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FALL 2002 EA-2A EXAM SOLUTIONS

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Fall 2002 EA-2A Exam Solutions

These solutions use beginning of year amortization payments in setting up the Minimum Funding Standard Account. These solutions were prepared based on the law as in effect at June 30, 2002.

These solutions have been compared with those produced by other technical actuaries, and they represent my best understanding of the correct way to solve these problems. As usual, it seems easy to get an answer in the correct range as long as you are not actually taking the exam!

For problems involving the deductible limit you should use the following sequence of steps:

1. Calculate the normal cost plus limit adjustments with interest to the earlier of the end of the plan year or the end of the tax year.
2. Calculate the Full Funding Limitation under Section 404 with interest to the end of the plan year. If this is less than the result of step one, then you can skip to step four.
3. Calculate the absolute minimum amount necessary to produce a non-negative credit balance in the Minimum Funding Standard Account. This amount should never be based on the Alternative MFSA. This amount may be increased by the amount of any "includible employer contribution."
4. The maximum deductible limit is the greater of (1) and (3), but not greater than (2).
5. If the Unfunded Current Liability exceeds the final deductible limit, then the final deductible limit will be the UCL. This UCL limit ignores recent benefit improvements for small plans with highly compensated employees.

Revision History:

October 31, 2006	Corrected solution for problem 27
October 10, 2006	Corrected solutions for problems 9 and 14
July 14, 2006	Corrected solutions for problems 28 and 37
June 20, 2006	Added solution for problem 15, clarified solution for problem 17
July 8, 2005	Clarified solution for problem 10, corrected solutions for problems 1, 4, 18, 22, 31, 32 and 38
July 9, 2004	Clarified solution for problem 40
June 22, 2004	Clarified solution for problem 13
September 30, 2003	Corrected solution for problem 40
August 8, 2003	Original solutions

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NOTES on 2002 exam

Revised 07/08/05

The 2002 exam was the first EA-2A exam given which tested the EGTRRA provisions. This exam was significantly easier than the 2001 exam. This means that you had to get a higher number of points correct to pass in 2002 than in 2001.

If you look at the percentage of students who passed, it was approximately 37.5% in 2001 and 44.1% in 2002.

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Problem 1

Revised 07/08/05

The key point of this problem is calculating the Full Funding Limitation under §404. With an aggregate type cost method, you need market value of assets, Entry age normal valuation results, and current liability to check the Full Funding Limitation.

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. This value is given in the problem as 534,000. Next, you should calculate the Full Funding Limitation (FFL). For 2002, the OBRA FFL calculation uses 165% of the current liability. Since this plan uses an aggregate type cost method, the ERISA FFL must be calculated using the entry age normal cost and accrued liability:

$$\begin{aligned}\text{\$404 "ERISA" FFL} &= (1+i) * (\text{EAN NC} + \text{EAN AL}) - (1+i) * (\text{lesser MVA, AAV}) \\ &= 1.07 * (150,000 + 2,325,000 - 2,000,000) \\ &= 508,250\end{aligned}$$

$$\begin{aligned}\text{\$404 "OBRA" FFL} &= 1.65 (12/31 \text{ CL}) - (1+i) * (\text{lesser MVA, AAV}) \quad (\text{if no benefit payments}) \\ &= 1.65 * (1,625,000) - 1.07 * (2,000,000) \\ &= 541,250\end{aligned}$$

$$\begin{aligned}\text{\$404 "RPA 94" FFL} &= .90 (12/31 \text{ CL}) - (1+i) * (\text{AAV}) \quad (\text{if no benefit payments}) \\ &= .90 * (1,625,000) - 1.07 * (2,100,000) \\ &= \text{Zero}\end{aligned}$$

Note that the end of year asset value (if any) should be used in calculating the OBRA '87 and RPA '94 FFL. The reason is that any benefit payments during the year should be reflected at the valuation rate in the assets. They presumably are included in the end of year asset value. They would be accumulated at the current liability interest rate in the end of year current liability.

The final §404 FFL value is the greater of the RPA '94 floor, and the lesser of the ERISA and OBRA FFL values, or 508,250. Since the §404 FFL does apply, you do not need to calculate the §412 minimum contribution. The deductible limit is the lesser of the §404 FFL of 508,250, or the greater of the normal cost plus limit adjustments of 534,000 and the minimum contribution. The final result is 508,250, regardless of the magnitude of the minimum contribution.

The final calculation is the unfunded current liability. There are no specific details of how to calculate this value in §404, but it is generally done on an end of year basis:

$$\begin{aligned}\text{\$404 "RPA 94" UCL} &= 1.00 (12/31 \text{ CL}) - (1+i) * (\text{AAV}) \quad (\text{if no benefit payments}) \\ &= 1,625,000 - 1.07 * (2,000,000) \\ &= \text{zero}\end{aligned}$$

The final deductible limit is still the §404 FFL of 508,250.

Answer is D

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Problem 2 - Page 1

Similar to 2000 EA-2 #46

The key point of this problem is calculating the Full Funding Limitation under §404. With an aggregate type cost method, you need market value of assets, Entry age normal valuation results, and current liability to check the Full Funding Limitation.

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. The only limit adjustment is for the Initial Accrued Liability of 500,000. You must determine the §404 NC.

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

$$\begin{aligned}\$404 \text{ PVNC} &= \text{PVB} - \$404 \text{ AAV} - \$404 \text{ UAL} \\ \$412 \text{ PVNC} &= \text{PVB} - \$412 \text{ AAV} - \$412 \text{ UAL} = \$404 \text{ PVNC}\end{aligned}$$

$$\begin{aligned}\$412 \text{ UAL} &= \text{O/S } \$412 \text{ bases} - \text{CB} - \text{ARA} = \$404 \text{ UAL} \\ &= 500,000 \left(\ddot{a}_{\overline{23}|.07} / \ddot{a}_{\overline{30}|.07} \right) - 0 - 0 \\ &= 454,193\end{aligned}$$

$$\begin{aligned}\text{PVNC} &= 1,460,000 - 630,000 - 454,193 \\ &= 375,807\end{aligned}$$

$$\begin{aligned}\text{PVE} / \text{E} &= 1,700,000 / 200,000 \\ &= 8.50\end{aligned}$$

$$\text{NC} = 44,213$$

$$\begin{aligned}\text{Limit adjustment} &= 500,000 / \ddot{a}_{\overline{10}|.07} \\ &= 66,532\end{aligned}$$

$$\begin{aligned}\text{Deductible limit} &= (44,213 + 66,532) * 1.07 \\ &= 118,496\end{aligned}$$

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

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Problem 2 - Page 2

A key point is that, in 2002, the OBRA 87 FFL current liability is multiplied by 165%.

$$\begin{aligned}\text{\$404 "ERISA" FFL} &= (1+i) * (\text{EAN NC} + \text{EAN AL} - (\text{lesser MVA, AAV})) \\ &= 1.07 * (50,000 + 625,000 - 610,000) \\ &= 69,550\end{aligned}$$

$$\begin{aligned}\text{\$404 "OBRA 87" FFL} &= 1.65 (12/31 \text{ CL}) - (1+i) * (\text{lesser MVA, AAV}) \quad (\text{if no benefit payments}) \\ &= 1.65 * 700,000 - 1.07 * 610,000 \\ &= 502,300\end{aligned}$$

$$\begin{aligned}\text{\$404 "RPA 94" FFL} &= .90 (12/31 \text{ RPA CL}) - (1+i) * (\text{AAV}) \quad (\text{if no benefit payments}) \\ &= .90 * 750,000 - 1.07 * 630,000 \\ &= 900\end{aligned}$$

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

The final §404 FFL value is the greater of the RPA '94 floor, and the lesser of the ERISA and OBRA FFL values, or 69,550. Since the §404 FFL does apply, you do not need to calculate the §412 minimum contribution. The deductible limit is the lesser of the §404 FFL of 69,550, or the greater of the normal cost plus limit adjustments of 118,496 and the minimum contribution. The final result is 69,550, regardless of the magnitude of the minimum contribution.

The final calculation is the unfunded current liability. There are no specific details of how to calculate this value in §404, but it is generally done on an end of year basis:

$$\begin{aligned}\text{\$404 "RPA 94" UCL} &= 1.00 (12/31 \text{ CL}) - (1+i) * (\text{AAV}) \quad (\text{if no benefit payments}) \\ &= 750,000 - 1.07 * 630,000 \\ &= 75,900\end{aligned}$$

The §404 UCL exceeds the previously calculated deductible limit of 69,550. The final deductible limit equals the §404 UCL of 75,900.

Answer is C

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Problem 3

The key to this problem is knowledge of the amortization periods for the different MFSA bases, and calculating the normal cost under the Frozen Initial Liability (FIL) cost method. You must also be careful to calculate the minimum contribution at the beginning of the year.

$$PVNC = PVB - AAV - UAL$$

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

Now use the given annual amortization amounts to derive the outstanding §412 bases:

Amortization base	Amortization amount	Remaining years	Outstanding base
1-1-1987 IAL	86,000	15 = 30-(2002-1987)	838,110 = $86,000 * \ddot{a}_{15 .07}$
1-1-1998 Assmp change	(15,500)	6 = 10-(2002-1998)	(79,053) = $(15,500) * \ddot{a}_{6 .07}$
1-1-2002 Plan change	35,000	30 = 30-(2002-2002)	464,719 = $35,000 * \ddot{a}_{30 .07}$
All Total			1,223,776

$$\begin{aligned} UAL &= 1,223,776 - 25,000 - 0 \\ &= 1,198,776 \end{aligned}$$

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

$$\begin{aligned} PVNC &= 4,000,000 - 2,200,000 - 1,198,776 \\ &= 601,224 \end{aligned}$$

$$\begin{aligned} PVE / E &= 8,800,000 / 780,000 = 11.2821 \\ NC &= 53,290 \end{aligned}$$

2002 Minimum Funding Standard Account			
Charges		Credits	
Normal Cost	53,290	Credit Balance	25,000
IAL amortization	86,000	ASSM amortization	15,500
PLAN amortization	35,000	01/01 contribution	x
NO interest	0	NO interest	0
Total charges	174,290	Total credits	x + 40,500

The MFSA has no interest, since the problem asks for the minimum payable at 01/01 (a cheap trick). The minimum contribution at 01/01/02 is $174,290 - 40,500 = 133,790$.

