revised 12/19/02

$$\begin{aligned}\text{UNL} &= 240,000 \text{ (given)} \\ \text{UOL} &= \text{UCL} - \text{UNL} - \text{UCEL} \\ &= 350,000 - 240,000 - 0 \\ &= 110,000\end{aligned}$$

The UOLA equals the amortization of the remaining portion of the unfunded old liability over a period that was 18 years at 1-1-89, at the 6.1% current liability interest rate. At 01/01/2001, the remaining period is 6 years = 18-(2001-1989).

$$\begin{aligned}\text{UOLA} &= \text{UOL} / \ddot{a}_{\overline{6}|.061} \\ &= 110,000 / 5.2009 \\ &= 21,150\end{aligned}$$

The UNLA is defined as the unfunded new liability times the applicable percentage, which is 30% - 40% (FCL% - 60%) under RPA '94. In this problem, you must calculate this percentage. In 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%.

$$\begin{aligned}\text{FCL\%} &= (\text{AAV} - \text{CB}) / \text{CL} \\ &= (975,000 - 25,000) / 1,300,000 \\ &= 73.08\%\end{aligned}$$

$$\begin{aligned}\text{APP\%} &= .30 - .40 [ .73080 - .60 ] \\ &= 24.7680\%\end{aligned}$$

$$\begin{aligned}\text{UNLA} &= 240,000 * 24.7680\% \\ &= 59,443\end{aligned}$$

$$\begin{aligned}\text{DRC} &= \text{UOLA} + \text{UNLA} + \text{CLNC} \\ \text{DRC} &= 21,150 + 59,443 + 60,000 \\ &= 140,593\end{aligned}$$

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

$$\begin{aligned}01/01/01 \text{ §412(l) AFC} &= \text{UCEA} + [\text{DRC} - (\text{§412 NC} + \text{§412 amortizations})] \\ &= 0 + 140,593 - (45,000 + 50,400) \\ &= 45,193 \\ 12/31/01 \text{ §412(l) AFC} &= 45,193 * 1.061 \\ &= 47,950\end{aligned}$$

## Fall 2001 EA-2A Exam Solutions

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### Problem 14 - Page 3

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

With less than 150 plan participants, you must pro-rate the §412(l) AFC. The pro-rata is based on the highest number of plan participants on any day in the prior plan year. This plan has always had 140 participants:

$$\begin{aligned} 12/31/01 \text{ §412(l) AFC} &= 47,950 * [2\% * (140-100)] \\ &= 47,950 * .80 \\ &= 38,360 \end{aligned}$$

Now you can calculate the 01/01/2002 ARA balance:

$$\begin{aligned} 01/01/02 \text{ ARA} &= 1.07(01/01/01 \text{ ARA}) + 2001 \text{ §412(l) charge} + 2001 \text{ §412(m) charge} \\ &= 1.07(50,500) + 38,360 + 800 \\ &= 93,195 \end{aligned}$$

**Answer is D**

## Fall 2001 EA-2A Exam Solutions

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### Problem 15 - Page 1

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, and there is also a takeover by a new actuary. This is the first question asked on the exam regarding a method change in a takeover situation.

The revenue procedure defines a "takeover" as when the actuary and the actuarial firm both change. The method used by the new actuary must be applied to the prior year (using the prior assumptions). The absolute value of each difference in the normal cost, accrued liability (for individual cost methods), and the actuarial value of assets, that is attributable to the change in cost method must not exceed 5% of the respective amounts calculated by the prior actuary for that year. The values shown for the new actuary's 2000 valuation results are all within 5% of the prior actuary's 2000 valuation results.

Section 4.03(4) specifies that, in the case of a takeover, the change in costs due to the funding method change is treated as an experience gain or loss, unless there is also a change in assumptions. If there is a change in assumptions, the change in method is considered part of the change in assumptions. Since the new actuary uses the same assumptions as the prior actuary, the base due to the change in cost method will be treated as an experience G/L, and amortized over 5 years.

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.

Based on the prior actuary's 01/01/2000 valuation results, you can solve for the Initial accrued liability (IAL):

$$\begin{aligned} 01/00 \text{ UAL} &= \text{O/S §412 bases} - \text{CB} - \text{ARA} \\ 900,000 &= \text{IAL} * \left( \ddot{a}_{\overline{20}|.07} / \ddot{a}_{\overline{30}|.07} \right) - 0 - 0 \\ \text{IAL} &= 1,054,193 \end{aligned}$$

You are told that the minimum contribution for 2000 was paid at 12/31/2000. This produces a zero credit balance at 12/31/00.

## Fall 2001 EA-2A Exam Solutions

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### Problem 15 - Page 2

Revised 10/13/06

The method base and the G/L base will be amortized over the same 5 year period. You could use a shortcut, and not determine each base separately.

$$\begin{aligned} 01/01 \text{ UAL} &= \text{O/S } \$412 \text{ bases (excluding G/L base) - CB - ARA} \\ &= \text{IAL} * \left( \ddot{a}_{\overline{19}|.07} / \ddot{a}_{\overline{30}|.07} \right) - 0 - 0 \\ &= 878,046 \end{aligned}$$

$$\begin{aligned} 01/01 \text{ UAL} &= \text{O/S } \$412 \text{ bases} + (\text{Method base} + \text{G/L base}) - \text{CB} - \text{ARA} \\ 800,000 &= 878,046 + \text{"GAIN"} - 0 - 0 \\ \text{"GAIN"} &= 78,046 \end{aligned}$$

$$\begin{aligned} \text{GAIN amort} &= 78,046 / \ddot{a}_{\overline{5}|.07} \\ &= 17,790 \end{aligned}$$

$$\begin{aligned} \text{IAL amort} &= 1,054,193 / \ddot{a}_{\overline{30}|.07} \\ &= 79,396 \end{aligned}$$

#### 2001 Minimum Funding Standard Account

Charges		Credits	
Normal Cost	177,000	Credit Balance	0
IAL amortization	79,396	GAIN amortization	17,790
		12/31 contribution	x
7% interest	17,948	7% interest	1,245
Total charges	274,344	Total credits	x + 19,035

You should at least think about the \$412 Full Funding Limitation. Since the UAL equals 800,000, it should be clear that the Full Funding Limitation will have no impact.

The minimum contribution at 12/31/01 is  $274,344 - 19,035 = 255,309$ .

**Answer is C**

(next page)

**Problem 15 - Page 3****Revised 10/13/06**

If you want to calculate the method change base separately from the G/L base, it is a bit more work. You have to compare the write down of the  ${}_e\text{UAL}$  at 12/31/00, based on the two sets of valuation results at 01/01/00.

$$\begin{aligned}\text{Prior actuary min} &= 1.07(162,000 + 79,396) \\ &= 258,294\end{aligned}$$

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

$$\begin{aligned}\text{Prior actuary } {}_e\text{UAL} &= 1.07(162,000 + 900,000) - 258,294 \\ &= 878,046\end{aligned}$$

This matches the value determined on the prior page, based on the outstanding \$412 base for the IAL. The prior actuary would determine the gain for 2000 as  $78,046 = 878,046 - 800,000$ . This assumes the prior actuary's value of the 01-01-2001 UAL is also 800,000.

$$\begin{aligned}\text{New actuary } {}_e\text{UAL} &= 1.07(165,000 + 875,000) - 258,294 \\ &= 854,506\end{aligned}$$

The new actuary would determine the gain for 2000 as  $54,506 = 854,506 - 800,000$ . The difference between the two gain bases is  $-23,540 = 54,506 - 78,046$ .

The method change base is  $-23,540$  and the experience gain base is  $-54,506$ . The total equals the  $-78,046$  shown on the prior page, and it is amortized over 5 years as an experience gain.



## Fall 2001 EA-2A Exam Solutions

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### Problem 16 - Page 1

You are given the cost method as Unit Credit. For a benefit that is based on final average pay, you typically would use Projected Unit Credit. However, since you have no assumed compensation increases, you will get exactly the same results with traditional Unit Credit. See the solution to problem 7 for more discussion.

Under the Unit Credit method, the normal cost and accrued liability are defined as follows:

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

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

The key to this problem is handling the mortality decrements correctly in calculating the accrued liability. The present value factors have two pieces. One piece reflects the probability that a participant remains active and survives to retire at age 65. The other piece reflects the probability that a participant dies prior to retirement, and their beneficiary receives a death benefit.

Age 62 at 01/01/01

Past service 23 years

Total service 26 years

$$\text{Projected benefit } 22,500 = 45,000 * 50\%$$

$$\text{Accrued benefit } 19,904 = 22,500(23/26)$$

$$\text{UC AL} = \text{PV of AB}$$

$$= \text{PV of AB for retirement benefits} + \text{PV of AB for death benefits}$$

$$= 19,904 \left[ v^3 {}_3p_{62}^{(T)} \ddot{a}_{65}^{(12)} + \sum_{t=0}^2 v^t {}_tp_{62}^{(T)} q_{62+t}^{(d)} (.90) \ddot{a}_{62+t}^{(12)} \right]$$

The problem asks for the accrued liability for the death benefit, which is the summation term. There are three terms in the summation, which represent death at ages 62, 63, and 64.

The mortality decrements are assumed to occur at the beginning of the year. The age for the monthly annuity is shown at 62+t, which is based on the assumption of identical ages for the participant and spouse.

The summation does not calculate the probability of survival for the spouse each year. I interpret the 90% assumption to imply that the spouse could die the first year, and we assume "spouse replacement" such that 90% of the participants are married at the time of death. This is typically how death benefit present values are calculated by most pension valuation systems.

## Fall 2001 EA-2A Exam Solutions

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### Problem 16 - Page 2

Revised 10/14/03

You are given the calculated values for the  ${}_t p_{62}^{(T)} q_{62+t}^{(d)}$  terms, so you can evaluate the summation:

$$\begin{aligned}\text{Death AL} &= 19,904(.90)[(.015)(1.0)(9.80) + (.017)(.928)(9.64) + (.019)(.860)(9.47)] \\ &= 19,904(.90)[.1470 + .1521 + .1547] \\ &= 8,130\end{aligned}$$

**Answer is A**

The answer ranges allow for a different interpretation regarding the spouse survival assumption. If you build in additional probabilities for the spouse's survival at ages 63 and 64, you still fall in answer range A:

$$\begin{aligned}\text{Death AL} &= 19,904(.90)[(.015)(1.0)(9.80) + (.017)(.985)(.928)(9.64) + \\ &\quad + (.019)(.985)(.983)(.860)(9.47)] \\ &= 19,904(.90)[.1470 + .1498 + .1498] \\ &= 8,001\end{aligned}$$

## Fall 2001 EA-2A Exam Solutions

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### Problem 17 - Page 1

NOTE: This problem is not in later copies of the 2001 EA-2A exam. It was marked as "Dropped", probably because of a typographical error. The credit balance is given as of 12/31/1999, but you need the value at 12/31/2000 to solve the problem.

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

The problem asks for the credit balance at 12/31/2001, including the 2001 contributions. The credit balance should reflect interest to 12/31/2001 on the four quarterly contributions of 40,000 that were paid for 2001.

Based on the exam conditions, when you are told nothing about the Optional or Transition Rules, you can ignore both. If the plan had elected the Optional Rule, the amount of the §412(l) AFC should be the greater of the values calculated under the post-GATT and pre-GATT rules.

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 have a very short problem (not likely to happen).

$$\begin{aligned}\text{Gateway \%} &= (\text{AAV} - 0) / (\text{CL at highest permissible rate}) \\ &= (870,000 - 0) / 1,000,000 = 87.0\%\end{aligned}$$

Another key point is correctly handling the end of year valuation date, which is somewhat confusing. Note that the valuation date is 12/31/01, and both the current liability and the assets are given as of that date. These values must exclude any 2001 plan year contributions that are paid during the 2001 calendar year, since they represent future plan year contributions.

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. You need to increase the credit balance with one year's interest to get the value at 12/31/01:

$$\begin{aligned}\text{UCL} &= \text{CL} - (\text{AAV} - \text{CB}) \\ &= 1,000,000 - [870,000 - 1.07(0)] \quad \text{NOTE: assumes the 12/31/00 CB is zero} \\ &= 130,000\end{aligned}$$

## Fall 2001 EA-2A Exam Solutions

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### Problem 17 - Page 2

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 not given the UOL.