Answer is B

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Problem 4 - Page 1

Similar to 2001 #14

Revised 07/08/05

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

Based on the exam conditions, when you are told nothing about the Optional or Transition Rules, you can ignore both (both rules expired at the end of 2001). You are told that the plan is subject to the §412(l) AFC, so you can skip the calculation of the Gateway test.

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

$$\begin{aligned}\text{UCL} &= \text{CL} - (\text{AAV} - \text{CB}) \\ &= 1,850,000 - (1,100,000 - 20,000) \\ &= 770,000\end{aligned}$$

The unfunded new liability (UNL) is usually calculated as the excess of the unfunded current liability (UCL) over the remaining portion of the unfunded old liability (UOL) plus any unpredictable contingent event liability. In this problem you are given the UOL, and you must calculate the UNL.

$$\begin{aligned}\text{UOL} &= 250,000 \text{ (given)} \\ \text{UNL} &= \text{UCL} - \text{UOL} - \text{UCEL} \\ &= 770,000 - 250,000 - 0 \\ &= 520,000\end{aligned}$$

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 5.75% current liability interest rate. At 01/01/2002, the remaining period is 5 years = 18-(2002-1989). You are given the 5 year period in this problem.

$$\begin{aligned}\text{UOLA} &= \text{UOL} / \ddot{a}_{\overline{5}|.0575} \\ &= 250,000 / 4.4850 \\ &= 55,741\end{aligned}$$

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Problem 4 - Page 2

Revised 07/08/05

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

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

$$\begin{aligned}\text{UNLA} &= 520,000 * 30.00\% \\ &= 156,000\end{aligned}$$

$$\begin{aligned}\text{DRC} &= \text{UOLA} + \text{UNLA} + \text{CLNC} \\ \text{DRC} &= 55,741 + 160,000 + 60,000 \\ &= 271,441\end{aligned}$$

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.

$$\begin{aligned}01/01/02 \text{ §412(l) AFC} &= \text{UCEA} + [\text{DRC} - (\text{§412 NC} + \text{§412 amortizations})] \\ &= 0 + 271,441 - (75,000 + 75,000 + 30,000 - 10,000) \\ &= 101,741 \\ 12/31/02 \text{ §412(l) AFC} &= 101,741 * 1.0575 \\ &= 107,591\end{aligned}$$

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

With less than 150 plan participants, you must pro-rate the §412(l) AFC. The pro-rata is based on the highest number of plan participants on any day in the prior plan year. You are given the highest participant count for the prior plan year as 145:

$$\begin{aligned}12/31/02 \text{ §412(l) AFC} &= 107,591 * [2\% * (145-100)] \\ &= 107,591 * .90 \\ &= 96,832\end{aligned}$$

Answer is B

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Problem 5

The key to this problem is knowledge of the amortization periods for the different MFSA bases, and calculating the normal cost under the Frozen Initial Liability (FIL) cost method.

$$PVNC = PVB - AAV - UAL$$

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

You need to calculate the outstanding §412 bases. You should first calculate the annual amortization amounts, and save them for use in the MFSA:

Amortization Base	Original Amount	Amortization amount	Remaining Period
1-1-1986 Initial AL	600,000	$45,189 = 600,000 / \ddot{a}_{30 .07}$	$14 = 30 - (2002 - 1986)$
1-1-1996 Assmp change	60,000	$7,984 = 60,000 / \ddot{a}_{10 .07}$	$4 = 10 - (2002 - 1996)$

$$\begin{aligned} O/S \text{ Bases} &= 45,189 * \ddot{a}_{14|.07} + 7,984 * \ddot{a}_{4|.07} \\ &= 451,795 \end{aligned}$$

$$\begin{aligned} UAL &= 451,795 - 30,000 - 0 \\ &= 421,795 \end{aligned}$$

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

$$\begin{aligned} PVNC &= 2,000,000 - 900,000 - 421,795 \\ &= 678,205 \end{aligned}$$

$$\begin{aligned} PVE / E &= 20,000,000 / 1,000,000 = 20.00 \\ NC &= 33,910 \end{aligned}$$

2002 Minimum Funding Standard Account			
Charges		Credits	
Normal Cost	33,910	Credit Balance	30,000
IAL amortization	45,189		
ASSM amortization	7,984	12/31 contribution	x
7% interest	6,096	7% interest	2,100
Total charges	93,178	Total credits	x + 32,100

You have no information to calculate the §412 Full Funding Limitation. The minimum contribution at 12/31/02 is $93,178 - 32,100 = 61,078$.

Answer is B

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Problem 6

Similar to 2001 #25

The key to this problem is calculating 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 total present value of benefits. There are three terms in the summation, which represent withdrawal at ages 63 and 64, and retirement at age 65. The withdrawal decrements are assumed to occur at the beginning of the year:

$$\text{PV of W/D benefits} = \sum_{t=0}^1 v_t^t p_{63}^{(T)} q_{63+t}^{(w)} (\text{Vested benefit}_{63+t}) (D_{65} / D_{63+t}) \ddot{a}_{65}^{(12)}$$

$$\text{PV of RET benefits} = v^2 {}_2p_{63}^{(T)} (\text{Retirement benefit}_{65}) \ddot{a}_{65}^{(12)}$$

With no mortality, the post-termination D/D terms are only based on the 7% interest rate:

$$\begin{aligned} \text{Total PV of benefits} &= (1.07)^{-0} (1.0) q_{63}^{(w)} (5)(12)(100)(60\%)(1.07)^{-2}(9.24) \\ &\quad + (1.07)^{-1} p_{63}^{(T)} q_{64}^{(w)} (6)(12)(100)(80\%)(1.07)^{-1}(9.24) \\ &\quad + (1.07)^{-2} p_{63}^{(T)} p_{64}^{(T)} (7)(12)(100)(9.24) \end{aligned}$$

You can simplify the calculation by grouping the terms:

$$\begin{aligned} \text{Total PV of benefits} &= (1.07)^{-2} (12)(100)(9.24) [q_{63}^{(w)} (5)(60\%) + p_{63}^{(T)} q_{64}^{(w)} (6)(80\%) + p_{63}^{(T)} p_{64}^{(T)} (7)] \\ &= (1.07)^{-2} (12)(100)(9.24) [.03(5)(.60) + .97(.01)(6)(.80) + .97(.99)(7)] \\ &= 9,684.69 [.09 + .05 + 6.72] \\ &= 66,424 \end{aligned}$$

Answer is A

This is a fairly tedious arithmetic problem. You have to be very careful to avoid making any arithmetic errors.

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Problem 7 - Page 1

This problem 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.

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.

Now you need to calculate the normal cost and accrued liability under Projected Unit Credit (PUC) at 01/01/2002. You should do this using the old and the new salary scale assumptions. The final step is calculating the change in the minimum contribution at 12/31/02.

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.

OLD assumptions

Age 40 at 01/01/02
Past service 20
2001 pay 20,000 (age 39 pay)
Age 64 pay $41,876 = 20,000(1.03)^{25}$

Be careful to check that the projected pay does not exceed the 401(a)(17) limit.

FAB = $[1.20\%(15) + 1.45\%(5)] (41,876)$

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Problem 7 - Page 2

I prefer to write down the formulas for NC and AL using symbols, and not evaluate them until the end of the problem.

$$\begin{aligned}AL &= PV(FAB) \\ &= [1.20\%(15) + 1.45\%(5)] (41,876) (D_{65} / D_{40}) \ddot{a}_{65}^{(12)}\end{aligned}$$

$$\begin{aligned}NC &= PV(\Delta FAB) \\ &= [1.45\%](41,876)(D_{65} / D_{40}) \ddot{a}_{65}^{(12)}\end{aligned}$$

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

NEW assumptions

$$\begin{aligned}2001 \text{ pay} &= 20,000 \quad (\text{age 39 pay}) \\ \text{Age 64 pay} &= 53,317 = 20,000(1.04)^{25}\end{aligned}$$

$$\begin{aligned}FAB &= [1.20\%(15) + 1.45\%(5)] (53,317) \\ \Delta FAB &= [1.20\%(15) + 1.45\%(5)] (53,317 - 41,876)\end{aligned}$$

$$\begin{aligned}\Delta AL &= [1.20\%(15) + 1.45\%(5)] (53,317 - 41,876) (D_{65} / D_{40}) \ddot{a}_{65}^{(12)} \\ &= 25.25\%(11,441)(1.07)^{-25}(9.24) \\ &= 4,918\end{aligned}$$

$$\begin{aligned}\Delta NC &= [1.45\%] (53,317 - 41,876) (D_{65} / D_{40}) \ddot{a}_{65}^{(12)} \\ &= 1.45\% (11,441) (1.07)^{-25}(9.24) \\ &= 282\end{aligned}$$

NOTE: Since you have varying rates of benefit accrual, you can't simply pro-rate the accrued liability to get the normal cost.

The assumption change will be amortized over 10 years in the MFSA. The change in the minimum contribution is

$$\begin{aligned}1.07(\Delta NC + \Delta AL / \ddot{a}_{10|0.07}) &= 1.07(282 + 4,918/7.5152) \\ &= 1,002\end{aligned}$$

Answer is D

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Problem 8

This problem gives you the value of the Deficit Reduction Contribution (DRC). This is a much easier problem than 2002 #4. The key to this problem is calculating the §412(l) charge.

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.

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.

$$\begin{aligned} 01/01/02 \text{ §412(l) AFC} &= \text{UCEA} + [\text{DRC} - (\text{§412 NC} + \text{§412 amortizations})] \\ &= 0 + 270,000 - (30,000 + 25,000 - 15,000 + 5,000 + 20,000 + 10,000) \\ &= 195,000 \\ 12/31/02 \text{ §412(l) AFC} &= 195,000 * 1.0575 \\ &= 206,213 \end{aligned}$$

Based on Revenue Ruling 96-21, this end of year §412(l) charge should be limited to the "end of year UCL". In this problem, that amount is given as 310,000, so the AFC is still 206,213. In general, the "end of year UCL" should never be less than the AFC.

With less than 150 plan participants, you must pro-rate the §412(l) AFC. The pro-rata is based on the highest number of plan participants on any day in the prior plan year. You are given the participant count at several dates. The highest participant count for the prior plan year is 146, at 07/01/2001:

$$\begin{aligned} 12/31/02 \text{ §412(l) AFC} &= 206,213 * [2\% * (146-100)] \\ &= 206,213 * .92 \\ &= 189,716 \end{aligned}$$

Answer is B

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Problem 9 - Page 1

Revised 10/10/06

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

This problem is a bit unusual, since you have a pay related benefit formula, but you are told to use a level dollar entry age normal cost. The plan was just established at 01/01/2002. The plan formula accrues benefits for all years of service, so you use the participant's age at hire as EA in these formulas:

$$\text{Level \$ EANC: } PVB_{EA} / \ddot{a}_{\overline{EA:RA-EA}|} \quad \text{level at all ages}$$

Age 50 at 01/01/02

Past service 15

Future service 15

Total service 30

Entry age 35

2002 pay 50,000 (age 50 pay)

Age 64 pay 86,584 = 50,000 (1.04)¹⁴

FAE3 at 65 83,297 = 86,584($\ddot{a}_{\overline{3}|.04}$ / 3)

Projected benefit 49,978 = 2%(30)(83,297)

$$\begin{aligned} PVB \text{ at } 35 &= 49,978(D_{65} / D_{35}) \ddot{a}_{65}^{(12)} \\ &= 49,978(1.07)^{-30}(9.24) \\ &= 60,665 \end{aligned}$$

With no decrements, the D/D terms are only based on the 7% interest rate. The next step is calculation of the EA normal cost and accrued liability.

$$EA \text{ NC} = PVB_{EA} / \ddot{a}_{\overline{EA:RA-EA}|} \quad (\text{for level \$ EANC})$$

$$\ddot{a}_{\overline{EA:RA-EA}|} = \ddot{a}_{\overline{35:30}|} = \ddot{a}_{\overline{30}|.07} \quad (\text{no pre-retirement decrements})$$

$$\begin{aligned} EA \text{ NC} &= 60,665 / 13.2777 \\ &= 4,569 \end{aligned}$$

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Problem 9 - Page 2

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

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

$$\ddot{s}_{\overline{\text{EA:CA-EA}}|} = \ddot{s}_{\overline{30:15}|} = \ddot{s}_{\overline{15}|.07} \quad (\text{no pre-retirement decrements})$$

$$\begin{aligned} \text{AL at 50} &= 4,569 * 26.8881 \\ &= 122,850 \end{aligned}$$

The IAL at 01/01/2002 is equal to the participant's accrued liability of 122,850. The final step is calculation of the minimum contribution.

The initial accrued liability will be amortized over 30 years in the MFSA. With a zero credit balance, the minimum contribution is

$$\begin{aligned} 1.07(\text{NC} + \text{IAL} / \ddot{a}_{\overline{30}|.07} - 0) &= 1.07(4,569 + 122,850 / 13.2777 - 0) \\ &= 14,789 \end{aligned}$$

Answer is C

Problem 10

Revised 07/08/05

The key to this problem is knowing the rules in Revenue Procedure 2000-40 for changes in cost method, asset valuation method, and valuation date. The way the question is worded ("pursuant to Revenue Procedure 2000-40"), you should ignore the rules in 412(c)(9) regarding changes in valuation date.

I. FALSE

If you read the data carefully, the cost method was changed to Entry age normal at 01/01/1998. Under Section 6.02(3), you can't change the cost method to Unit credit in 2002, since the cost method was changed in one of the four prior plan years (1998-2001).

II. TRUE

This is allowed under Section 3(10). The asset valuation method has not been changed within the four prior plan years.

The resulting EAN UAL will be less than zero, which is allowable under Revenue Procedure 2000-40. Section 6.02(6) does not allow automatic approval for any Section 3 change that results in a negative normal cost or a negative unfunded liability.

That restriction only applies to a change to a spread gain funding method under Section 3 of Revenue Procedure 2000-40. This does not apply to the Entry Age Normal method, which does not use the UAL to determine the normal cost (EAN is an immediate gain method).

III. FALSE

Under Section 3(13), you can only get automatic approval to change the valuation date to the first day of the plan year.

Only II is true

Answer is C

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Problem 11

This is a general knowledge question about mortality tables.

ASSERTION TRUE

The "reason portion" of the problem clarifies why the assertion is true. Some pension plans define disability as "total and permanent disability", and other plans do not. The mortality experience of employees who meet the different definitions of disability can be quite different.

REASON FALSE

The expected mortality is the opposite of that stated. If the plan defines disability as "total and permanent disability", you expect higher mortality rates than if the plan used a more liberal definition of disability.

Answer is C

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Problem 12

This is a general knowledge question about setting actuarial assumptions.

ASSERTION FALSE

The statement given is illogical. You must consider past experience when setting any assumption.

REASON TRUE

The statement given makes sense. If you had any extraordinary events, you would take this into account when setting your expense assumption.

Answer is D

Problem 13

Revised 06/22/04

This is a general knowledge question about setting actuarial assumptions.

ASSERTION FALSE

The statement given is illogical. You must consider the impact of election of optional forms of benefit payment when setting assumptions. Assuming the lump sums are subsidized (compared to the valuation interest rate), the minimum funding contribution should be higher than it would be in the absence of a lump sum option.

REASON TRUE

For calculating current liability values, you must use an interest rate in the "applicable range". This rate is not necessarily related to the interest rate used to calculate lump sums.

I think the question is designed to test whether you know the definition of the current liability interest rate in 412(b)(5)(B)(iii)(II):

"... consistent with the assumptions which reflect the purchase rates which would be used by insurance companies to satisfy the liabilities under the plan."

The idea is that the current liability rate should be set up on this independent basis. It does not matter whether the lump sums are subsidized with respect to your valuation rate. You should use the same rate to value current liability whether you have a 6% valuation rate, or an 8% valuation rate.

Answer is D

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Problem 14 - Page 1

The key to this problem is carefully handling the salary scale, and calculating the normal cost under the Aggregate method. Under the Aggregate method, the present value of normal costs (PVNC) is defined as the present value of benefits less the assets less the outstanding §412 bases (reduced by the credit balance). You must also be careful to calculate the minimum contribution at the beginning of the year.

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.

<u>Description</u>	<u>Calculation</u>
01/2002 Age	50
Past service	7
Total service	22
2002 pay (Age 50)	30,000
Age 64 pay	$30,000(1.04)^{14}$ $= 51,950$
Age 65 FAE3	$51,950(\ddot{a}_{\overline{3} .04} / 3)$ $= 49,978$
Projected benefit	$22(1\%)(49,978)$ $= 10,995$
PV future benefits	$10,995(D_{65} / D_{50})\ddot{a}_{65}^{(12)}$ $10,995(1.07)^{-15} (9.24)$ $= 36,823$

Now you can calculate the Aggregate PVNC:

$$\begin{aligned}\$412 \text{ PVNC} &= \text{PVB} - \text{AAV} - (\text{O/S } \$412 \text{ bases} - \text{CB}) && \text{NOTE: No ARA under Aggregate} \\ &= 36,823 - 10,000 - (0 - 500) \\ &= 27,323\end{aligned}$$

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

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

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Problem 14 - Page 2

Revised 10/10/06

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

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

In general, you calculate the average pay weighted annuity by dividing the present value of earnings by the total earnings.

Description

Smith

01/2002 Age

50

Temporary annuity

$$\begin{aligned} s\ddot{a}_{50:15} \\ &= \ddot{a}_{15|.0288} \\ &= 12.3854 \end{aligned}$$

Since you only have one participant, the average temporary annuity (PVE/E) is equal to Smith's temporary annuity of 12.3854.

$$\begin{aligned} \$412 \text{ NC} &= \text{PVNC} / (\text{PVE}/E) \\ &= 27,323 / 12.3854 \\ &= 2,206 \end{aligned}$$

One last trick to the problem is that you should calculate the minimum contribution at 01/01/2002. This is equal to the normal cost at 01/01, reduced by the credit balance at 01/01. The minimum contribution at 01/01/02 is $2,206 - 500 = 1,706$.

Answer is B

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Problem 15

Revised 06/20/06

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

$$G/L = {}_eU\text{AL}_1 - \text{UAL}_1$$

The G/L must be calculated based on the prior plan benefits (see section 8 of Revenue Ruling 81-213). Otherwise, the difference between expected and actual unfunded liability would include both the plan change and the experience G/L.

01/01/2002 AL prior to the plan change is $891,304 = (1.00/1.15)(1,025,000)$

$$\begin{aligned}\text{UAL}_1 &= \text{AL}_1 - \text{AAV}_1 \\ &= 891,304 - 710,000 \\ &= 181,304\end{aligned}$$

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

You know that the 2001 minimum contribution was paid at 01/01/2001. You can't directly use the formula shown above, since the problem does not give you the prior year's UAL.