The point of the problem is that this plan has a post 1995 inception date. The initial UOL was set up in 1989, and a new layer could have been created in 1995. Since this plan did not exist until after 1995, the UOL must be zero. The UOLA is also zero.

$$\begin{aligned}\text{UOL} &= 0 \\ \text{UNL} &= \text{UCL} - \text{UOL} - \text{UCLE} \\ &= 130,000 - 0 - 0 \\ &= 130,000\end{aligned}$$

$$\text{UOLA} = 0$$

The UNLA is defined as the unfunded new liability times the applicable percentage, which is 30% - 40% (FCL% - 60%) under RPA '94. In this problem, you must calculate this percentage. In 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%.

$$\begin{aligned}\text{FCL\%} &= (\text{AAV} - \text{CB}) / \text{CL} \\ &= [870,000 - 1.07(0)] / 1,000,000 \\ &= 87.00\%\end{aligned}$$

$$\begin{aligned}\text{APP\%} &= .30 - .40 [ .8700 - .60 ] \\ &= 19.20\%\end{aligned}$$

$$\begin{aligned}\text{UNLA} &= 130,000 * 19.20\% \\ &= 24,960\end{aligned}$$

$$\begin{aligned}\text{DRC} &= \text{UOLA} + \text{UNLA} + \text{CLNC} \\ \text{DRC} &= 0 + 24,960 + 40,000 \\ &= 64,960\end{aligned}$$

You must subtract the §412 normal cost plus all amortization charges from the DRC to calculate the §412(l) AFC. Since you have an end of year valuation date, you do NOT need to bring the §412(l) charge forward to the end of the year. Under the Aggregate method, there are usually no §412 amortization charges.

$$\begin{aligned}12/31/01 \text{ §412(l) AFC} &= \text{UCEA} + [\text{DRC} - (\text{§412 NC} + \text{§412 amortizations})] \\ &= 0 + 64,960 - (50,000 + 0) \\ &= 14,960\end{aligned}$$

## Fall 2001 EA-2A Exam Solutions

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### Problem 17 - Page 3

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

With more than 149 plan participants, you do not need to pro-rate the §412(l) AFC. At this point, you could set up the MFSA. But you need to check the Full Funding Limitation (FFL) first. If there is a FFL credit, it will affect the amount of the credit balance.

In 2001, the OBRA 87 FFL current liability is multiplied by 160%. You are given the Entry Age Normal accrued liability value at the end of the year, but including the normal cost. You are given the current liability at the end of the year, but excluding the normal cost.

$$\begin{aligned}\$412 \text{ "ERISA" FFL} &= (\text{EA NC} + \text{EAN AL}) - [\text{lesser}(\text{EOY MVA}, \text{AAV}) - \text{CB}] \\ &= 935,000 - [870,000 - 1.07(0)] \\ &= 65,000\end{aligned}$$

$$\begin{aligned}\$412 \text{ "OBRA" FFL} &= 1.60 (12/31 \text{ CL}) - [\text{lesser}(\text{EOY MVA}, \text{AAV}) - \text{CB}] \quad (\text{if no benefit payments}) \\ &= 1.60 * (1,000,000 + 40,000) - [870,000 - 1.07(0)] \\ &= 794,000\end{aligned}$$

$$\begin{aligned}\$412 \text{ "RPA 94" FFL} &= .90 (12/31 \text{ CL}) - (\text{EOY AAV}) \quad (\text{if no benefit payments}) \\ &= .90 * (1,000,000 + 40,000) - 870,000 \\ &= 66,000\end{aligned}$$

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.

The final §412 FFL value is the greater of the RPA 94 floor, and the lesser of the ERISA and OBRA FFL values. The final value is the RPA floor of 66,000.

## Fall 2001 EA-2A Exam Solutions

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### Problem 17 - Page 4

Now you can set up the MFSA, and see if there is a FFL credit for 2001:

2001 Minimum Funding Standard Account			
Charges		Credits	
12/31 Normal Cost	50,000	Credit Balance	0
		04/15/01 contribution	40,000
		07/15/01 contribution	40,000
		10/15/01 contribution	40,000
12/31 §412(l) AFC	14,960	01/15/02 contribution	40,000
7% interest	0	7% interest	3,850
Total charges	64,960	Total credits	163,850

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 charges of 64,960. Since this is less than the FFL of 66,000, there is no FFL credit in the MFSA.

The interest on the quarterly contributions reflects interest at the valuation rate, from the date of payment, to the end of the plan year. There is no interest earned by the last payment, since it is made after the end of the plan year:

$$3,850 = 40,000 (.07)[8.5/12 + 5.5/12 + 2.5/12]$$

The credit balance equals 98,890, which is equal to 163,850 - 64,960.

**Answer is B**

You could have credited compound interest on the quarterly contributions. But you will still produce a result in answer range B:

$$\begin{aligned} 3,791 &= 40,000 \{ [(1.07)^{8.5/12} - 1] + [(1.07)^{5.5/12} - 1] + [(1.07)^{2.5/12} - 1] \} \\ &= 40,000 \{ .0491 + .0315 + .0142 \} \end{aligned}$$

The credit balance now equals 98,831, which is equal to 163,791 - 64,960.

## Fall 2001 EA-2A Exam Solutions

### Problem 18 - Page 1

Revised 10/14/03

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.

This is a very long calculation problem. You must do two lengthy sets of calculations. The initial set is based on the incorrect information for Smith.

<u>Description</u>	<u>Smith - Original data</u>	<u>Jones</u>	<u>Total</u>
01/2001 Age	35	55	
Past service	5	20	
Total service	35	30	
2001 pay	30,000	100,000	130,000
Age 64 pay	$30,000(1.05)^{29}$ = 123,484	$100,000(1.05)^9$ = 155,133	
Age 65 FAE3	$123,484(\ddot{a}_{\overline{3} .05} / 3)$ = 117,697	$155,133(\ddot{a}_{\overline{3} .05} / 3)$ = 147,863	
Projected benefit	$35(1\%)(117,697)$ = 41,194	$30(1\%)(147,863)$ = 44,359	
PV future benefits	$41,194(D_{65} / D_{35}) \ddot{a}_{65}^{(12)}$ $41,194(1.07)^{-30} (10.0)$ = 54,115	$44,359(D_{65} / D_{55}) \ddot{a}_{65}^{(12)}$ $44,359 (1.07)^{-10} (10.0)$ = 225,498	279,613

Now you can calculate the Aggregate PVNC:

$$\begin{aligned}
 \text{\$412 PVNC} &= \text{PVB} - \text{AAV} - (\text{O/S } \text{\$412 bases} - \text{CB}) \\
 &= 279,613 - 50,000 - (0 - 20,000) \\
 &= 249,613
 \end{aligned}$$

## Fall 2001 EA-2A Exam Solutions

### Problem 18 - Page 2

Revised 10/14/03

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

$$\begin{aligned} s\ddot{a}_{55:10|} &= 1 + (1.05/1.07)^1 + \dots + (1.05/1.07)^9 \\ &= \ddot{a}_{10|j} \text{ where } 1+j = (1.07 / 1.05), j = 1.90\% \end{aligned}$$

The average pay weighted annuity is calculated by dividing the present value of earnings by the total earnings of 130,000.

<u>Description</u>	<u>Smith - Original data</u>	<u>Jones</u>	<u>Total</u>
01/2001 Age	35	55	
Temporary annuity	$s\ddot{a}_{35:30 }$ $= \ddot{a}_{30 .0190}$ $= 23.1248$	$s\ddot{a}_{55:10 }$ $= \ddot{a}_{10 .0190}$ $= 9.1995$	
PV of earnings	$30,000(23.1248)$ $= 693,743$	$100,000(9.1995)$ $= 919,946$	1,613,690
PVE / E	$= 1,613,690 / 130,000$ $= 12.4130$		
§412 NC	$= PVNC / (PVE/E)$ $= 249,613 / 12.4130$ $= 20,109$		
§412 Min	$= 1.07(NC - CB)$ $= 117$		

Now, you have to redo the calculations for Smith based on the revised data.



## Fall 2001 EA-2A Exam Solutions

### Problem 18 - Page 3

Revised 06/20/06

<u>Description</u>	<u>Smith - Revised data</u>	<u>Jones</u>	<u>Total</u>
01/2001 Age	45	55	
Past service	5	20	
Total service	25	30	
2001 pay	60,000	100,000	160,000
Age 64 pay	$60,000(1.05)^{19}$ = 151,617	$100,000(1.05)^9$ = 155,133	
Age 65 FAE3	$151,617(\ddot{a}_{\overline{3} .05} / 3)$ = 144,512	$155,133(\ddot{a}_{\overline{3} .05} / 3)$ = 147,863	
Projected benefit	$25(1\%)(144,512)$ = 36,128	$30(1\%)(147,863)$ = 44,359	
PV future benefits	$36,128(D_{65} / D_{45}) \ddot{a}_{65}^{(12)}$ $36,128(1.07)^{-20} (10.0)$ = 93,361	$44,359(D_{65} / D_{55}) \ddot{a}_{65}^{(12)}$ $44,359 (1.07)^{-10} (10.0)$ = 225,498	318,859
Temporary annuity	$S\ddot{a}_{\overline{35:30} }$ = $\ddot{a}_{\overline{20} .0190}$ = 16.8171	$S\ddot{a}_{\overline{55:10} }$ = $\ddot{a}_{\overline{10} .0190}$ = 9.1995	
PV of earnings	$60,000(16.8171)$ = 1,009,023	$100,000(9.1995)$ = 919,946	1,928,969

## Fall 2001 EA-2A Exam Solutions

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### Problem 18 - Page 4

Revised 10/14/03

$$\begin{aligned}\$412 \text{ PVNC} &= \text{PVB} - \text{AAV} - (\text{O/S } \$412 \text{ bases} - \text{CB}) \\ &= 318,859 - 50,000 - (0 - 20,000) \\ &= 288,859\end{aligned}$$

$$\begin{aligned}\text{PVE} / \text{E} &= 1,928,969 / 160,000 \\ &= 12.0561\end{aligned}$$

$$\begin{aligned}\$412 \text{ NC} &= \text{PVNC} / (\text{PVE}/\text{E}) \\ &= 288,859 / 12.0561 \\ &= 23,960\end{aligned}$$

$$\begin{aligned}\$412 \text{ Min} &= 1.07(\text{NC} - \text{CB}) \\ &= 4,237\end{aligned}$$

The effect of the data changes on the §412 Minimum is  $4,120 = 4,237 - 117$ .

**Answer is D**

NOTE: Due to the lengthy calculations, there are many ways to go wrong in this problem. It seems that there should be some way to shortcut the calculations, but I could not find any.

## Fall 2001 EA-2A Exam Solutions

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### Problem 19 - Page 1

The key to this problem is knowing how to handle the interest rate change for calculating the maximum deductible limit. This problem is less difficult due to the use of the Fresh start alternative for 2001. See 1998 EA-2 #34 and 1996 EA-2 #40 for more difficult problems on the change in interest rate and the maximum deductible limit.

The plan was established in 2000, so the contribution of 18,000 at 12/31/2000 is also the actuarial value of assets at 01/01. You are told that the contribution was less than the unfunded current liability for 2000. With no information on the participant count, the contribution could still exceed the deductible limit.

Any problem with a non-deductible contribution has to give you something specific that identifies why a portion of the contribution was not deducted. In the absence of any such information, you can assume that the entire contribution was deducted. This is based on the following exam condition:

"The employer is taxable, and all employer contributions for each prior plan year have been deducted by the employer for its tax year coincident with such plan year."

The first step for the deductible limit is calculating the normal cost plus limit adjustments. You are told to do this calculation under the fresh start alternative, which requires you to calculate a single ten year amortization for the entire Unfunded Actuarial Liability.

The §404 UAL will equal the §412 UAL, since there are no non-deductible contributions. Under the Frozen Initial Liability (FIL) method, the UAL is defined as equal to the expected UAL. Be careful to do the write-down using the 6% interest rate:

$$\begin{aligned} 6\% {}_e\text{UAL} &= 6\% {}_e\text{UAL} \\ &= (1+i) * (NC_0 + \text{UAL}_0) - (\text{contribution} + i) \\ &= 1.06(6,000 + 84,000) - 18,000 \\ &= 77,400 \end{aligned}$$

You also need to calculate the impact on the UAL due to the change in interest rate. This equals the change in the Entry Age Normal unfunded accrued liability, which would typically equal the change in the Entry Age Normal accrued liability.

$$\begin{aligned} \Delta \text{UAL} &= 7\% \text{EAN AL} - 6\% \text{EAN AL} \\ &= 85,000 - 93,000 \\ &= -8,000 \end{aligned}$$

$$\begin{aligned} 7\% \text{UAL} &= 77,400 - 8,000 \\ &= 69,400 \end{aligned}$$

**Problem 19 - Page 2****Revised 07/14/06**

Now that you have the UAL, you can calculate the normal cost under the FIL method. All these calculations are based on the new 7% valuation results.

$$\begin{aligned}\text{NC} &= \text{PVNC} / (\text{PVE}/\text{E}) \\ \text{PVNC} &= \text{PVB} - \text{AAV} - \text{UAL} \\ &= 136,000 - 18,000 - 69,400 \\ &= 48,600\end{aligned}$$

$$\begin{aligned}\text{PVE}/\text{E} &= 250,000 / 56,000 \\ &= 4.4643 \quad (\text{very low average annuity value!})\end{aligned}$$

$$\begin{aligned}\text{NC} &= \text{PVNC} / (\text{PVE}/\text{E}) \\ &= 48,600 / 4.4643 \\ &= 10,886\end{aligned}$$

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:

$$\begin{aligned}\text{Limit adjustment} &= 69,400 / \ddot{a}_{10|.07} \\ &= 9,235\end{aligned}$$

$$\begin{aligned}\text{Deductible limit} &= (10,886 + 9,235) * (1.07) \\ &= 21,529\end{aligned}$$

The second step is usually to check the Full Funding Limitation under §404. Since the UAL equals 69,400, it should be clear that the Full Funding Limitation will have no impact.

The only remaining step would be to compare the deductible limit to the minimum required contribution. If the minimum is greater than 21,529, then the deductible limit would equal the minimum required contribution.

You don't need to do any calculations to determine that the minimum is less than the deductible limit. Ignoring any credit balance, the minimum would use a 30 year amortization of the initial accrued liability, and a 10 year amortization of the 8,000 assumption change base. The final deductible limit is 21,529.

**Answer is C**

## Fall 2001 EA-2A Exam Solutions

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### Problem 20 - Page 1

Similar to EA-2 1996 #17

The key point of this problem is knowing that you must re-amortize the outstanding waiver base each year using the 150% FMR rate. In addition, you must assume that the employer contributes the waiver amortization during 2000. As described in §412(d)(1), you can't waive any amortization for prior waivers (you can't waive a waiver).

In this problem you are given values in 2000 and 2001 of 150% of the FMR, which should be used to calculate the amortization of all waivers each year. If these rates were not provided, you would rely on one of the general conditions of the exam that states that the default for the interest rate used to calculate the amortization of a waiver would equal the valuation interest rate.

You must write down the waiver outstanding bases at the waiver rate and valuation rate each year. You also must recalculate the end of year waiver amortization amount each year. When you write down the waiver base at the valuation rate each year, you assume that the contribution paid towards the base equals the end of year amortization at the waiver rate.

If the waiver interest rate is constant, you can write down the formula for the answer to the question. Assume that the waiver rate is  $j$ , and the valuation interest rate is 7%:

$$\begin{aligned}\text{End of year waiver amortization amount} &= W &= (1+j) * \text{WAIVER} \div \ddot{a}_{5|j} \\ \text{Waiver O/S base (at waiver rate) after } n \text{ years } (n < 5) &= \text{WAIVER} (1+j)^n - W s_{n|j} \\ \text{Waiver O/S base (at valuation rate) after } n \text{ years } (n < 5) &= \text{WAIVER} (1.07)^n - W s_{n|.07}\end{aligned}$$

Accumulated reconciliation account balance after  $n$  years ( $n < 5$ ):

$$[\text{WAIVER} (1+j)^n - W s_{n|j}] - [\text{WAIVER} (1.07)^n - W s_{n|.07}]$$

The initial waiver base of 100,000 is established at 01/01/2000. You should calculate the 12/31 amortization at the waiver rate. This is the amount of contribution that the employer is required to contribute at 12/31/00, even though they get a waiver for that year:

$$\begin{aligned}\text{12/31/00 Waiver amortization} &= 1.0943 * (100,000 / \ddot{a}_{5|.0943}) \\ &= 25,997\end{aligned}$$

$$\begin{aligned}\text{01/01/01 Waiver base at 7\%} &= 1.07(100,000) - 25,997 \\ &= 81,003\end{aligned}$$

## Fall 2001 EA-2A Exam Solutions

### Problem 20 - Page 2

Revised 10/14/03

You also need to calculate the amount of the waiver base that is set up at 01/01/2001. This equals the portion of the 2000 minimum contribution in excess of the amortization of the 01/01/2000 waiver base:

$$\begin{aligned} 01/01/01 \text{ New waiver base} &= 1.07(100,000 \text{ NC} + 600,000 / \ddot{a}_{30|.07}) \\ &= 155,352 \end{aligned}$$

The following tables summarize the calculations for both waiver bases. The values are shown in separate tables to make the numbers easier to follow:

Year	Waiver rate	01/00 Waiver base at waiver rate	Remaining Amortization period	12/31 amortization at waiver rate	01/00 Waiver base at 7% valuation rate
2000	9.43%	100,000	5	25,997	100,000
2001	8.47%	83,433	4	25,454	81,003
2002		65,046			61,219

Year	Waiver rate	01/01 Waiver base at waiver rate	Remaining Amortization period	12/31 amortization at waiver rate	01/01 Waiver base at 7% valuation rate
2001	8.47%	155,352	5	39,392	155,352
2002		129,118			126,834

The final accumulated reconciliation account balance is 6,111, calculated as  $(65,046 - 61,219) + (129,118 - 126,834) = 3,827 + 2,284$ .

**Answer is C**

There is a significant shortcut for calculating the ARA in this problem. It is almost as simple as the formula shown earlier for non-varying interest rates. You must calculate the O/S waiver bases (at the waiver rate) at 01/01/2000 and 01/01/2001. The impact on the ARA is simply the O/S waiver base times the difference in the waiver rate and the valuation rate of interest for that year:

$$\begin{aligned} 01/01 \text{ ARA} &= 100,000(9.43\% - 7.00\%) \\ &= 2,430 \end{aligned}$$

$$\begin{aligned} 01/02 \text{ ARA} &= 1.07(2,430) + (83,433 + 155,352)(8.47\% - 7.00\%) \\ &= 6,110 \end{aligned}$$

## Fall 2001 EA-2A Exam Solutions

### Problem 21

Similar to EA-2 1999 #24

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 8%, and re-determine the amortization of all three bases at the new 7% interest rate:

Amortization base	Remaining years	8% Outstanding base	New Amortization Amount at 7%
1-1-96 Initial AL	25 = 30-(101-96)	$449,622 = 39,000 * \ddot{a}_{\overline{25} .08}$	36,058
1-1-98 Plan base	27 = 30-(101-98)	$129,910 = 11,000 * \ddot{a}_{\overline{27} .08}$	10,129
1-1-01 Assump base	10 = 10-(101-101)	60,000	7,984

Now you must set up the MFSA for 2000, and solve for the credit balance at 12/31/00:

2000 Minimum Funding Standard Account			
Charges		Credits	
Normal Cost	90,000	Credit Balance	10,000
IAL amortization	39,000		
PLAN amortization	11,000	07/01 contribution	150,000
8% interest	11,200	8% interest	6,800
Total charges	151,200	Total credits	166,800

The interest on the charges is based on simple interest for half a year on the contribution:  $6,800 = .08(10,000) + .08(6/12)(150,000)$ . The resulting credit balance is 15,600. Now you can calculate the minimum contribution for 2001:

2001 Minimum Funding Standard Account			
Charges		Credits	
Normal Cost	100,000	Credit Balance	15,600
IAL amortization	36,058		
PLAN amortization	10,129		
ASSM amortization	7,984	12/31 minimum	x
7% interest	10,792	7% interest	1,092
Total charges	164,963	Total credits	x + 16,692

The minimum contribution payable 12/31/01 is  $148,271 = 164,963 - 16,692$ .

**Answer is B**

## Fall 2001 EA-2A Exam Solutions

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### Problem 22 - Page 1

Similar to EA-1B 2000 #05

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

You must allow for the unreduced early retirement benefits based on the sum of age plus service. The problem is unusual in that it gives you the projected benefit. You have to carefully allow for the maximum 25 years of benefit accrual service when you calculate the accrued benefits.

In general, under the Unit Credit method, you would expect a loss upon early retirement, unless the early retirement benefits are actuarially reduced. The Unit Credit accrued liability is defined as the present value of the actual accrued benefit. As an active employee, this is simply a deferred annuity calculation:

Description	<u>Smith</u>	<u>Jones</u>
01/2001 Age	62	62
Past service	26	16
Total service	29	19
Past benefit service	25	16
Total benefit service	25	19
Projected benefit	30,000	30,000
Accrued benefit	$(25/25)*30,000$ = 30,000	$(16/19)*30,000$ = 25,263
Age + past service	88	78
Early retirement factor	1.00	$1.00 - 5\%(65-62)$ = .85
Early retirement benefit	30,000	$.85*25,263$ = 21,474



## Fall 2001 EA-2A Exam Solutions

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### Problem 22 - Page 2

Now you need to calculate the two accrued liability values:

Retired AL = PV of Early retirement benefit

Active AL = PV of AB

Description	<u>Smith</u>	<u>Jones</u>
Early retirement benefit	30,000	21,474
Retired AL	$30,000 \ddot{a}_{62}^{(12)}$	$21,474 \ddot{a}_{62}^{(12)}$
	$= 30,000(8.84)$	$= 21,474(8.84)$
	$= 265,200$	$= 189,827$
Accrued benefit	30,000	25,263
Active AL	$30,000 (D_{65} / D_{62}) \ddot{a}_{65}^{(12)}$	$25,263 (D_{65} / D_{62}) \ddot{a}_{65}^{(12)}$
	$= 30,000(1.07)^{-3}(8.12)$	$= 25,263(1.07)^{-3}(8.12)$
	$= 198,850$	$= 167,453$

The accrued liability as a retiree is greater for both participants, so each produces a loss upon retirement at 01/01/01.

The loss is 88,724, calculated as  $(265,200 - 198,850) + (189,827 - 167,453)$ .

**Answer is D**

### Problem 23 - Page 1

Revised 10/14/03

Similar to problem 7, this problem on the exam has a salary scale, and a cost method given as Unit Credit. The key to this problem is knowing that the calculations must be performed using Projected Unit Credit, otherwise you don't have a reasonable funding method.

Another 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.

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

For an active employee, the benefit payments in the  ${}_eAL_1$  formula are zero. For a non-active employee, the normal cost in the  ${}_eAL_1$  formula is zero.

Now you need to calculate the normal cost and accrued liability under Projected Unit Credit (PUC) at 01/01/2000. Then you can use those values to calculate the expected accrued liability. The final step is calculation of the accrued liability at 01/01/2001.