Instead, you can directly calculate the value of ${}_eU\text{AL}_1$ using the actuarial equation of balance:

$$\begin{aligned}{}_eU\text{AL}_1 &= \text{O/S } \$412 \text{ bases}_1 - \text{CB}_1 - \text{ARA}_1 \quad (\text{excluding the bases created at 01/01/2002}) \\ &= (1.07)(250,000 - 25,000) - 0 - 0 \\ &= 240,750\end{aligned}$$

$$\begin{aligned}G/L &= 240,750 - 181,304 \\ &= 59,446\end{aligned}$$

The net result is a gain of 59,446

Answer is C

NOTE:

You could also use the equation of balance to calculate the value of the UAL at 01/01/2001, and use that in the typical formula for ${}_eU\text{AL}_1$:

$$\begin{aligned}\text{UAL}_0 &= \text{O/S } \$412 \text{ bases}_0 - \text{CB}_0 - \text{ARA}_0 \\ {}_eU\text{AL}_1 &= (1+i)(\text{NC}_0 + \text{UAL}_0) - (\text{contribution} + \text{interest})\end{aligned}$$

$$\begin{aligned}{}_eU\text{AL}_1 &= (1+i)(\text{NC}_0 + \text{O/S } \$412 \text{ bases}_0 - \text{CB}_0 - 0) - (1+i)(\text{NC}_0 + 25,000 - \text{CB}_0) \\ &= (1+i)(\text{O/S } \$412 \text{ bases}_1 - 25,000) \\ &= (1.07)(250,000 - 25,000) \\ &= 240,750\end{aligned}$$

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Problem 16 - Page 1

Similar to 2001 #08

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):

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

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.

$$\text{EAN UAL} = \text{O/S §412 bases} + \text{Method base} - \text{CB} - \text{ARA}$$

One minor trick to this problem is that you need to determine the G/L base that was established at 01/01/2002. This base would be established when the new cost method is anything other than Individual Aggregate, or the Aggregate method (see section 5.01(2) of Revenue Procedure 2000-40).

$$\begin{aligned} \text{EAN UAL} &= \text{O/S §412 bases} + \text{G/L base} + \text{Method base} - \text{CB} - \text{ARA} \\ &= \text{EAN AL} - \text{AAV} \\ &= 600,000 - 380,000 \\ &= 220,000 \end{aligned}$$

$$\begin{aligned} \text{O/S §412 bases} &= 150,000 \left(\ddot{a}_{\overline{24}|.07} / \ddot{a}_{\overline{30}|.07} \right) + \text{G/L base} + 60,000 \text{ Method} \\ &= 138,641 + \text{G/L} + 60,000 \end{aligned}$$

$$\begin{aligned} 220,000 &= 138,641 + \text{G/L} + 60,000 - 0 - 0 \\ \text{G/L} &= 21,359 \text{ Loss} \end{aligned}$$

The amortization period for all cost method change amortization bases specified in Revenue Procedure 2000-40 is 10 years. You could have saved the value of the IAL amortization from the prior calculation of the O/S base:

$$\begin{aligned} \text{IAL amortization} &= 150,000 / \ddot{a}_{\overline{30}|.07} = 11,297 \\ \text{Method amortization} &= 60,000 / \ddot{a}_{\overline{10}|.07} = 7,984 \\ \text{Loss amortization} &= 21,359 / \ddot{a}_{\overline{5}|.07} = 4,869 \end{aligned}$$

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Problem 16 - Page 2

The final step is setting up the MFSA to calculate the minimum contribution:

2002 Minimum Funding Standard Account			
Charges		Credits	
Normal Cost	75,000	Credit Balance	0
IAL amortization	11,297		
Method amortization	7,984	12/31 contribution	x
Loss amortization	4,869		
7% interest	6,940	7% interest	0
Total charges	106,090	Total credits	x

You have no information to calculate the §412 Full Funding Limitation. The minimum contribution at 12/31/02 is 106,090.

Answer is D

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Problem 17 - Page 1

Similar to 2001 #26

Revised 06/20/06

The key to this problem is calculation of the required quarterly installment, and the amount of the underpayment. To calculate the required quarterly contribution for 2002, 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 few details of the contribution for 2001. The reason is that the plan is exempt from the quarterly contribution requirement for 2001, since that is the first year of the MFSA.

You are given the normal cost for 2001 and 2002, both as of the valuation date. You can use the initial accrued liability to calculate the amortization payment for 2001. Since there is no G/L for 2001, you have the same amortization payment for 2002.

$$\text{IAL Amort} = 5,200,000 / \ddot{a}_{30|.07} = 391,635$$

$$12/31/01 \text{ "MFSA excluding CB"} = (\$412 \text{ NC} + \$412 \text{ amort} - 0) * 1.07 = 847,049$$

$$01/01/02 \text{ "MFSA excluding CB"} = (\$412 \text{ NC} + \$412 \text{ amort} - 0) = 891,635$$

$$\text{Lesser of 2001 or 90\% of 2002} = \text{Lesser of } (847,049 \text{ or } .90 * 891,635) = 802,471$$

The required quarterly installment is based on the applicable percentage multiplied by the RAP, which is $25\%(802,471) = 200,618$.

You are given the credit balance at 12/31/01 as 403,099. You may use this credit balance like an employer contribution for a required quarterly installment, but only if the contribution that creates the credit balance is actually in the trust fund at the installment date. The problem states that the contribution was paid by 12/31/01.

Date	Required	Amount Available	Overpayment (Underpayment)
01/01/02		403,099	403,099
04/15/02	200,618	$403,099 * [1 + (.07)*(3.5/12)]$ $= 411,329$	$411,329 - 200,618$ $= 210,711$
07/15/02	200,618	$210,711 * [1 + (.07)*(3.0/12)]$ $= 214,399$	$214,399 - 200,618$ $= 13,781$
10/15/02	200,618	$13,781 * [1 + (.07)*(3.0/12)]$ $= 14,022$	$14,022 - 200,618$ $= (186,596)$
01/15/03	200,618	Deductible Limit	0

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Problem 17 - Page 2

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 was paid at 12/31/01, so the period of underpayment is 2.5 months. Using simple interest, the interest penalty is calculated as follows:

$$\begin{array}{rcccl} & \text{Period of} & & & \\ \text{Pmt date} & \text{Underpayment} & \text{Amount} & \text{Penalty interest} & \text{Valuation interest} & \text{Penalty} \\ 10/15/02 & 2.5 \text{ months} & 186,596 * & [(1 + (.0792)(2.5/12)) - (1 + (.07)(2.5/12))] & & = 358 \end{array}$$

If 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)
01/01/02		403,099	403,099
04/15/02	200,618	$403,099 * (1.07)^{3.5/12}$ = 411,133	411,133 - 200,618 = 210,515
07/15/02	200,618	$210,515 * (1.07)^{3.0/12}$ = 214,106	214,106 - 200,618 = 13,488
10/15/02	200,618	$13,488 * (1.07)^{3.0/12}$ = 13,718	13,718 - 200,618 = (186,900)
01/15/03	200,618	Deductible Limit	0

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:

$$\begin{array}{rcccl} & \text{Period of} & & & \\ \text{Pmt date} & \text{Underpayment} & \text{Amount} & \text{Penalty interest} & \text{Valn interest} & \text{Penalty} \\ 10/15/02 & 2.5 \text{ months} & 186,900 * & [(1.0792)^{2.5/12} - (1.07)^{2.5/12}] & & = 338 \end{array}$$

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

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Problem 18 - Page 1

Revised 07/08/05

The first half of the problem is calculating the normal cost under the Individual Level Premium method. The key to this problem is calculating the G/L for 2001, and reflecting that in the 2002 MFSA.

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 01/01/2001, and at 01/01/2002. You need to calculate two layers of normal cost at those two dates.

Hire Age 48 at 01/01/98
Total service 17 years

Since there are no pre-retirement decrements, the calculation of present value of benefits and temporary annuity factors is on an interest-only basis. You can save some time by not calculating a result for the present value of the change in projected benefit. This allows you to combine terms and simplify the calculation of the change in the normal cost.

Normal cost calculation date		
	01/01/01	01/01/02
Age	51	52
Total service	17	17
Projected benefit	12(\$50)(17) = 10,200	12(\$60)(17) = 12,240
Δ Projected benefit	10,200 [‡]	2,040
PV (Δ Projected Benefit)	$10,200(D_{65} / D_{51}) \ddot{a}_{65}^{(12)}$ $= 10,200 v^{14} \ddot{a}_{65}^{(12)}$	$2,040(D_{65} / D_{52}) \ddot{a}_{65}^{(12)}$ $= 2,040 v^{13} \ddot{a}_{65}^{(12)}$
Δ Normal cost	$10,200 v^{14} \ddot{a}_{65}^{(12)} / \ddot{a}_{51:14} $ $= 10,200 v^{14} \ddot{a}_{65}^{(12)} / \ddot{a}_{14 .07}$ $= 10,200(10.0) / \ddot{s}_{14 .07}$	$2,040 v^{13} \ddot{a}_{65}^{(12)} / \ddot{a}_{52:13} $ $= 2,040 v^{13} \ddot{a}_{65}^{(12)} / \ddot{a}_{13 .07}$ $= 2,040(10.0) / \ddot{s}_{13 .07}$
Annuity certain value	24.1290	21.5505
Δ Normal cost	4,227	947
Total normal cost	4,227	5,174

[‡]NOTE: Some students don't like this identification of the initial normal cost layer.
I consider that their benefit increases from zero to 10,200 when the plan is established.

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Problem 18 - Page 2

Since ILP is an individual cost method, you must think about calculating the amount of G/L for 2001. The G/L must be calculated based on the prior plan benefits (see section 8 of Revenue Ruling 81-213). Otherwise, the difference between expected and actual unfunded liability would include both the plan change and the experience G/L.

$$\begin{aligned} G/L &= {}_eU\bar{A}L_1 - U\bar{A}L_1 \\ {}_eU\bar{A}L_1 &= (1+i)(NC_0 + U\bar{A}L_0) - (\text{contribution} + \text{interest}) \end{aligned}$$

You are told that the credit balance is zero at 12/31/2001. Under the ILP method, you know that the initial accrued liability is zero. Since the credit balance was also zero at 01/01/2001, the contribution plus interest must equal $(1+i)(NC_0)$:

$${}_eU\bar{A}L_1 = (1+i)(NC_0 + 0) - (1+i)(NC_0) = \text{zero}$$

Now you need to calculate this year's UAL. You can calculate the accrued liability by thinking in terms of the retrospective definition:

$$\begin{aligned} \bar{A}L_1 &= \sum_{t=IA}^{CA-1} NC_t (D_t/D_{CA}) \\ &= NC_{51} (D_{51}/D_{52}) && \text{Note: } IA = 51 = CA-1 \\ &= 4,227(1.07/p_{51}) && \text{Note: } p_{51} = 1.0 \\ &= 4,523 \end{aligned}$$

$$\begin{aligned} U\bar{A}L_1 &= \bar{A}L_1 - A\bar{A}V_1 \\ &= 4,523 - 1,800 = 2,723 \end{aligned}$$

$$G/L = 0 - 2,723$$

The net result is a loss of 2,723, since you expected to have a UAL of zero.

$$\text{Loss amortization} = 2,723 / \ddot{a}_{\overline{5}|.07} = 621$$

2002 Minimum Funding Standard Account			
Charges		Credits	
Normal Cost	5,174	Credit Balance	0
Loss amortization	621	12/31 contribution	x
7% interest	406	7% interest	0
Total charges	6,200	Total credits	x

You have no information to calculate the §412 Full Funding Limitation. The minimum contribution at 12/31/02 is 6,200.

Answer is D

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Problem 19

The key to this problem is handling the waiver in the MFSA. The waiver should be amortized at the greater of the valuation rate, or 150% of the Federal mid-term rate. In this problem, you should amortize the waiver at the valuation rate of 7%.

At 01/01/02, the new waiver base is established. The amortization of the waiver is over five years at 7%.

Amortization base	Original Base	Amortization
1-1-80 IAL base	400,000	$30,126 = 400,000 / \ddot{a}_{30 .07}$
1-1-02 Waiver base	47,800	$10,895 = 47,800 / \ddot{a}_{5 .07}$

2002 Minimum Funding Standard Account

Charges		Credits	
---------	--	---------	--

Normal Cost	45,000	Credit Balance	-0-
IAL amortization	30,126		
01/01 Waiver amortization	10,895	12/31 contribution	x
7% interest	6,021	7% interest	-0-
Total charges	92,043	Total credits	x

Since you have no EAN valuation results, you can't calculate the Full Funding Limitation. The minimum contribution at 12/31/02 is 92,043.

Answer is D

NOTES:

1. If you incorrectly amortize the waiver at 6.77%, you get the wrong answer (minimum contribution of 91,971 in answer range C).
2. To avoid "interest confusion" in the MFSA, it is a good idea to use an end of year amortization for the waiver. Then you would credit the valuation rate of interest on all the other MFSA charges. Since the waiver rate and the valuation rate are the same in this problem, the solution simply used the beginning of year waiver amortization.

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Problem 20 - Page 1

Similar to EA-1B 1999 #12

The key to this problem is handling mandatory employee contributions. The remainder of the problem is determining the normal cost under the Aggregate method.

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

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

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

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

The mandatory employee contributions are 1% of pay, so the present value of future contributions can be approximated as $1\%(5,400,000) = 54,000$. This is an approximation, because it assumes that the current year's employee contribution is paid in full at the beginning of the year. In reality, employee contributions are withheld from each paycheck, or are simply paid at the end of each year.

$$\begin{aligned}\$412 \text{ PVNC} &= (1,280,000 + 100,000) - (195,000 + 30,000 + 54,000) - (0 - 0) \\ &= 1,101,000\end{aligned}$$

$$\begin{aligned}\text{PVE} / \text{E} &= 5,400,000 / 600,000 \\ &= 9.0\end{aligned}$$

$$\text{AGG NC} = 122,333$$

The problem asks for the minimum employer contribution for 2002. With a zero credit balance at 12/31/2001, the minimum is simply the normal cost increased with interest:

$$\begin{aligned}12/31 \text{ min} &= 122,333 * 1.07 \\ &= 130,897\end{aligned}$$

Answer is C

NOTE:

There is another solution technique that some students prefer, which does not reduce the PVNC by the present value of future expected mandatory employee contributions (PVEEC). As a result, the "total NC" is calculated. You then have to calculate the "employer NC" by reducing the total NC by the mandatory employee contributions for the current year. These calculations are shown on the next page.

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Problem 20 - Page 2

(Alternate solution method)

$$\begin{aligned}\text{Total PVNC} &= (\text{PVB} + \text{refunds}) - (\text{AAV} + \text{EECWI}) - (\text{O/S } \$412 \text{ bases} - \text{CB}) \\ &= (1,280,000 + 100,000) - (195,000 + 30,000) - (0 - 0) \\ &= 1,155,000\end{aligned}$$

$$\begin{aligned}\text{Total NC} &= 1,155,000 / 9.0 \\ &= 128,333\end{aligned}$$

$$\begin{aligned}\text{Employer NC} &= 128,333 - 1\%(600,000) \\ &= 122,333\end{aligned}$$

The problem asks for the minimum employer contribution for 2002. With a zero credit balance at 12/31/2001, the minimum is simply the normal cost increased with interest:

$$\begin{aligned}\text{12/31 min} &= 122,333 * 1.07 \\ &= 130,897\end{aligned}$$

In this problem (as well as prior exam problems), this solution method gives the identical answer. This is not always the case - consider a plan where the mandatory employee contributions are 1% up to 50,000 and 3% above 50,000. If the valuation assumptions include a salary scale, then the two solution methods will produce a different result.

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Problem 21 - Page 1

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

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

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

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

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

(15) Smoothed market value without phase-in

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

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

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Problem 21 - Page 2

Here is the calculation of the actuarial value of assets based on Method 15 (smoothed market value):

Year	2000	2001	2002
Market value at 1-1	6,900,000	6,900,000	5,800,000
Full year of interest	483,000	483,000	
Contributions	250,000	150,000	
Benefit payments	(250,000)	(350,000)	
Half year of interest (compound)	0	(6,882)	
Expected value at 12-31	7,383,000	7,176,118	
Market value at 1-1	6,900,000	6,900,000	5,800,000
Expected value at 1-1	6,900,000	7,383,000	7,176,118
Gain (loss)		(483,000)	(1,376,118)
Fraction		1/3	2/3
Unrecognized portion		(161,000)	(917,412)

The preliminary actuarial value of assets is the final market value at 1-1-2002 minus the total unrecognized portion of the G/L:

$$6,878,412 = 5,800,000 - (-161,000 - 917,412)$$

This asset value must be compared to the 80% and 120% corridors. The final actuarial value of assets is just below the 120% corridor of $6,960,000 = 120\%(5,800,000)$.

Answer is E

NOTES

1. If you mistakenly calculate the average market value (Approval 11), you get 5,800,000 as the final actuarial asset value, which is the wrong answer.
2. If you used simple interest to calculate the expected market value, the expected asset value at 12/31/01 would be 7,176,000. The final actuarial asset value would be slightly different: $6,878,333 = 5,800,000 - (-161,000 - 917,333)$

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Problem 22 - Page 1

Similar to 2001 #18

Revised 07/08/05

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.

Unlike the 2001 problem, there is only one active employee. This greatly simplifies the normal cost calculation.

<u>Description</u>	<u>Jones</u>	<u>Smith</u>	<u>Total</u>
01/2002 Age	55	69	
Future service	10		
2001 pay (age 54)	28,500		
Age 64 pay	$28,500(1.04)^{10}$ = 42,187		
Projected benefit	$(50\%)(42,187)$ = 21,093	$12(1,000)$ = 12,000	
PV future benefits	$21,093(D_{65} / D_{55}) \ddot{a}_{65}^{(12)}$ = $21,093(1.07)^{-10} (9.70)$ = 104,012	$12,000 \ddot{a}_{69}^{(12)}$ = $12,000(7.83)$ = 93,960	197,972

Now you can calculate the Aggregate PVNC:

$$\begin{aligned}
 \text{\$412 PVNC} &= \text{PVB} - \text{AAV} - (\text{O/S } \text{\$412 bases} - \text{CB}) && \text{NOTE: No ARA under Aggregate} \\
 &= 197,972 - 95,000 - (0 - 1,500) \\
 &= 104,472
 \end{aligned}$$

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

$$\begin{aligned}
 {}^S\ddot{a}_{55:10} &= 1 + (1.04/1.07)^1 + \dots + (1.04/1.07)^9 \\
 &= \ddot{a}_{10|j} \text{ where } 1+j = (1.07 / 1.04), \quad j = 2.88\%
 \end{aligned}$$

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Problem 22 - Page 2

Since you only have one participant, the average temporary annuity (PVE/E) is equal to Smith's temporary annuity:

$$\begin{aligned} s\ddot{a}_{\overline{55:10}|} &= \ddot{a}_{\overline{10}|2.88\%} \\ &= 8.8282 \end{aligned}$$

$$\begin{aligned} \$412 \text{ NC} &= \text{PVNC} / (\text{PVE}/E) \\ &= 104,472 / 8.8282 \\ &= 11,834 \end{aligned}$$

The final step is calculation of the minimum required contribution.

2002 Minimum Funding Standard Account			
Charges		Credits	
Normal Cost	11,834	Credit Balance	1,500
		12/31 contribution	x
7% interest	828	7% interest	105
Total charges	<u>12,662</u>	Total credits	<u>x + 1,605</u>

You have no information to calculate the §412 Full Funding Limitation. The minimum contribution at 12/31/02 is $12,662 - 1,605 = 11,057$.

Answer is B

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Problem 23 - Page 1

Similar to 1998 EA-2 #19

The key to this problem is the derivation of the average temporary annuity used for the normal cost calculation at 01/01/2002. You must set up both the expected (and actual) balance sheets at 01/01/02.

Item	Actual 01/01/01	Expected 01/01/02
PVB	2,000,000	$(1.07)(2,000,000)$ $= 2,140,000$
UAL	N/A	615,000
AAV	N/A	1,335,000
PVE / E	10.0	$\frac{(1.07) * (10.0 - 1.0)}{p_x(1.04)}$ $= 9.2596$

The key point of the problem is the formula used for the PVE/E ratio at 01/01/02. The calculation of the expected PVE/E assumes that the value of p_x is 1.0 at all ages (no pre-retirement decrements). This assumption is based on exam condition #19.

Once you have calculated the expected PVE/E, you are mostly done with the solution. The reason is that most items in the actual column have the same value as the expected column.

The only real calculation is the actual PVB. You must allow for the difference between the salary scale of 4% and the actual compensation increases of 2%:

Item	Actual 01/01/01	Expected 01/01/02	Actual 01/01/02
PVB	2,000,000	$(1.07)(2,000,000)$ $= 2,140,000$	$\frac{(1.02)(2,140,000)}{(1.04)}$ $= 2,098,846$
UAL	N/A	615,000	Same
AAV	N/A	1,335,000	Same
PVNC	N/A		$2,098,846$ $- 615,000 - 1,335,000$ $= 148,846$
PVE / E	10.0	$= 9.2596$	Same
NC			$148,846 / 9.2596$ $= 16,075$

Answer is C

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Problem 23 - Page 2

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

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

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

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

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Problem 24

Similar to 2001 #21

The key to this problem is handling the change in the interest rate in the §412 MFSA. You have to determine the outstanding amount of several §412 bases at 8.5%, and re-determine the amortization of all three bases at the new 6.75% interest rate:

Amortization base	Remaining years	8.5% Outstanding base	New Amortization Amount at 6.75%
1-1-1980 Initial AL	$8 = 30 - (2002 - 1980)$	$305,926 = 50,000 * \ddot{a}_{8 0.085}$	$305,926 / \ddot{a}_{8 0.0675}$ $= 47,529$
1-1-1999 Plan base	$27 = 30 - (2002 - 1999)$	$96,510 = 8,500 * \ddot{a}_{27 0.085}$	$96,510 / \ddot{a}_{27 0.0675}$ $= 7,365$
1-1-2002 Assump base	$10 = 10 - (2002 - 2002)$	200,000	$200,000 / \ddot{a}_{10 0.0675}$ $= 26,368$

Now you must set up the MFSA for 2002, and solve for the minimum contribution at 12/31/02:

2002 Minimum Funding Standard Account			
Charges		Credits	
Normal Cost	60,000	Credit Balance	0
IAL amortization	47,529		
PLAN amortization	7,365		
ASSM amortization	26,368	12/31 minimum	x
6.75% interest	9,535	6.75% interest	0
Total charges	150,797	Total credits	x

You have no information to calculate the §412 Full Funding Limitation. The minimum contribution payable 12/31/02 is 150,797.