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 54 at 01/01/00

Partic. service 1

1999 pay 52,000 NOTE: corresponds to age 53

Age 64 pay 80,052 = 52,000 (1.04)<sup>11</sup>

FAE3 at 65 77,012 = 80,052 ( $\ddot{a}_{\overline{3}|.04}$  / 3)

## Fall 2001 EA-2A Exam Solutions

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### Problem 23 - Page 2

Revised 10/14/03

The values of pay for 1997 and 1998 are not used, since the funding accrued benefit is based on projected pay.

$$\begin{aligned}FAB_0 &= 2\%(1)(77,012) \\ &= 1,540\end{aligned}$$

$$\begin{aligned}AL_0 &= PV(FAB_0) \\ &= 1,540 (D_{65} / D_{54}) \ddot{a}_{65}^{(12)} \\ &= 1,540 (1.07)^{-11} (9.24) \\ &= 6,761\end{aligned}$$

With no pre-retirement decrements, the  $D / D$  term is interest only.

$$\begin{aligned}{}_eFAB_1 &= 2\%(2)(77,012) \\ \Delta FAB_0 &= 2\%(1)(77,012) \\ &= 1,540\end{aligned}$$

$$\begin{aligned}NC_0 &= PV(\Delta FAB_0) \\ &= 6,761 \quad \text{(no calculation needed - same as accrued liability)}\end{aligned}$$

Finally, you can calculate the  ${}_eAL_1$

$$\begin{aligned}{}_eAL_1 &= (1+i)(NC_0 + AL_0) - (\text{actual benefit payments} + i) \\ &= 1.07(6,761 + 6,761) - 0 \\ &= 14,470\end{aligned}$$

Now you need to do similar calculations at 01/01/01 for the accrued liability. Then you can calculate the non-investment G/L.

Age 55 at 01/01/01

2000 pay 56,000 NOTE: corresponds to age 54

Age 64 pay 82,894 = 56,000  $(1.04)^{10}$

FAE3 at 65 79,746 = 82,894  $(\ddot{a}_{\overline{3}|.04} / 3)$

$$\begin{aligned}FAB_1 &= 2\%(2)(79,746) \\ &= 3,190\end{aligned}$$

$$\begin{aligned}AL_1 &= PV(FAB_1) \\ &= 3,190 (D_{65} / D_{55}) \ddot{a}_{65}^{(12)} \\ &= 3,190 (1.07)^{-10} (9.24) \\ &= 14,983\end{aligned}$$

The experience loss is 513 = 14,983 - 14,470.

**Answer is B**

### Problem 24 - Page 1

Revised 06/20/05

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

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

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

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

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

The effect of this provision with annual CBA is to delay for one year the amortization of both experience and shortfall gains and losses. The 2000 CBA expires 12/31/00, so it is treated as if it expires on 12/31/01 for purposes of determining amortization periods.

Neither the Shortfall G/L nor the experience G/L for 2000 would be amortized in 2001. The solution to the problem is made shorter, since you can skip the calculation of both the experience G/L and the Shortfall G/L for 2000.

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

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

## Fall 2001 EA-2A Exam Solutions

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### Problem 24 - Page 2

Revised 06/19/03

$$\begin{aligned}\text{Annual computation charge} &= 1.07 ( \text{NC} + \text{IAL} / \ddot{a}_{\overline{30}|.07} ) \\ &= 1.07( 36,000 + 300,000 / \ddot{a}_{\overline{30}|.07} ) \\ &= 62,696 \\ \text{Shortfall Gain} &= 62,696 [ ( 10,000 / 12,000 ) - 1 ] \\ &= - 10,449\end{aligned}$$

The Shortfall loss is 10,449.

**Answer is B**

NOTE:

The original answer key showed answer range E. To produce answer range E, it appears that the experience G/L for 2000 was used to determine the Shortfall G/L for 2001, and it was also incorrectly amortized over 5 years.

Since the estimated base units were equal to the actual base units in 2000, there was no shortfall G/L in 2000. The §412 equation of balance can be used to determine the experience G/L base that is established at 1/1/2001:

$$\begin{aligned}\text{UAL} &= \text{O/S §412 bases} - \text{credit balance} - \text{ARA} \\ 315,000 &= 300,000 ( \ddot{a}_{\overline{29}|.07} / \ddot{a}_{\overline{30}|.07} ) + \text{LOSS} - 3,600 - 0 \\ \text{LOSS} &= 315,000 - 296,824 + 3,600 \\ &= 21,776\end{aligned}$$

This is the correct calculation of the experience loss base. Based on 1.412(c)(1)-2(g)(2)(i), the annual CBA that expires at 12/31/2000 is treated as if it is renewed for 12 months, and thus has an expiration date at 12/31/2001.

The experience loss base should be increased with interest during 2001, and amortized starting 1/1/2002. Here is the result if it is incorrectly amortized over 5 years, and incorrectly starting 1/1/2001:

$$\begin{aligned}\text{Annual computation charge} &= 1.07 ( \text{NC} + \text{IAL} / \ddot{a}_{\overline{30}|.07} + \text{Loss} / \ddot{a}_{\overline{5}|.07} ) \\ &= 1.07( 36,000 + 300,000 / \ddot{a}_{\overline{30}|.07} + 21,776 / \ddot{a}_{\overline{5}|.07} ) \\ &= 68,007 \\ \text{Shortfall Gain} &= 68,007 [ ( 10,000 / 12,000 ) - 1 ] \\ &= -11,334\end{aligned}$$

**Incorrect answer is E**

## Fall 2001 EA-2A Exam Solutions

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### Problem 25

The key to this problem is understanding how a cash balance plan works, so you can calculate the withdrawal 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 present value of the withdrawal benefits. There are three terms in the summation, which represent withdrawal at ages 30, 31, and 32. The withdrawal decrements are assumed to occur at the beginning of the year:

$$\text{PV of W/D benefits} = \sum_{t=0}^2 v^t {}_t p_{30}^{(T)} q_{30+t}^{(w)} (\text{Cash balance}_{30+t})$$

Let  $\text{CB}_{30+t}$  represent the cash balance account at age  $30+t$

$$\text{PV of W/D benefits} = (1.07)^0 q_{30}^{(w)} \text{CB}_{30} + (1.07)^{-1} {}_1 p_{30}^{(T)} q_{31}^{(w)} \text{CB}_{31} + (1.07)^{-2} {}_2 p_{30}^{(T)} q_{32}^{(w)} \text{CB}_{32}$$

Now you need to calculate the cash balance account at each age:

t	Date	Age 30+t	CB at 30+t	Pay at 30+t	Interest credit	Pay credit
0	1/1/2001	30	0	30,000	0	1,200
1	1/1/2002	31	1,200	30,900	72	1,236
2	1/1/2003	32	2,508			

You really only have two terms in the summation, since the cash balance is zero when the participant is hired at age 30.

$$\begin{aligned} \text{PV of W/D benefits} &= 0 + .9346(.70)(.20)(1,200) + .8734(.70)(.80)(.10)(2,508) \\ &= 157.01 + 122.67 \\ &= 279.68 \end{aligned}$$

**Answer is A**

## Fall 2001 EA-2A Exam Solutions

### Problem 26 - Page 1

Similar to EA-2 1997 #36

Revised 06/20/06

To calculate the required quarterly contribution for 2001, you must first calculate the required annual payment (RAP). This is the lesser of last year's minimum required contribution or 90% of this year's. These numbers are both interest adjusted to the first day of this plan year, and they both would not reflect any credit balance.

You are given the normal cost and net §412 amortization charges for 2000 and 2001, both as of the valuation dates:

$$\begin{aligned} 12/31/00 \text{ "MFSA excluding CB"} &= (\$412 \text{ NC} + \$412 \text{ amort} - 0) * 1.07 = 395,900 \\ 01/01/01 \text{ "MFSA excluding CB"} &= (\$412 \text{ NC} + \$412 \text{ amort} - 0) = 395,000 \end{aligned}$$

$$\text{Lesser of 2000 or 90\% of 2001} = \text{Lesser of } (395,900 \text{ or } .90 * 395,000) = 355,500$$

The required quarterly installment is based on the applicable percentage multiplied by the RAP, which is  $25\%(355,500) = 88,875$ .

You are given the credit balance at 12/31/00 as 50,000. You may use this credit balance like an employer contribution for a required quarterly installment, but only if the contribution that creates the credit balance is actually in the trust fund at the installment date. The problem states that no contribution was required for 2000, which means there was a very large credit balance at 01/01/00.

Date	Required	Amount Available	Overpayment (Underpayment)
01/01/01		50,000	50,000
04/15/01	88,875	$50,000 * [1 + (.07)(3.5/12)]$ $= 51,021$	$51,021 - 88,875$ $= (37,854)$
07/15/01	88,875	0	(88,875)
10/15/01	88,875	0	(88,875)
01/15/02	88,875	0	(88,875)

The interest penalty is calculated based on the period of the underpayment, and is applied to the amount of the underpayment. The final 2001 contribution will not be paid until 02/15/02, so the periods are 10 months for the first underpayment, 7 months for the second underpayment, and so on. Using simple interest, the interest penalty is calculated as follows:

Pmt date	Period	Amount	Penalty interest	Valuation interest	Penalty
04/15/01	10 months	$37,854 *$	$[ (1 + (.0991)(10/12)) - (1 + (.07)(8.5/12)) ]$		$= 1,249$
07/15/01	7 months	$88,875 *$	$[ (1 + (.0991)(07/12)) - (1 + (.07)(5.5/12)) ]$		$= 2,286$
10/15/01	4 months	$88,875 *$	$[ (1 + (.0991)(04/12)) - (1 + (.07)(2.5/12)) ]$		$= 1,640$
01/15/02	1 months	$88,875 *$	$[ (1 + (.0991)(01/12)) - (1 + (.07)(0/12)) ]$		$= 734$
					<u>5,909</u>

## Fall 2001 EA-2A Exam Solutions

### Problem 26 - Page 2

As shown above, when the underpayment period extends beyond the end of the plan year, interest at the valuation rate is only credited to the end of the plan year. The 175% of the F.M.R. continues to accrue to the date of payment.

**Answer is B**

Compound interest is “harder”. Since the time period is less than one year, it produces a smaller payment, and a larger underpayment:

Date	Required	Amount Available	Overpayment (Underpayment)
01/01/01		50,000	50,000
04/15/01	88,875	$50,000 * (1.07)^{3.5/12}$ = 50,996	50,996 - 88,875 = (37,879)
07/15/01	88,875	0	(88,875)
10/15/01	88,875	0	(88,875)
01/15/02	88,875	0	(88,875)

The interest penalty is calculated based on the period of the underpayment, and is applied to the amount of the underpayment. Using compound interest, the interest penalty is calculated as follows:

<u>Pmt date</u>	<u>Period</u>	<u>Amount</u>	<u>Penalty interest</u>	<u>Valn interest</u>	<u>Penalty</u>
04/15/01	10 months	37,879 *	$[(1.0991)^{10/12} - (1.07)^{8.5/12}]$		= 1,244
07/15/01	7 months	88,875 *	$[(1.0991)^{7/12} - (1.07)^{5.5/12}]$		= 2,237
10/15/01	4 months	88,875 *	$[(1.0991)^{4/12} - (1.07)^{2.5/12}]$		= 1,582
01/15/02	1 months	88,875 *	$[(1.0991)^{1/12} - (1.07)^{0/12}]$		= 703
					<u>5,766</u>

The resulting penalty is in the same range, as it must be.



## Fall 2001 EA-2A Exam Solutions

### Problem 27 - Page 1

Similar to EA-2 2000 #43

Revised 07/14/06

Since the Funded Current Liability percentage is less than 100% at 01/01/00, the plan is subject to quarterly contributions for 2001.

A key point of this problem is that you can use the credit balance at 12/31/00 to meet the quarterly contribution requirement for 2001. You need to set up the MFSA for 2000 to calculate the credit balance at 12/31/00.

2000 Minimum Funding Standard Account			
Charges		Credits	
Normal Cost	100,000	Credit Balance	5,000
Net amortization	25,000	04/15/00 contribution	125,000
7% interest	8,750	7% interest	6,548
Total charges	133,750	Total credits	136,548

With a UAL of 200,000, it should be clear that the Full Funding Limitation will have no effect. The credit balance at 12/31/00 is  $2,798 = 136,548 - 133,750$ . The interest on the credits of 6,548 is calculated using simple interest on the 04/15/00 contribution:

$$6,548 = .07(5,000) + .07(8.5/12)(125,000)$$

To calculate the required quarterly contribution for 2001, 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 components of the minimum contribution for both 2000 and 2001. Since you are told that no bases were fully amortized, and there was no G/L for 2000, the net amortization will be 25,000 for 2001. If there was an additional funding charge for either year, it would affect the calculation of the RAP.

$$\begin{aligned} 12/31/00 \text{ "MFSA excluding CB"} &= (100,000 \text{ NC} + 25,000) * 1.07 &= 133,750 \\ 01/01/01 \text{ "MFSA excluding CB"} &= (120,000 \text{ NC} + 25,000) &= 145,000 \end{aligned}$$

$$\text{Lesser of 1999 or 90\% of 2000} = \text{Lesser of } (133,750 \text{ or } .90 * 145,000) = 130,500$$

The required quarterly installment is based on the applicable percentage multiplied by the RAP, which is  $25\%(130,500) = 32,625$ .