Answer is C

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Problem 25

The key to this problem is recognizing the impact of the zero FFL for 2000 and 2001. You also need to use the MFSA amortization periods for multiemployer plans.

You are told that both the ERISA FFL and the RPA FFL are zero for 2000 and 2001. That means that all the prior year's MFSA bases were eliminated at 01/01/2001 and at 01/01/2002. This destroys the actuarial equation of balance.

Section 7 of RR 81-213 defines a "Special G/L" calculation that establishes an amortization base that FORCES the theoretical equation of balance to hold. Section 7 of RR 81-213 states that you can do a special determination of the G/L only when an experience loss has occurred, and when there are no other amortization bases.

Unit Credit is an individual cost method, and you normally would calculate the experience G/L each year. For the 2001 loss base (established at 01/01/2002), you simply "back into" the amount of the base needed, and call that an experience loss base:

$$\begin{aligned}\text{UAL} &= \text{O/S } \$412 \text{ bases} - \text{CB} - \text{ARA} \\ \text{Loss base} &= \text{UAL} + \text{credit balance} + \text{ARA} \\ &= 4,000,000 + 0 + 0\end{aligned}$$

The loss is amortized over fifteen years, since this is a multiemployer plan:

$$\begin{aligned}\text{Loss amortization} &= 4,000,000 / \ddot{a}_{15|.07} \\ &= 410,447\end{aligned}$$

2002 Minimum Funding Standard Account			
Charges		Credits	
Normal Cost	7,000,000	Credit Balance	0
Loss amortization	410,447	12/31 contribution	x
7% interest	518,731	7% interest	0
Total charges	<u>7,929,178</u>	Total credits	<u>x</u>

You have no information to calculate the \$412 Full Funding Limitation. The minimum contribution payable 12/31/02 is 7,929,178.

Answer is A

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Problem 26 - Page 1

The key point of this problem is calculating the Full Funding Limitation under §404. With an aggregate type cost method, you need market value of assets, Entry age normal valuation results, and current liability to check the Full Funding Limitation (FFL). The end of year valuation date in the problem usually simplifies the calculation of the normal cost and FFL.

You need to calculate the deductible limit, which is defined as normal cost plus limit adjustments. There are no limit adjustments under the Aggregate method. You must determine the §404 NC.

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

$$\begin{aligned}\$404 \text{ PVNC} &= \text{PVB} - \$404 \text{ AAV} \\ &= 2,000,000 - 880,000 \\ &= 1,120,000\end{aligned}$$

$$\begin{aligned}\text{PVE} / \text{E} &= 1,400,000 / 140,000 \\ &= 10.00\end{aligned}$$

$$\text{NC} = 112,000$$

$$\text{Deductible limit} = 112,000$$

Since the valuation date is 12/31, there is no interest adjustment on the sum of normal cost plus limit adjustments.

The next step is to check the Full Funding Limitation under §404. A key point is that, in 2002, the OBRA 87 FFL current liability is multiplied by 165%.

$$\begin{aligned}\$404 \text{ "ERISA" FFL} &= (1+i) * (\text{EAN NC} + \text{EAN AL} - (\text{lesser MVA, AAV})) \\ &= 950,000 - 850,000 \\ &= 100,000\end{aligned}$$

$$\begin{aligned}\$404 \text{ "OBRA 87" FFL} &= 1.65 (12/31 \text{ CL}) - (1+i) * (\text{lesser MVA, AAV}) \quad (\text{if no benefit payments}) \\ &= 1.65 * 1,025,000 - 850,000 \\ &= 841,250\end{aligned}$$

$$\begin{aligned}\$404 \text{ "RPA 94" FFL} &= .90 (12/31 \text{ RPA CL}) - (1+i) * (\text{AAV}) \quad (\text{if no benefit payments}) \\ &= .90 * 1,000,000 - 880,000 \\ &= 20,000\end{aligned}$$

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Problem 26 - Page 2

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

The final §404 FFL value is the greater of the RPA '94 floor, and the lesser of the ERISA and OBRA FFL values, or 100,000. Since the §404 FFL does apply, you do not need to calculate the §412 minimum contribution. The deductible limit is the lesser of the §404 FFL of 100,000, or the greater of the normal cost plus limit adjustments of 112,000 and the minimum contribution. The final result is 100,000, regardless of the magnitude of the minimum contribution.

The final calculation is the unfunded current liability. There are no specific details of how to calculate this value in §404, but it is generally done on an end of year basis:

$$\begin{aligned}\text{\$404 "RPA 94" UCL} &= 1.00 (12/31 \text{ CL}) - (1+i) \cdot (\text{AAV}) && \text{(if no benefit payments)} \\ &= 1,000,000 - 880,000 \\ &= 120,000\end{aligned}$$

The §404 UCL exceeds the previously calculated deductible limit of 100,000. The final deductible limit equals the §404 UCL of 120,000.

Answer is C

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Problem 27 - Page 1

Similar to 1998 EA-2 #14

The key to this problem is the derivation of the average temporary annuity used for the normal cost calculation at 01/01/2002. You must set up both the expected (and actual) balance sheets at 01/01/02.

There is one key difference between this problem and #23 on the 2002 exam. In #23, the cost method was FIL. In that problem, we did not use the credit balance in the problem solution. This is because we relied on the relationship

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

This problem uses the Aggregate cost method, which has no UAL. Under the Aggregate method, the present value of normal costs (PVNC) is defined as the present value of benefits less the assets less the outstanding \$412 bases (reduced by the credit balance):

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

Item	Actual 01/01/01	Expected 01/01/02
PVB	500,000	(1.07)(500,000)
AAV	350,000	(1.07)(350,000+25,500)
CB	20,000	(1.07)(20,000)
PVNC	$500,000 - 350,000 - [0 - 20,000]$ $= 170,000$	(don't care)
PVE / E	$6.6667 = 2,000,000 / 300,000$	$5.8301 = \frac{(1.07) * (6.6667-1.0)}{p_x(1.04)}$
NC	25,500	(don't care)

The key point of the problem is the formula used for the PVE/E ratio at 01/01/02. The calculation of the expected PVE/E assumes that the value of p_x is 1.0 at all ages (no pre-retirement decrements).

Once you have calculated the expected PVE/E, you must set up the 2001 MFSA and calculate the 12/31/2001 credit balance. If the contribution was equal to the normal cost of 25,500, the credit balance would equal $1.07(20,000)$, as shown above.

2001 Minimum Funding Standard Account			
Charges		Credits	
Normal Cost	25,500	Credit Balance	20,000
		12/31/01 contribution	7,000
7% interest	1,785	7% interest	1,400
Total charges	27,285	Total credits	28,400

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Problem 27 - Page 2

Revised 10/31/06

The 12/31/2001 credit balance is $1,115 = 28,400 - 27,285$. Now you can calculate values for items in the actual column.

The PVB must reflect the difference between the salary scale of 4% and the actual compensation increases of 8%. The assets must reflect the timing and amount of contribution, plus the actual investment return of 8.5%.

Item	Actual 01/01/01	Expected 01/01/02	Actual 01/01/02
PVB	500,000	$(1.07)(500,000)$	$555,577 = \frac{(1.07)(1.08)(500,000)}{1.04}$
AAV	350,000	$(1.07)(350,000 + 25,500)$	$386,750 = (1.085)(350,000) + 7,000$
CB	20,000	$(1.07)(20,000)$	1,115
PVNC	170,000	(don't care)	$169,942 = 555,577 - 386,750 + 1,115$
PVE / E	6.6667	5.8301	5.8301
NC	25,500	(don't care)	29,149

Finally, you can complete the 2002 MFSA:

2002 Minimum Funding Standard Account			
Charges		Credits	
Normal Cost	29,149	Credit Balance	1,115
		12/31/01 contribution	x
7% interest	2,040	7% interest	78
Total charges	31,189	Total credits	x + 1,193

You have no information to calculate the §412 Full Funding Limitation. The minimum contribution payable 12/31/02 is $31,189 - 1,193 = 29,996$.

Answer is C

NOTE

Unlike 2002 #23, in this problem you can verify that the expected balance sheet numbers are consistent with the 2001 valuation results. The 2001 normal cost is 1.275% of pay. If all the assumptions are met, then the expected normal cost for 2002 should be 1.275% of pay. Since all participants are less than age 64 at 01/01/2001, the normal cost will increase by the salary scale: $1.275\%(1.04)(2,000,000) = 1.04(25,500) = 26,520$.

If you calculate the normal cost from the expected column, you will get 26,520. This demonstrates that the formula for the expected PVE/E must be correct. See 2002 #23 for the derivation of the formula.

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Problem 28 - Page 1

The key to this problem is handling of the contribution of 50,000 for 2002 that was deducted for 2001. This is an advance-deducted contribution, which has rarely been tested on the exam.

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

The deductible limit for the taxable year ending 09/30/02 is based on the valuation for the plan year beginning in that tax year. The 01/01/02 valuation should be used to determine the deductible limit needed for the answer to this problem.

Any problem with a non-deductible (or advance-deducted) contribution has to give you something specific that identifies why a portion of the contribution was not deducted (or deducted in advance). In the absence of any such information, you can assume that the entire contribution was deducted. This is based on the exam condition #35:

"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 problem asks for the deductible limit for the tax year ending 09/30/2002. You are told that the contribution of 50,000 for 2002 was deducted for the tax year ending 09/30/2001.