## Fall 2001 EA-2A Exam Solutions

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### Problem 27 - Page 2

You may use the 01/01/01 credit balance like an employer contribution for a required quarterly installment, but only if the contribution that creates the credit balance is actually in the trust fund at the installment date.

The problem states that the 125,000 contribution was paid at 04/15/00, so you can apply the credit balance towards the 04/15/01 required quarterly installment. You could use it in exactly the same manner, even if the contribution was paid at 04/15/01.

Date	Required	Amount Available	Overpayment (Underpayment)
01/01/01		2,798	2,798
04/15/01	32,625	$2,798 * [1 + (.07)*(3.5/12)]$ = 2,855	$32,625 - 2,855$ = (29,770)

The final underpayment at 04/15/01 represents the amount the employer must contribute at that date to avoid any late quarterly contribution penalty.

**Answer is B**

Note that in prior years, the wording of the final question was slightly different. For example in EA-2 2000 #43, the question was "In what range is the smallest additional contribution for 2000 that must be paid on 1/15/2001 to avoid an additional interest charge for 2000 due to late quarterly contributions?"

Compound interest is "harder". Since the time period is less than one year, it produces a smaller payment, and a larger underpayment. The amount of the credit balance is also lower. The credit balance at 12/31/00 is calculated as follows:

$$2,736 = 1.07(5,000) + (125,000)(1.07)^{8.5/12} - 133,750.$$

Date	Required	Amount Available	Overpayment (Underpayment)
01/01/01		2,736	2,736
04/15/01	32,625	$2,736 * (1.07)^{3.5/12}$ = 2,791	$32,625 - 2,791$ = (29,834)

The final contribution due at 04/15/01 is 29,834, which still falls in answer range B.

### Problem 28 - Page 1

Revised 10/14/03

Similar to problem 7, this problem on the exam has a salary scale, and a cost method given as Unit Credit. The key to this problem is knowing that the calculations must be performed using Projected Unit Credit, otherwise you don't have a reasonable funding method.

Another 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.

Now you need to calculate the normal cost and accrued liability under Projected Unit Credit (PUC) at 01/01/2001. Then you can use those values to calculate the unfunded accrued liability. The final step is setting up the method change base at 01/01/2001, and completing the Minimum Funding Standard Account, and the minimum contribution.

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.

## Fall 2001 EA-2A Exam Solutions

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### Problem 28 - Page 2

Age 55 at 01/01/01  
Past service 5  
2001 pay 150,000  
Age 64 pay  $213,497 = 150,000 (1.04)^9$

Be careful that you don't actually use that projected pay. It should be limited by 401(a)(17) to 170,000. The prior two years' pay would also each be limited to 170,000:

FAE3 at 65 170,000 limited by 401(a)(17)

$$\begin{aligned} \text{FAB}_0 &= 5\%(5)(170,000) \\ &= 42,500 \end{aligned}$$

$$\begin{aligned} \text{AL} &= \text{PV}(\text{FAB}_0) \\ &= 42,500 (D_{65} / D_{55}) \ddot{a}_{65}^{(12)} \\ &= 42,500 (1.07)^{-10} (9.24) \\ &= 199,629 \end{aligned}$$

With no pre-retirement decrements, the  $D / D$  term is interest only.

$$\begin{aligned} {}_c\text{FAB}_1 &= 5\%(6)(170,000) \\ \Delta\text{FAB}_0 &= 5\%(1)(170,000) \\ &= \text{FAB}_0 / 5 \end{aligned}$$

This is a minor shortcut - you can simply pro-rate the accrued liability to get the normal cost:

$$\begin{aligned} \text{NC} &= \text{PV}(\Delta\text{FAB}_0) \\ &= \text{PV}(\text{FAB}_0 / 5) \\ &= 199,629 / 5 \\ &= 39,926 \end{aligned}$$

Now that you have the accrued liability, you can derive the method change base so the equation of balance is met:

$$\begin{aligned} \text{PUC UAL} &= \text{O/S } \$412 \text{ bases} + \text{Method base} - \text{CB} - \text{ARA} \\ \text{PUC UAL} &= 199,629 - 135,000 \\ &= 64,629 \end{aligned}$$

Under the Aggregate method, the O/S §412 bases are usually zero.

$$\begin{aligned} 64,629 &= \text{Zero O/S bases} + \text{Method base} - 0 - 0 \\ \text{Method} &= 64,629 \end{aligned}$$

## Fall 2001 EA-2A Exam Solutions

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### Problem 28 - Page 3

Revised 07/14/06

The amortization period for all cost method change amortization bases specified in Revenue Procedure 2000-40 is 10 years.

$$\text{Method amortization} = 64,629 / \ddot{a}_{10|.07} = 8,600$$

Now you can calculate the minimum contribution:

2001 Minimum Funding Standard Account			
Charges		Credits	
Normal Cost	39,926	Credit Balance	0
Method amortization	8,600	01/01/01 contribution	x
7% interest	<u>3,397</u>	7% interest	<u>.07x</u>
Total charges	51,923	Total credits	1.07x

You should at least think about the §412 Full Funding Limitation. Since the UAL equals 64,629, it should be clear that the Full Funding Limitation will have no impact.

The minimum contribution at 01/01/01 is  $48,525 = 51,923 / 1.07$ . Specifying the minimum contribution at the beginning of the year is a "cheap trick".

**Answer is C**

## Fall 2001 EA-2A Exam Solutions

### Problem 29

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

The assumption change base will be amortized over 30 years instead of 10 years. The G/L base will be amortized over 15 years.

$$\begin{aligned}\text{EAN UAL} &= \text{AL} - \text{AAV} \\ &= \text{AL} - 700,000\end{aligned}$$

$$\begin{aligned}\text{EAN UAL} &= \text{O/S } \$412 \text{ bases} - \text{CB} - \text{ARA} \\ &= \text{O/S } \$412 \text{ bases} - 55,000\end{aligned}$$

$$\begin{aligned}\text{AL} &= \text{EAN UAL} + 700,000 \\ &= \text{O/S } \$412 \text{ bases} - 55,000 + 700,000\end{aligned}$$

Amortization base	Remaining years	Amortization charge	7% Outstanding base
1-1-96 Initial AL	25 = 30-(101-96)	90,000	$1,122,240 = 90,000 * \ddot{a}_{25 .07}$
1-1-97 Assump base	26 = 30-(101-97)	30,000	$379,607 = 30,000 * \ddot{a}_{26 .07}$
1-1-98 Plan base	27 = 30-(101-98)	50,000	$641,289 = 50,000 * \ddot{a}_{27 .07}$
1-1-00 Loss base	14 = 15-(101-100)	40,000	$374,306 = 40,000 * \ddot{a}_{14 .07}$
1-1-01 Gain base	15 = 15-(101-101)		(20,000)
<b>TOTAL</b>			<b>2,497,443</b>

$$\begin{aligned}\text{AL} &= 2,497,442 + 645,000 \\ &= 3,142,443\end{aligned}$$

**Answer is C**

## Fall 2001 EA-2A Exam Solutions

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### Problem 30 - Page 1

The key point to this problem is the calculation of the unpredictable contingent event amount. This is the first time that calculation was tested on the exam.

The unpredictable contingent event amount is defined in §412(l)(5) as the greater of

- (i) (Applicable percentage) times (100% - Funded current liability %) times Unpredictable contingent event benefits
- (ii) 7 year amortization of the Unpredictable contingent event liability
- (iii) Application of formula for Unfunded New Liability Amount to the amount of Unpredictable contingent event liability

You are given the "transition percentage" as 100%. If you refer to §412(l)(5)(B), you'll see that the applicable percentage is 100% starting in 2001 also. Several students noted that this problem was "defective", probably due to this typographical error - you should have been given the applicable percentage under §412(l)(5)(B).

Items (i) and (iii) above are based on items that are calculated as part of the Deficit Reduction Contribution. It makes sense to do those calculations first, then do the unpredictable contingent event amount.

The DRC is defined as the sum of the unfunded old liability amount (UOLA), the unfunded new liability amount (UNLA), and current liability normal cost.

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

$$\begin{aligned}\text{UCL} &= \text{CL} - (\text{AAV} - \text{CB}) \\ &= 3,000,000 - [1,475,000 - 0] \\ &= 1,525,000\end{aligned}$$

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 not given the UOL, but you are given the UNLA. You must use the UNLA to solve for the Unfunded New Liability.

## Fall 2001 EA-2A Exam Solutions

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### Problem 30 - Page 2

The UNLA is defined as the unfunded new liability times the "applicable percentage", which is 30% - 40% (FCL% - 60%) under RPA '94. In this problem, you must calculate this percentage. In calculating the FCL%, any debit balance is treated as a zero CB. Based on the Schedule B instructions, the FCL% should be rounded to the nearest .01%.

$$\begin{aligned}\text{FCL\%} &= (\text{AAV} - \text{CB}) / \text{CL} \\ &= [1,475,000 - 0] / 3,000,000 \\ &= 49.17\%\end{aligned}$$

$$\begin{aligned}\text{APP\%} &= .30 - .40 [ .4917 - .60 ] \\ &= 30.0\%\end{aligned}$$

Since the FCL% is less than 60%, the offset is limited to zero, and the applicable percentage is limited to 30%.

$$\begin{aligned}\text{UNLA} &= 150,000 \\ &= \text{UNL} * 30\% \\ \text{UNL} &= 150,000 / 30\% \\ &= 500,000\end{aligned}$$

Now you can derive the value of the UOL, and the UOLA:

$$\begin{aligned}\text{UOL} &= \text{UCL} - \text{UNL} - \text{UCEL} \\ &= 1,525,000 - 500,000 - 325,000 \\ &= 700,000\end{aligned}$$

The UOLA equals the amortization of the remaining portion of the unfunded old liability (UOL) over a period that was 18 years at 1-1-89, at the 6.1% current liability interest rate. At 01/01/2001, the remaining period is 6 years = 18-(2001-1989).

$$\begin{aligned}\text{UOLA} &= \text{UOL} / \ddot{a}_{\overline{6}|.061} \\ &= 700,000 / 5.2009 \\ &= 134,591\end{aligned}$$

$$\begin{aligned}\text{DRC} &= \text{UOLA} + \text{UNLA} + \text{CLNC} \\ \text{DRC} &= 134,591 + 150,000 + 75,000 \\ &= 359,591\end{aligned}$$



## Fall 2001 EA-2A Exam Solutions

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### Problem 30 - Page 3

Now you can finish the calculation of the UCEA. The unpredictable contingent event amount is defined in §412(l)(5) as the greater of

- (i) (Applicable percentage) times (100% - Funded current liability %) times Unpredictable contingent event benefits
- (ii) 7 year amortization of the Unpredictable contingent event liability
- (iii) Application of formula for Unfunded New Liability Amount to the amount of Unpredictable contingent event liability

Based on the Schedule B instructions, item (i) should be calculated using the benefits paid during the plan year, attributable to the unpredictable contingent event.

- |       |                                    |        |
|-------|------------------------------------|--------|
| (i)   | $100\% (1 - 49.17\%)(65,000)$      | 33,040 |
| (ii)  | $325,000 / \ddot{a}_{7 0.061}$     | 55,067 |
| (iii) | UNLA formula gives $30\%(325,000)$ | 97,500 |

The greatest of the three numbers is 97,500. The sum of the DRC and the UCEA is  $457,091 = 359,591 + 97,500$ .

**Answer is D**

The problem said the employer elected not to apply the special first-year rule of §412(l)(5)(D). If it did not say that, clause (i) would be multiplied by 150%, and no other calculations would be made. The UCEA would equal 49,559.

## Fall 2001 EA-2A Exam Solutions

### Problem 31

Similar to EA-1B 2000 #15

Revised 10/14/03

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

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

The point of the problem is that the projected benefit changed at 01/01/1995, and at 01/01/2001. You need to calculate two layers of normal cost that those two dates.

Hire Age 25 at 01/01/86

Total service 40 years

#### Normal cost calculation date

	01/01/95	01/01/01
Age	34	40
Total service	40	40
Projected benefit	12(\$20)(40) = 9,600	12(\$25)(40) = 12,000
$\Delta$ Projected benefit	9,600 <sup>‡</sup>	2,400
PV ( $\Delta$ Projected Benefit)	$9,600(D_{65} / D_{34}) \ddot{a}_{65}^{(12)}$ $= 9,600 v^{31} \ddot{a}_{65}^{(12)}$	$2,400(D_{65} / D_{40}) \ddot{a}_{65}^{(12)}$ $= 2,400 v^{25} \ddot{a}_{65}^{(12)}$
$\Delta$ Normal cost	$9,600 v^{31} \ddot{a}_{65}^{(12)} / \ddot{a}_{34:31 }$ $= 9,600 v^{31} \ddot{a}_{65}^{(12)} / \ddot{a}_{31 .07}$ $= 9,600 \ddot{a}_{65}^{(12)} / \ddot{s}_{31 .07}$	$2,400 v^{25} \ddot{a}_{65}^{(12)} / \ddot{a}_{40:25 }$ $= 2,400 v^{25} \ddot{a}_{65}^{(12)} / \ddot{a}_{25 .07}$ $= 2,400 \ddot{a}_{65}^{(12)} / \ddot{s}_{25 .07}$
Annuity certain value	109.2182	67.6765
$\Delta$ Normal cost	868	350
Total normal cost	868	1,218

<sup>‡</sup>NOTE: Some students don't like this identification of the initial normal cost layer. I consider that their benefit increases from zero to 9,600 when the plan is established.

**Answer is C**

## Fall 2001 EA-2A Exam Solutions

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### Problem 32 - Page 1

Revised 10/14/03

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 01/01/2000 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	<b>1/1/2000</b>
Age	46
Past service	11
Total service	30

$$\begin{aligned}\text{Accrued Benefit} & 11(12)(\$40) \\ & = 5,280\end{aligned}$$

$$\begin{aligned}\text{Unit Credit} \\ \text{Accrued Liability} & 5,280 (D_{65} / D_{46}) \ddot{a}_{65}^{(12)} \\ & 5,280 (1.07)^{-19} (8.74) \\ & = 12,760\end{aligned}$$

$$\text{Projected Benefit} \quad 30(12)(\$40)$$

$$\begin{aligned}\text{Projected Liability} & (30/11)(12,760) \\ & = 34,800\end{aligned}$$

The next step is the AAN valuation at 01/01/2000:

$$\begin{aligned}\text{PVNC} & = \text{PVB} - \text{UAL} - \text{AAV} \\ & = 34,800 - 12,760 - 0 \\ & = 22,040\end{aligned}$$

$$\begin{aligned}\text{AAN NC} & = \text{PVNC} / (\text{PVL}/L) \\ & = 22,040 / \ddot{a}_{46:\overline{19}|} \\ & = 22,040 / \ddot{a}_{19|\overline{.07}|} \\ & = 1,993\end{aligned}$$

## Fall 2001 EA-2A Exam Solutions

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### Problem 32 - Page 2

Revised 10/14/03

The minimum contribution for 2000 is based on a 30 year amortization of the IAL:

$$\begin{aligned} 01/01/00 \text{ min} &= NC + IAL / \ddot{a}_{\overline{30}|.07} \\ &= 1,993 + 12,760 / 13.2777 \\ &= 2,954 \end{aligned}$$

### 01/01/2001 Valuation

You need to write down the UAL from 2000 to 2001 to calculate the normal cost at 01/01/2001.

$$\begin{aligned} 01/01 \text{ UAL} &= {}_e\text{UAL} \\ &= (1+i)(NC_0 + \text{UAL}_0) - (\text{contribution} + \text{interest}) \\ &= 1.07(1,993 + 12,760) - (1.07)(1,993 + 961) \\ &= 12,625 \end{aligned}$$

Since the minimum contribution was paid for 2000, you could also calculate this UAL using the equation of balance. Using this approach, you would not need to calculate the amount of the 01/01/2000 minimum:

$$\begin{aligned} \text{UAL} &= \text{O/S } \$412 \text{ bases} - \text{CB} - \text{ARA} \\ &= 12,760 \left( \ddot{a}_{\overline{29}|.07} / \ddot{a}_{\overline{30}|.07} \right) - 0 - 0 \\ &= 12,625 \end{aligned}$$

$$\begin{aligned} 01/01 \text{ PVB} &= {}_e\text{PVB} \quad (\text{only had investment G/L}) \\ &= (1+i)(\text{PVB}_0) - (\text{actual BP} + \text{interest}) \\ &= 1.07(34,800) - 0 \\ &= 37,236 \end{aligned}$$

$$\begin{aligned} \text{PVNC} &= \text{PVB} - \text{UAL} - \text{AAV} \\ &= 37,236 - 12,625 - 2,700 \\ &= 21,911 \end{aligned}$$

$$\begin{aligned} \text{AAN NC} &= \text{PVNC} / (\text{PVL/L}) \\ &= 21,911 / \ddot{a}_{\overline{47:18}|} \\ &= 21,911 / \ddot{a}_{\overline{18}|.07} \\ &= 2,036 \end{aligned}$$

**Answer is B**

## Fall 2001 EA-2A Exam Solutions

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### Problem 32 - Page 3

Another method for working this problem is to attack it as a gain / loss problem. If there were no investment G/L, then the normal cost would be level. You can determine the amount of the investment G/L, and adjust the expected normal cost:

#### 01/01/2001 Valuation

$$\begin{aligned} 01/01 \text{ } {}_e\text{AAV} &= 1.07(\text{AAV}_0) \\ &= 1.07(2,954) \\ &= 3,161 \end{aligned}$$

$$\begin{aligned} \text{Loss} &= 3,161 - 2,700 \\ &= 461 \end{aligned}$$

$$\begin{aligned} 01/01 \text{ } {}_e\text{NC} &= \text{NC}_0 \\ 01/01 \text{ NC} &= {}_e\text{NC} + \text{Loss} / (PVL/L) \\ &= 1,993 + 461 / \ddot{a}_{18|.07} \\ &= 2,036 \end{aligned}$$

**Answer is B**

## Fall 2001 EA-2A Exam Solutions

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### NOTE:

**This topic is no longer on the EA-2A exam. It was moved to the EA-2B exam in 2002.**

### Problem 33 - Page 1

Similar to EA-2 1998 #38
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#### Credit balance allocation

Revenue Ruling 81-212 contains acceptable methods used to allocate Minimum Funding Standard Account items when a plan is spun off into two or more plans. Revenue Ruling 86-47 contains different rules which must be used when the market value of assets exceeds the present value of benefits on a termination basis (before the plan is spun off), or when one of the spun off plans has a zero UAL.

RR 86-47 requires the allocation of the credit balance in a specific manner:

1. Determine the lesser of (MVA - CB) or PV of accrued benefits for the single plan.
2. Allocate the lesser amount between the spun-off plans on a termination basis.
3. Calculate the excess of the market value of assets allocated to each plan over the amount allocated in step 2
4. The credit balance is allocated based on the excess calculated in step 3

For Plan A, the MVA less CB is 440,000 - 80,000, or 360,000. The PV of accrued benefits is 350,000, which is less. You already have the values for PVAB allocated on a plan termination basis. What you need to complete the allocation of the credit balance is the allocated market value of assets.

#### Market value allocation

IRC §414(l)(2) contains provisions for allocating assets to spun off plans when the assets exceed the present value of accrued benefits on a termination basis, and when the spun off plans are members of the same controlled group. Since the plan sponsor continues to maintain both plans B and C, they remain members of the same controlled group.

You must allocate the "applicable percentage" of the "excess assets" to each spun off plan. The "excess assets" equal the excess of the market value of assets over the present value of accrued benefits on a termination basis. In this problem, the excess assets equal  $440,000 - 350,000 = 90,000$ .

The "applicable percentage" is the ratio for a spun off plan to the total (for the original plan) of the excess, if any, of (I) the lesser of 160% of Current Liability or (normal cost plus accrued liability), over (II) the present value of accrued benefits on a termination basis. This problem gives you the values for the liability component of the Full Funding Limitation.

## Fall 2001 EA-2A Exam Solutions

### Problem 33 - Page 2

	Total Plan A	Plan B	Plan C
Liability component of FFL, lesser (1) of 160% CL or EAN AL	500,000	350,000	150,000
(2) PV of AB on termination basis	350,000	225,000	125,000
(3) Excess of (1) over (2)	150,000	125,000	25,000
(4) Applicable percentage	100%	83.33%	16.67%
(5) Allocated excess assets	90,000	75,000	15,000
(6) Total allocated assets (2)+(5)	440,000	300,000	140,000

Once you have the total market value of assets, you can finish the allocation of the credit balance:

	Total Plan A	Plan B	Plan C
(1) Allocated market value	440,000	300,000	140,000
(2) PV of AB on termination basis	350,000	225,000	125,000
(3) Excess of (1) over (2)	90,000	75,000	15,000
(4) Applicable percentage	100%	83.33%	16.67%
(5) Allocated credit balance	80,000	66,667	13,333
(6) Market value minus credit balance	360,000	233,333	126,667

The market value minus the credit balance for plan C is 126,667.

**Answer is C**

There is a minor shortcut available for this type of problem, where the PV of AB on termination basis is less than the market value minus the credit balance. In that situation, the allocation percentage for the credit balance will always equal the allocation percentage for the excess assets at spinoff. We could have simply added these two rows to the first table shown above:

	Total Plan A	Plan B	Plan C
(7) Allocated credit balance using (4)	80,000	66,667	13,333
(8) Market value minus credit balance	360,000	233,333	126,667

## Fall 2001 EA-2A Exam Solutions

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### Problem 34

Revised 10/14/03

The key to this problem is knowing how to handle the change in the interest rate under §412. You have to determine the outstanding amount of several §412 bases at 7%, and re-determine the amortization of all three bases at the new 8% interest rate.

You are given the Initial Accrued Liability (IAL) at 01/01/93. You can calculate the outstanding amount of the §412 base at 01/01/01. Eight years have passed since the plan's effective date, so there are 22 years of amortization payments remaining:

$$\begin{aligned}\text{IAL base} &= 110,000 * \ddot{a}_{\overline{22}|.07} / \ddot{a}_{\overline{30}|.07} \\ &= 98,052\end{aligned}$$

The problem tells you to handle the assumption change before the plan amendment. The Assumption change base is the excess of the second accrued liability over the first accrued liability given. The Plan change base is the excess of the third accrued liability over the second accrued liability given:

$$\begin{aligned}\text{Assump base} &= 180,000 - 202,000 \\ &= (22,000)\end{aligned}$$

$$\begin{aligned}\text{Plan chg base} &= 248,000 - 180,000 \\ &= 68,000\end{aligned}$$

Amortization base	Remaining years	Outstanding Base	New Amortization Amount at 8%
1-1-1993 Initial AL	22 = 30-(101-93)	98,052	8,900
1-1-2001 Assump base	10 = 10-(101-101)	(22,000)	(3,036)
1-1-2001 Plan base	30 = 30-(101-101)	68,000	5,593
<b>TOTAL</b>			<b>11,457</b>

**Answer is B**

NOTE: The problem did not need to tell you which order to handle the effect of the changes at 01/01/2001. You could not measure the plan amendment first, since you are not given the accrued liability based on the new formula and old assumptions.



## Fall 2001 EA-2A Exam Solutions

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### Problem 35 - 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 the market value of assets. The key point of this problem is that you should check for experience gains or losses each year.