This contribution is not included in the credit balance, the MFSA, or the asset values as of 01/01/2002. The reason is that the 50,000 contribution is considered a future plan year contribution under Section 412. As described earlier, the asset values given in any problem are (by default) for purposes of 412.

Since the contribution of 50,000 for the current plan year has been deducted in advance, you must adjust the assets when calculating the §404 normal cost. The general relationship between the asset values is that the §404 AAV equals the §412 AAV minus any non-deducted contributions (or plus any advance-deducted contributions):

$$\text{\$404 PVNC} = \text{PVB} - \text{\$404 AAV}$$

$$\begin{aligned}\text{\$404 AAV} &= \text{\$412 AAV} - \text{NDC} \\ &= \text{\$412 AAV} + \text{ADC}\end{aligned}$$

$$\begin{aligned}\text{\$404 AAV} &= 750,000 + 50,000 \\ &= 800,000\end{aligned}$$

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Problem 28 - Page 2

Revised 07/14/06

The first step should be to calculate the normal cost plus limit adjustments. There are no ten year amortization bases or limit adjustments under the Aggregate method. The deductible limit is the normal cost plus limit adjustments brought forward with interest to the earlier of the end of the plan year, or the end of the tax year, which is 09/30/02.

$$\begin{aligned}\$404 \text{ PVNC} &= \text{PVB} - \$404 \text{ AAV} \\ &= 4,000,000 - 800,000 \\ &= 3,200,000\end{aligned}$$

$$\begin{aligned}\text{PVE/E} &= 3,000,000 / 250,000 \\ &= 12.00\end{aligned}$$

$$\begin{aligned}\text{NC} &= 3,200,000 / 12.00 \\ &= 266,667\end{aligned}$$

$$\begin{aligned}\text{Limit adjustment} &= \text{zero} \\ \text{Deductible limit} &= (266,667 + 0) * [1 + (9/12)*.07] \\ &= 280,667\end{aligned}$$

The second step is usually to check the Full Funding Limitation under §404. Since you have no Entry Age Normal valuation results, you can't check the Full Funding Limitation.

With the Aggregate method, and a credit balance of 75,000, it is unlikely that the minimum contribution would exceed 280,667. You can safely skip any work involving the Minimum Funding Standard Account.

The deductible limit is 280,667. Since you have no information on current liability, you can't check the §404 unfunded current liability.

Answer is B

On a compound interest basis, the deductible limit is $266,667 * (1.07)^{(9/12)} = 280,548$.

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Problem 29 - Page 1

Similar to 2001 #3

The key point to this problem is the calculation of the liquidity shortfall. You have to construct 12 months of disbursements from the monthly payments you are given.

You are given the required quarterly contribution for 2002 as 5,000, ignoring the liquidity requirement. You have to calculate the amount of the liquidity shortfall. If it were greater than 5,000, then the required payment at 04/15/2002 would equal the liquidity shortfall. This is based on the definition of the "required installment" in §412(m)(5)(A), which is actually a bit more precise:

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

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

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

Adjusted disbursements equal all disbursements from the 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.

$$\begin{aligned}\text{All Disbursements} &= 9(7,000+50) + 3(7,100+100) + 8,000 \\ &= 93,050\end{aligned}$$

$$\text{Accelerated payments} = 8,000 \text{ lump sum at } 03/01/02$$

$$\begin{aligned}\text{FCL\%} &= 275,000 / 800,000 \\ &= 34.38\%\end{aligned}$$

$$\begin{aligned}\text{Base amount} &= 3 * [93,050 - 34.38\%(8,000)] \\ &= 270,899\end{aligned}$$

$$\text{Liquid assets} = 250,000 \text{ market value}$$

$$\begin{aligned}\text{Liquidity Shortfall} &= 270,899 - 250,000 \\ &= 20,899\end{aligned}$$

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Problem 29 - Page 2

The required installment at 04/15/2001 is the greater of the quarterly requirement of 5,000 and the liquidity shortfall of 20,899.

The cap on the liquidity shortfall is the amount to increase the FCL% to 100%. This is an amount larger than the 525,000 unfunded current liability at 01/01/2002. This has no impact, since it is much greater than the liquidity shortfall.

Answer is B

NOTE

One point of the problem is that you must be careful in adding up the disbursements for the 12 months ending on 03/31/02. If you incorrectly use 12 times the 2002 monthly values, you will have total disbursements of 94,400. This will give you a liquidity shortfall of 24,950, which is the wrong answer.

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Problem 30 - Page 1

The key point of this problem is calculating the Full Funding Limitation under §404. With an aggregate type cost method, you need market value of assets, Entry age normal valuation results, and current liability to check the Full Funding Limitation.

You need to calculate the deductible limit, which is defined as normal cost plus limit adjustments, brought forward with interest to the earlier of the end of the plan year, or the end of the tax year. The only limit adjustment is for the Initial Accrued Liability of 106,000.

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

$$404 \text{ NC} = 1,660$$

$$\begin{aligned} \text{Limit adjustment} &= 106,000 / \ddot{a}_{10|.07} \\ &= 14,105 \end{aligned}$$

$$\begin{aligned} \text{Deductible limit} &= (1,660 + 14,105) * 1.07 \\ &= 16,868 \end{aligned}$$

Next, you should calculate the Full Funding Limitation (FFL). For 2002, the OBRA FFL calculation uses 165% of the current liability. Since this plan uses an aggregate type cost method, the ERISA FFL must be calculated using the entry age normal cost and accrued liability

One of the key points of the problem is that you must bring the current liability forward to the end of the plan year for the FFL calculation. You should use the 6% current liability rate, and the expected increase of 4,000:

$$\begin{aligned} \text{\$404 "ERISA" FFL} &= (1+i)*(EAN \text{ NC} + EAN \text{ AL}) - (1+i)*(\text{lesser MVA, AAV}) \\ &= 1.07 * (2,000 + 118,000 - 92,500) \\ &= 29,425 \end{aligned}$$

$$\begin{aligned} \text{\$404 "OBRA" FFL} &= 1.65 (12/31 \text{ CL}) - (1+i)*(\text{lesser MVA, AAV}) \quad (\text{if no benefit payments}) \\ &= 1.65 * (1.06) * (62,000+4,000) - 1.07 * (92,500) \\ &= 16,459 \end{aligned}$$

$$\begin{aligned} \text{\$404 "RPA 94" FFL} &= .90 (12/31 \text{ CL}) - (1+i)*(AAV) \quad (\text{if no benefit payments}) \\ &= .90 * (1.06) * (62,000+4,000) - 1.07 * (92,500) \\ &= \text{Zero} \end{aligned}$$

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Problem 30 - Page 2

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 §404 FFL value is the greater of the RPA '94 floor, and the lesser of the ERISA and OBRA FFL values, or 16,459. Since the §404 FFL does apply, you do not need to calculate the §412 minimum contribution. The deductible limit is the lesser of the §404 FFL of 16,459, or the greater of the normal cost plus limit adjustments of 16,868 and the minimum contribution. The final result is 16,459, regardless of the magnitude of the minimum contribution.

The final calculation is the unfunded current liability. There are no specific details of how to calculate this value in §404, but it is generally done on an end of year basis:

$$\begin{aligned}\text{\$404 "RPA 94" UCL} &= 1.00 (12/31 \text{ CL}) - (1+i) * (\text{AAV}) && \text{(if no benefit payments)} \\ &= 1.0 * (1.06) * (62,000 + 4,000) - 1.07 * (92,500) \\ &= \text{zero}\end{aligned}$$

The final deductible limit is still the §404 FFL of 16,459.

Answer is D

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Problem 31 - Page 1

Revised 07/08/05

The key point of this problem is calculating the Full Funding Limitation under §404. With an aggregate type cost method, you need market value of assets, Entry age normal valuation results, and current liability to check the Full Funding Limitation.

You need to calculate the deductible limit, which is defined as 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. There are two limit adjustments for the Initial Accrued Liability and the change in assumptions.

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

$$404 \text{ NC} = 112,273$$

$$\begin{aligned} \text{Limit adjustment} &= (2,100,000 + 340,000) / \ddot{a}_{10|.07} \\ &= 324,674 \end{aligned}$$

$$\begin{aligned} \text{Deductible limit} &= (112,273 + 324,674) * 1.07 \\ &= 467,533 \end{aligned}$$

Next, you should calculate the Full Funding Limitation (FFL). For 2002, the OBRA FFL calculation uses 165% of the current liability. Since this plan uses an aggregate type cost method, the ERISA FFL must be calculated using the entry age normal cost and accrued liability.

One of the key points of the problem is that you must bring the current liability forward to the end of the plan year for the FFL calculation. You should use the 6% current liability rate:

$$\begin{aligned} \text{\$404 "ERISA" FFL} &= (1+i)*(EAN \text{ NC} + EAN \text{ AL}) - (1+i)*(lesser \text{ MVA, AAV}) \\ &= 1.07 * (2,150,000 - 1,740,000) \\ &= 438,700 \end{aligned}$$

$$\begin{aligned} \text{\$404 "OBRA" FFL} &= 1.65 (12/31 \text{ CL}) - (1+i)*(lesser \text{ MVA, AAV}) \quad (\text{if no benefit payments}) \\ &= 1.65 * (1.06) * (2,180,000) - 1.07 * (1,740,000) \\ &= 1,951,020 \end{aligned}$$

$$\begin{aligned} \text{\$404 "RPA 94" FFL} &= .90 (12/31 \text{ CL}) - (1+i)*(AAV) \quad (\text{if no benefit payments}) \\ &= .90 * (1.06) * (2,180,000) - 1.07 * (1,740,000) \\ &= 217,920 \end{aligned}$$

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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 §404 FFL value is the greater of the RPA '94 floor, and the lesser of the ERISA and OBRA FFL values, or 438,700. Since the §404 FFL does apply, you do not need to calculate the §412 minimum contribution. The deductible limit is the lesser of the §404 FFL of 438,700, or the greater of the normal cost plus limit adjustments of 467,533 and the minimum contribution. The final result is 438,700, regardless of the magnitude of the minimum contribution.