You must use the actuarial equation of balance to determine the expected unfunded accrued liability (UAL) at 01/01/2001:

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

You must develop the credit balance at 12/31/2000, based on the information given:

2000 Minimum Funding Standard Account			
Charges		Credits	
Normal Cost	9,000	Credit Balance	20,000
Net amortizations	8,000	12/31/00 contribution	12,000
7% interest	1,190	7% interest	1,400
Total charges	18,190	Total credits	33,400

The credit balance at 12/31/00 is  $15,210 = 33,400 - 18,190$ . You can write down the outstanding \$412 bases from 01/01/2000:

$$\text{O/S } \$412 \text{ bases (excl G/L)} = 93,090 = 1.07(95,000 - 8,000)$$

$$\begin{aligned}\text{eUAL} &= \text{O/S } \$412 \text{ bases} - \text{CB} - \text{ARA} \\ &= 93,090 - 15,210 - 0 \\ &= 77,880\end{aligned}$$

$$\begin{aligned}\text{UAL} &= \text{AL} - \text{AAV} \\ &= 530,000 - 420,000 \\ &= 110,000\end{aligned}$$

$$\begin{aligned}\text{Loss} &= \text{UAL} - \text{eUAL} \\ &= 110,000 - 77,880 \\ &= 32,120\end{aligned}$$

$$\begin{aligned}\text{Loss amort} &= 32,120 / \ddot{a}_{\overline{5}|.07} \\ &= 7,321\end{aligned}$$

## Fall 2001 EA-2A Exam Solutions

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### Problem 35 - Page 2

Revised 07/14/06

Now you can calculate the 12/31/2001 minimum contribution:

2001 Minimum Funding Standard Account			
Charges		Credits	
Normal Cost	10,500	Credit Balance	15,210
Net amortizations	8,000		
Loss amortization	7,321	12/31/01 contribution	x
7% interest	1,807	7% interest	1,065
Total charges	<u>27,629</u>	Total credits	<u>x + 16,275</u>

You should at least think about the §412 Full Funding Limitation. Since the UAL equals 110,000, it should be clear that the Full Funding Limitation will have no impact.

The minimum contribution at 12/31/01 is  $11,354 = 27,629 - 16,275$ .

**Answer is C**

## Fall 2001 EA-2A Exam Solutions

### Problem 36

Revised 10/14/03

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 8%, and re-determine the amortization of all the bases at the new 7% interest rate.

This problem is similar to others on this exam, but with a twist. The change in interest rate occurred at 01/01/2000. You must first determine the 8% outstanding bases at that date. Then you need to allow for one year of amortization at 7% to produce the outstanding bases at 01/01/2001.

Amortization base	Remaining Years 01/01/00	8% Outstanding base at 01/01/2000	7% Outstanding base at 01/01/2001
1-1-1998 Initial AL	30-(100-98) = 28	$185,000 * \ddot{a}_{28 .08} / \ddot{a}_{30 .08}$	$* \ddot{a}_{27 .07} / \ddot{a}_{28 .07} = 179,353$
1-1-2000 Gain base	5-(100-100) = 5	(10,000)	$* \ddot{a}_{4 .07} / \ddot{a}_{5 .07} = (8,261)$
1-1-2001 Gain base	N/A	N/A	(8,000)
1-1-1999 Plan base	30-(100-99) = 29	$20,000 * \ddot{a}_{29 .08} / \ddot{a}_{30 .08}$	$* \ddot{a}_{28 .07} / \ddot{a}_{29 .07} = 19,596$
1-1-2000 Assump base	10-(100-100) = 10	15,000	$* \ddot{a}_{9 .07} / \ddot{a}_{10 .07} = 13,914$
<b>TOTAL</b>			<b>196,603</b>

$$\begin{aligned} \text{UAL} &= \text{AL} - \text{AAV} \\ &= 375,000 - 200,000 \\ &= 175,000 \end{aligned}$$

$$\begin{aligned} 175,000 &= \text{O/S §412 bases} - \text{CB} - \text{ARA} \\ &= 196,603 - \text{CB} - 0 \end{aligned}$$

$$\begin{aligned} \text{CB} &= 196,603 - 175,000 \\ &= 21,603 \end{aligned}$$

**Answer is C**

## Fall 2001 EA-2A Exam Solutions

### Problem 37

The key to this problem is reflecting the effect of the change in assumptions on both the normal cost and the accrued liability. You are not given the effective date, or the initial accrued liability (IAL), but you don't need either item:

$$\text{Min contribution under old assumptions: } 1.07(\text{NC}_{\text{old}} + \text{IAL} / \ddot{a}_{30|.07})$$

$$\text{Min contribution under new assumptions: } 1.07(\text{NC}_{\text{new}} + \text{IAL} / \ddot{a}_{30|.07} + \Delta\text{AL} / \ddot{a}_{10|.07})$$

$$\Delta\text{Min contribution: } 1.07(\text{NC}_{\text{new}} - \text{NC}_{\text{old}} + \Delta\text{AL} / \ddot{a}_{10|.07})$$

$\Delta\text{AL}$  represents the change in the accrued liability due to the change in assumptions. Now you should calculate the 2001 valuation results. Under the Unit Credit cost method, the accrued liability is defined as the present value of the accrued benefit. The Unit Credit normal cost is defined as the present value of the change in the accrued benefit.

	Old assumptions	New assumptions
Assumed retirement age	65	62
01/01/01 Age	61	61
Past service	10	10
Accrued benefit	12(\$75)(10) = 9,000	12(\$75)(10) = 9,000
Early retirement factor	1.00	.90
Reduced accrued benefit	9,000	8,100
$\Delta$ Accrued benefit	900	810
Accrued Liability	$9,000(D_{65} / D_{61}) \ddot{a}_{65}^{(12)}$ $= 9,000v^4 \ddot{a}_{65}^{(12)}$ $= 9,000(1.07)^{-4}(10.10)$ $= 69,347$	$8,100(D_{62} / D_{61}) \ddot{a}_{62}^{(12)}$ $= 8,100v^1 \ddot{a}_{62}^{(12)}$ $= 8,100(1.07)^{-1}(10.74)$ $= 81,303$
Normal cost	$900(D_{65} / D_{61}) \ddot{a}_{65}^{(12)}$ $= 6,935$	$810(D_{62} / D_{61}) \ddot{a}_{62}^{(12)}$ $= 8,130$

The assumption change base is  $11,956 = 81,303 - 69,347$ . Now you can calculate the increase in the minimum contribution, using the formula shown above:

$$\begin{aligned}
 \Delta\text{Min contribution} &= 1.07(\text{NC}_{\text{new}} - \text{NC}_{\text{old}} + \Delta\text{AL} / \ddot{a}_{10|.07}) \\
 &= 1.07(8,130 - 6,935 + 11,956 / \ddot{a}_{10|.07}) \\
 &= 2,981
 \end{aligned}$$

**Answer is C**

### Problem 38

Revised 10/14/03

The key to this problem is knowing the rules in Revenue Procedure 2000-40 for a change in asset valuation method.

#### I. FALSE

In general, the statement is false. This item does not refer to Revenue Procedure 2000-40, since it does not say "for automatic approval of method changes".

If this item did say "for automatic approval of method changes" the statement is still false. The reason is that Section 6.02(3) of Revenue Procedure 2000-40 exempts method changes covered under Section 4. This means that a terminating plan could change the asset valuation method using the special approval in Section 4.02, even though the asset valuation method had been changed within the prior four years.

#### III. TRUE

This is a requirement of the asset valuation regulation at 1.412(c)(3)-2, as well as Revenue Procedure 2000-40. The asset valuation regulation allows for a different corridor for multiemployer plans, which may have an AAV within 15% of the average market value, or within 20% of the market value.

For purposes of answering this question, you should rely on the condition that states the plan is not a multiemployer plan.

#### III. TRUE

Under Section 5, all bases for a cost method change are funded over 10 years. There are exceptions in Section 4.03 and 4.04 under which the effect of the cost method change may be treated as an experience G/L (amortized over 5 years), or treated as part of an assumption change (amortized over 10 years).

II and III are true

**Answer is C**

## Fall 2001 EA-2A Exam Solutions

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### Problem 39 - Page 1

Similar to EA-2 1998 #37

Revised 10/29/02

§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 equal to the unfunded current liability, the deduction limitation would be no less than that amount.

### DB PLAN

First you should calculate the deductible limit for the DB plan. You are told that the limit adjustment is based on the fresh start alternative:

$$\begin{aligned}\text{NC} + \text{Limit adj} &= 1.07(\text{NC} + \text{UAL} / \ddot{a}_{10|.07}) \\ &= 1.07(50,000 + (900,000 - 750,000)/7.5152) \\ &= 74,857\end{aligned}$$

Next, you should calculate the Full Funding Limitation (FFL). One reason is to see if it affects the deductible limit, and another is that you are told the employer actually contributed the FFL at 12/31/2001. For 2001, the OBRA FFL calculation uses 160% of the current liability:

$$\begin{aligned}\text{\$404 "ERISA" FFL} &= (1+i)(\text{UC NC} + \text{UC AL}) - (1+i)(\text{lesser MVA, AAV}) \\ &= 1.07 * (50,000 + 900,000 - 750,000) \\ &= 214,000\end{aligned}$$

$$\begin{aligned}\text{\$404 "OBRA" FFL} &= 1.60 (12/31 \text{ CL}) - (1+i)(\text{lesser MVA, AAV}) \quad (\text{if no benefit payments}) \\ &= 1.60 * (1,000,000) - 1.07 * (750,000) \\ &= 797,500\end{aligned}$$

$$\begin{aligned}\text{\$404 "RPA 94" FFL} &= .90 (12/31 \text{ CL}) - (1+i)(\text{AAV}) \quad (\text{if no benefit payments}) \\ &= .90 * (1,250,000) - 1.07 * (750,000) \\ &= 322,500\end{aligned}$$

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.

The final §412 FFL value is the greater of the RPA '94 floor, and the lesser of the ERISA and OBRA FFL values, or 322,500. The DB plan contribution was equal to the RPA floor in this problem.

## Fall 2001 EA-2A Exam Solutions

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### Problem 39 - Page 2

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.

The §412 minimum contribution would have the initial accrued liability amortized over 30 years, plus any interim gains and losses amortized over 5 years. It is unlikely that the §412 minimum contribution would exceed 74,857. The deductible limit is still the Normal cost plus limit adjustments of 74,857.

The final comparison is to the unfunded current liability, since this is a non-multiemployer plan with more than 100 participants. There are no specific details of how to calculate this value in §404, but it is generally done on an end of year basis:

$$\begin{aligned}\$404 \text{ UCL} &= 12/31 \text{ RPA CL} - 12/31 \text{ AAV} \\ &= 1,250,000 - 1.07(750,000) \\ &= 447,500\end{aligned}$$

Since this exceeds the normal cost plus limit adjustments, the final deductible limit is 447,500. You are told that the employer contributed the FFL of 322,500 at 12/31/2001. This entire amount was the DB plan deduction for 2001.

### **DC PLAN**

The profit sharing plan has a separate deduction limitation of 15% of taxable compensation. The maximum amount that could be contributed to the profit sharing plan is 15% of (560,000 + 1,500,000), which gives 309,000. This calculation is based on the compensation for all employees covered by the profit sharing plan.

### OVERALL DB/DC

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

To calculate the 25% limit, you need to add up the compensation figures for all participants covered by both the DB and the DC plan:

$$\begin{aligned} 25\% \text{ taxable compensation} &= .25(200,000 + 560,000 + 1,500,000) \\ &= 565,000 \end{aligned}$$

$$\begin{aligned} \text{DB plan minimum} &= (\text{unknown}) \\ \text{DB plan unfunded current liability} &= 447,500 \\ \text{DB plan deduction} &= 322,500 \end{aligned}$$

The overall DB/DC plan deduction limit is 565,000. It is not affected by the various DB plan limits in this problem.

The employer has contributed 322,500 to the DB plan, which was also deducted. This means that the maximum deduction that could be taken for the profit sharing plan is  $565,000 - 322,500 = 242,500$ .

**Answer is C**

### **NOTE:**

The final deduction that could be taken for the profit sharing plan could not exceed the stand-alone DC plan deductible limit of 309,000 (calculated on the prior page).



## Fall 2001 EA-2A Exam Solutions

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### Problem 40 - Page 1

The key to this problem is applying the Full Funding Limitation (FFL) in the 2001 Minimum funding standard account (MFSA). If you skip this step, the problem is way too short for this exam.

You are told that there are no amortization charges or credits in the 2001 MFSA. This probably means that the ERISA FFL applied for 2000, and all the old bases were eliminated at 01/01/2001. When the old §412 bases are wiped out, you should use Revenue Ruling 81-213, Section 7. This specifies that you should force the equation of balance to be met, and the resulting base would be a loss base.

In this problem, you would not establish a new base, since the UAL is zero:

$$\begin{aligned}\text{UAL} &= \text{O/S } \$412 \text{ bases} - \text{CB} - \text{ARA} \\ 0 &= 0 - 0 - 0\end{aligned}$$

The UAL should be 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. If you incorrectly set up a negative §412 base, it makes no difference in the final answer, due to the effect of the FFL.

2001 Minimum Funding Standard Account			
Charges		Credits	
Normal Cost	90,000	Credit Balance	0
Net amortizations	0	12/31/01 contribution	x
7% interest	6,300	7% interest	0
Total charges	<u>96,300</u>	Total credits	<u>x</u>

The key to this problem is that you must check the Full Funding Limitation. If there is a FFL credit, then the minimum contribution will be less than 96,300.

## Fall 2001 EA-2A Exam Solutions

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### Problem 40 - Page 2

In 2001, the OBRA 87 FFL current liability is multiplied by 160%. 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:

$$\begin{aligned}\$412 \text{ "ERISA" FFL} &= (1+i) * (\text{EA NC} + \text{EAN AL}) - (1+i) * [\text{lesser (MVA, AAV)} - \text{CB}] \\ &= 1.07 * (90,000 + 1,070,000 - (1,100,000 - 0)) \\ &= 64,200\end{aligned}$$

$$\begin{aligned}\$412 \text{ "OBRA" FFL} &= 1.60 (12/31 \text{ CL}) - (1+i) * [\text{lesser (MVA, AAV)} - \text{CB}] \quad (\text{if no benefit payments}) \\ &= 1.60 * [(1.06)(130,000 + 1,200,000) - 0 \text{ BP}] - [1.07 * (1,100,000 - 0) - 0 \text{ BP}] \\ &= 1,078,680\end{aligned}$$

$$\begin{aligned}\$412 \text{ "RPA '94" FFL} &= .90 (12/31 \text{ CL}) - (1+i) * (\text{AAV}) \quad (\text{if no benefit payments}) \\ &= .90 * [(1.06)(130,000 + 1,200,000) - 0 \text{ BP}] - [1.07 * (1,100,000) - 0 \text{ BP}] \\ &= 91,820\end{aligned}$$

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 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 91,820. 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 96,300. Since this exceeds the FFL of 91,820, there is a FFL credit in the MFSA for the excess of 4,480.

2001 Minimum Funding Standard Account			
Charges		Credits	
Normal Cost	90,000	Credit Balance	0
Net amortizations	0	12/31/01 FFL credit	4,480
		12/31/01 contribution	x
7% interest	6,300	7% interest	0
Total charges	<u>96,300</u>	Total credits	<u>x + 4,480</u>

The minimum contribution at 12/31/01 is  $91,820 = 96,300 - 4,480$ . As you should expect, the minimum contribution is equal to the FFL.

**Answer is D**

## Fall 2001 EA-2A Exam Solutions

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### Problem 41 - Page 1

Similar to EA-2 1985 #08
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The key point of this problem is whether you know how to calculate the Full Funding Limitation (FFL) under §404 when you have non-deductible contributions (NDC). The method of calculation is outlined in Revenue Ruling 82-125, which says that you should adjust the FFL by the amount of the NDC, but with no interest adjustment.

Based on the default exam conditions, the AAV given in problems is the appropriate value for minimum funding calculations. This is consistent with the description of the assets in the problem. If a contribution has been paid to the trust, it should be considered as part of the §412 assets, regardless of whether or not it has been deducted.

### General rule - no NDC

Assume AAV = assets used for §412 costs

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

### Intuitive FFL - with NDC

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

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

### RR 82-125 - with NDC

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

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

## Fall 2001 EA-2A Exam Solutions

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### Problem 41 - Page 2

In this problem the NDC equals 200. The problem asks you to calculate the §404 FFL.

For 2001, the OBRA FFL calculation uses 160% of the current 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:

$$\begin{aligned}\$404 \text{ "ERISA" FFL} &= (1+i) * (\text{UC NC} + \text{UC AL}) - (1+i) * (\text{lesser MVA, AAV}) + \text{NDC} \\ &= 1.07 * (8,000 + 95,000 - 97,000) + 200 \\ &= 6,620\end{aligned}$$

$$\begin{aligned}\$404 \text{ "OBRA" FFL} &= 1.60 (12/31 \text{ CL}) - (1+i) * (\text{lesser MVA, AAV}) + \text{NDC} \quad (\text{if no benefit payments}) \\ &= 1.60 * (1.061)(9,000 + 57,000) - 1.07 * (97,000) + 200 \\ &= 8,452\end{aligned}$$

$$\begin{aligned}\$404 \text{ "RPA 94" FFL} &= .90 (12/31 \text{ CL}) - (1+i) * (\text{AAV}) + \text{NDC} \quad (\text{if no benefit payments}) \\ &= \text{Not calculated} - \text{answer range is E regardless}\end{aligned}$$

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.

The final §412 FFL value is the greater of the RPA '94 floor, and the lesser of the ERISA and OBRA FFL values. The FFL is at least 6,620, which is in answer range E. The RPA floor may be greater, but the final answer is still E.

**Answer is E**

The point of the problem is whether you knew to make the adjustment to the FFL for the NDC. If you left it out, or made the adjustment "backwards", you would fall in a different answer range.

It did not matter if you gave the NDC interest, which is incorrect. You would still have an answer in range E.

## Fall 2001 EA-2A Exam Solutions

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### Problem 42 - Page 1

The key to this problem is correctly handling the unusual benefit formula for the normal cost and the accrued liability. You must do the 01/01/2000 valuation to determine the normal cost and the deductible limit. Then you do calculations at 01/01/2001 to determine the normal cost and the minimum contribution.

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

	01/01/2000 valuation
Age	61
Past service	10
Accrued benefit	$12(\$50)(10)$ $= 6,000$
$\Delta$ Accrued benefit	$12(\$65)(1)$ $= 780$
Accrued Liability	$6,000(D_{65} / D_{61}) \ddot{a}_{65}^{(12)}$ $= 50,000$
Normal cost	$780(D_{65} / D_{61}) \ddot{a}_{65}^{(12)}$ $= 50,000 * (780/6,000)$ $= 6,500$

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:

$$\begin{aligned}\text{Limit adjustment} &= \text{IAL} / \ddot{a}_{10|.07} \\ &= 50,000 / 7.5152 \\ &= 6,653\end{aligned}$$

$$\begin{aligned}\text{Deductible limit} &= (6,500 + 6,653) * (1.07) \\ &= 14,074\end{aligned}$$

Now you can use the 04/01/00 contribution of the deductible limit to determine the amount of the credit balance. You need to calculate the amortization of the IAL:

$$\begin{aligned}\text{IAL amort.} &= \text{IAL} / \ddot{a}_{30|.07} \\ &= 50,000 / 13.2777 \\ &= 3,766\end{aligned}$$

## Fall 2001 EA-2A Exam Solutions

Problem 42 - Page 2

Revised 07/14/06

2000 Minimum Funding Standard Account			
Charges		Credits	
Normal Cost	6,500	Credit Balance	0
IAL amortization	3,766	04/01/00 contribution	14,074
7% interest	719	7% interest	739
Total charges	<u>10,985</u>	Total credits	<u>14,813</u>

The credit balance at 12/31/00 is  $3,828 = 14,813 - 10,985$ .

### 01/01/2001 Valuation

With no gains or losses during 2000, the normal cost will grow with survivorship and interest. Since there are no pre-retirement decrements, the 2001 normal cost will grow by the 7% interest rate:

$$\begin{aligned} \text{2001 NC} &= 780(D_{65} / D_{62}) \ddot{a}_{65}^{(12)} \\ &= (D_{61} / D_{62})(2000 \text{ NC}) \\ &= 1.07 (6,500) \\ &= 6,955 \end{aligned}$$

2001 Minimum Funding Standard Account			
Charges		Credits	
Normal Cost	6,955	Credit Balance	3,828
IAL amortization	3,766	01/01/01 contribution	x
7% interest	750	7% interest	.07x + 268
Total charges	<u>11,471</u>	Total credits	<u>1.07x + 4,096</u>

You can ignore the Full Funding Limitation in this problem. Since this is almost a brand new plan, it is extremely unlikely that the FFL would impact the minimum contribution.

The minimum contribution at 01/01/01 is  $6,892 = (11,471 - 4,096) / 1.07$ . Specifying the minimum contribution at the beginning of the year is a "cheap trick".

**Answer is D**

## Fall 2001 EA-2A Exam Solutions

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### Problem 43 - Page 1

The key to this problem is carefully doing the 01/01/2001 valuation based on the new plan benefits and the new asset valuation method. Another key is knowing the rules in Revenue Procedure 2000-40 for setting up a new amortization base when there is a change in cost method.

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

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

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

Except under the  
Aggregate method

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

### **OLD PLAN / OLD METHOD**

It is straightforward to calculate the minimum contribution on the old valuation basis.

$$\begin{aligned} \text{UAL} &= \text{O/S §412 bases} - \text{CB} - \text{ARA} \\ &= 275,000 - 0 - 0 = 275,000 \end{aligned}$$

$$\begin{aligned} \text{PVNC} &= \text{PVFB} - \text{AAV} - \text{UAL} \\ &= 1,000,000 - 610,000 - 275,000 \\ &= 115,000 \end{aligned}$$

$$\begin{aligned} \text{PVE/E} &= 33,200,000 / 4,000,000 \\ &= 8.3000 \end{aligned}$$

$$\begin{aligned} \text{NC} &= 115,000 / 8.3 \\ &= 13,855 \end{aligned}$$

You are given the net amortization charges for the MFSA. The "old" 12/31/01 minimum equals  $1.07(13,855 + 21,200) = 37,509$ .

## Fall 2001 EA-2A Exam Solutions

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### Problem 43 - Page 2

#### NEW PLAN / NEW METHOD

Under the Frozen Initial Liability method, the UAL must be adjusted for plan changes, assumption changes, and cost method changes. The change in the UAL equals the change in the Entry Age Normal UAL:

$$\begin{aligned}\text{old EAN UAL} &= 700,000 - 610,000 \\ &= 90,000\end{aligned}$$

$$\begin{aligned}\text{new EAN UAL} &= 720,000 - 620,000 \\ &= 100,000\end{aligned}$$

$$\begin{aligned}\Delta \text{FIL UAL} &= 100,000 - 90,000 \\ &= 10,000 \\ &= 20,000 \text{ plan change} - 10,000 \text{ AAV change}\end{aligned}$$

$$\begin{aligned}\text{new FIL UAL} &= 275,000 + 10,000 \\ &= 285,000\end{aligned}$$

There are two changes in the FIL UAL. The plan change increased the EAN AL from 700,000 to 720,000. The cost method change increased the AAV from 610,000 to 620,000, which produced a decrease of 10,000 in the UAL.

$$\begin{aligned}\text{PVNC} &= \text{PVFB} - \text{AAV} - \text{UAL} \\ &= 1,035,000 - 620,000 - 285,000 \\ &= 130,000\end{aligned}$$

$$\text{PVE/E} = 8.3000$$

$$\begin{aligned}\text{NC} &= 130,000 / 8.3 \\ &= 15,663\end{aligned}$$

You must calculate the new amortization charges for the MFSA. The amortization period for all cost method change amortization bases specified in Revenue Procedure 2000-40 is 10 years. The plan change base is amortized over 30 years:

$$\text{Method amortization} = -10,000 / \ddot{a}_{10|.07} = -1,331$$

$$\text{Plan amortization} = 20,000 / \ddot{a}_{30|.07} = 1,506$$

The "new" 12/31/01 minimum equals  $1.07(15,663 + 21,200 - 1,331 + 1,506) = 39,631$ .

The increase in the 12/31/01 minimum is  $2,122 = 39,631 - 37,509$ .

**Answer is B**