The final calculation is the unfunded current liability. There are no specific details of how to calculate this value in §404, but it is generally done on an end of year basis:

$$\begin{aligned}\text{\$404 "RPA 94" UCL} &= 1.00 (12/31 \text{ CL}) - (1+i) * (\text{AAV}) && \text{(if no benefit payments)} \\ &= 1.00 * (1.06) * (2,180,000) - 1.07 * (1,740,000) \\ &= 449,000\end{aligned}$$

The §404 UCL exceeds the previously calculated deductible limit of 438,700. The final deductible limit equals the §404 UCL of 449,000.

Answer is B

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Problem 32

Similar to 2000 EA-1B #14

Revised 07/08/05

The key to this problem is handling the multiple retirement decrements correctly in calculating the accrued liability. The Unit Credit accrued liability is defined as the present value of the actual accrued benefit. With retirement decrements, the accrued liability must be calculated as a complicated summation.

Age 63 at 01/01/02

Past service is 33 years

Accrued benefit $13,860 = 35(12)(33)$

$$UC\ AL = \sum_{t=0}^2 v^t {}_t p_{63}^{(T)} q_{63+t}^{(r)} ERB_{63+t} \ddot{a}_{63+t}^{(12)}$$

		(1)	(2)	(3)		(4)	(5)	(6)
t	$63+t$	v^t	${}_t p_{63}^{(T)}$	$q_{63+t}^{(r)}$	${}_t p_{63+t}^{(T)}$	ERB_{63+t}	$\ddot{a}_{63+t}^{(12)}$	$(1)(2)(3)(4)(5)$
0	63	1.0000	1.00	.20	.80	12,197	9.72	23,711
1	64	.9346	0.80	.40	.60	13,028	9.48	36,937
2	65	.8734	0.48	1.00	0.00	13,860	9.24	<u>53,692</u>
								114,340

The early retirement benefits are calculated by applying the 6% per year reductions to the accrued benefit:

$$ERB_{63} = 12,196.80 = 13,860 (1-.06(65-63))$$

$$ERB_{64} = 13,028.40 = 13,860 (1-.06(65-64))$$

Answer is A

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Problem 33 - Page 1

The key to this problem is calculating the Full Funding Limitation (FFL) credit in the 2002 Minimum Funding Standard Account (MFSA). This problem did not try to be sneaky about the FFL credit at all.

The first step in the problem is calculation of the normal cost under the Aggregate method:

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

$$\begin{aligned}\$412 \text{ PVNC} &= 8,500,000 - 6,600,000 - (0 - 0) \\ &= 1,900,000\end{aligned}$$

$$\begin{aligned}\text{PVE} / \text{E} &= 32,500 / 2,700 \\ &= 12.3070\end{aligned}$$

$$\text{AGG NC} = 157,846$$

Now you can set up the MFSA for 2002:

2002 Minimum Funding Standard Account			
Charges		Credits	
Normal Cost	157,846	Credit Balance	0
		12/31/02 contribution	x
7% interest	11,049	7% interest	0
Total charges	168,895	Total credits	x

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

Next, you should calculate the Full Funding Limitation (FFL). For 2002, the OBRA FFL calculation uses 165% of the current liability. Since this plan uses an aggregate type cost method, the ERISA FFL must be calculated using the entry age normal cost and accrued liability. In this problem, you are given end-of-year liability values, which simplifies the calculations:

$$\begin{aligned}\$412 \text{ "ERISA" FFL} &= (1+i) * (\text{EA NC} + \text{EAN AL}) - (1+i) * [\text{lesser (MVA, AAV)} - \text{CB}] \\ &= 7,275,000 - 1.07 * (6,500,000 - 0) \\ &= 320,000\end{aligned}$$

$$\begin{aligned}\$412 \text{ "OBRA" FFL} &= 1.65 (12/31 \text{ CL}) - (1+i) * [\text{lesser (MVA, AAV)} - \text{CB}] \quad (\text{if no benefit payments}) \\ &= 1.65 * (4,300,000) - 1.07 * (6,500,000 - 0) \\ &= 140,000\end{aligned}$$

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$$\begin{aligned}\$412 \text{ "RPA 94" FFL} &= .90 (12/31 \text{ CL}) - (1+i) * (\text{AAV}) && \text{(if no benefit payments)} \\ &= .90 * (4,300,000) - 1.07 * (6,600,000) \\ &= \text{Zero}\end{aligned}$$

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 140,000.

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 168,895. Since this exceeds the FFL of 140,000, there is a FFL credit in the MFSA for the excess of 28,895.

Answer is B

Unlike many prior exam problems, this question did not ask for the minimum contribution at 12/31/02. Here is that calculation:

2002 Minimum Funding Standard Account			
Charges		Credits	
Normal Cost	157,846	Credit Balance	0
		12/31/01 FFL credit	28,895
		12/31/01 contribution	x
7% interest	11,049	7% interest	0
Total charges	<u>168,895</u>	Total credits	<u>x + 28,895</u>

The minimum contribution at 12/31/02 is $140,000 = 168,895 - 28,895$. As you should expect, the minimum contribution is equal to the FFL.

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Problem 34

The key to this problem is knowing the gain / loss formulas, and how to calculate the G/L due to salary increases. As in earlier problems, this one has a salary scale, and a cost method given as Unit Credit. The cost method is actually Projected Unit Credit, which affects the solution very little.

The only source of G/L was the salary scale. You need to calculate the non-investment gain / loss, which is defined as the difference between the expected and actual accrued liability:

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

$$\begin{aligned}\text{AL}_0 &= 195,000 + 225,000 \\ &= 420,000\end{aligned}$$

$$\begin{aligned}{}_e\text{AL}_1 &= (1.07)(420,000 + 25,000) - \text{zero} \\ &= 476,150\end{aligned}$$

Since the only source of G/L was the salary scale, you can easily calculate the actual accrued liability at 01/01/02:

$$\text{AL}_1 = \frac{(1.0875)(476,150)}{(1.0500)}$$

$$\begin{aligned}\text{Non-inv G/L} &= {}_e\text{AL}_1 - \text{AL}_1 \\ &= \frac{(-0.0375)(476,150)}{(1.0500)} \\ &= 17,005 \text{ Loss}\end{aligned}$$

Answer is C

How did we use the PUC cost method in the solution? We used the PUC cost method to write the formula for AL_1 . Both ${}_e\text{AL}_1$ and AL_0 are based on a projected FAE3 at 65. Since all participants are under age 60, a salary increase of 8.75% produces a projected FAE3 at 65 that equals the expected value times $(1.0875)/(1.05)$.

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Problem 35 - Page 1

Similar to 2000 EA-1B #17

This problem has a salary scale, and a cost method given as Unit Credit. One key to this problem is knowing that the calculations must be performed using Projected Unit Credit, otherwise you don't have a reasonable funding method. Another key to this problem is handling the multiple withdrawal decrements correctly in calculating the normal cost under the Projected Unit Credit (PUC) method.

Under PUC, the normal cost is defined based on the change in the "Funding accrued benefit" (FAB). The Unit Credit method simply uses the actual accrued benefit. For a final average pay plan, you can calculate the FAB based on past service and the benefit accrual formula, but with final average pay projected to the benefit commencement age.

Age 50 at 01/01/02
Past service 20 years

The PUC normal cost is defined as the present value of the change in the funding accrued benefit. Using withdrawal decrements, the normal cost must be calculated as a complicated summation, plus a term that represents survival to NRA 65:

$$\text{PUC NC} = \left[\sum_{t=0}^{14} v^t p_{50}^{(T)} q_{50+t}^{(w)} \Delta \text{FAB}_{50+t} (D_{65} / D_{50+t}) \ddot{a}_{65}^{(12)} \right] + \left[v^{15} {}_{15}p_{50}^{(T)} \Delta \text{FAB}_{65} \ddot{a}_{65}^{(12)} \right]$$

There are really only two terms in the summation above, since the probability of exit is zero prior to age 63. One key point is that you need to project pay to each exit age. This projected pay is used to calculate the FAE3 at each exit age, which is used to calculate the FAB. The FAB at each exit age is based on past service - do not use service at each exit age.

$$\begin{aligned} \text{2001 pay} & \quad 60,000 \quad (\text{Age 49 pay}) \\ \text{Age 62 pay} & \quad 88,112 = 60,000(1.03)^{13} \\ \text{FAE3 at 63} & \quad 85,571 = 88,112(\ddot{a}_{\overline{3}|.03} / 3) \end{aligned}$$

You can calculate the FAE3 at exit ages 64 and 65 by increasing the 85,571 based on the 3% salary scale. Here is the PUC NC written out "long hand":

$$\begin{aligned} \text{PUC NC} &= v^{13} {}_{13}p_{50}^{(T)} q_{63}^{(w)} \Delta \text{FAB}_{63} (D_{65}/D_{63}) \ddot{a}_{65}^{(12)} \\ &+ v^{14} {}_{14}p_{50}^{(T)} q_{64}^{(w)} \Delta \text{FAB}_{64} (D_{65}/D_{64}) \ddot{a}_{65}^{(12)} \\ &+ v^{15} {}_{15}p_{50}^{(T)} \Delta \text{FAB}_{65} \ddot{a}_{65}^{(12)} \end{aligned}$$

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You can rewrite the expression to clarify the probability of survival to ages 64 and 65:

$$\begin{aligned} \text{PUC NC} &= v^{13} {}_{13}p_{50}^{(T)} q_{63}^{(w)} \Delta \text{FAB}_{63} (D_{65}/D_{63}) \ddot{a}_{65}^{(12)} \\ &\quad + v^{14} {}_{13}p_{50}^{(T)} (1 - q_{63}^{(w)}) q_{64}^{(w)} \Delta \text{FAB}_{64} (D_{65}/D_{64}) \ddot{a}_{65}^{(12)} \\ &\quad + v^{15} {}_{13}p_{50}^{(T)} (1 - q_{63}^{(w)}) (1 - q_{64}^{(w)}) \Delta \text{FAB}_{65} \ddot{a}_{65}^{(12)} \end{aligned}$$

Since there is no mortality, the D/D terms are only based on the 7% interest rate. You can also fill in the details for the ΔFAB at each exit age:

$$\begin{aligned} \text{PUC NC} &= v^{13} {}_{13}p_{50}^{(T)} q_{63}^{(w)} (1\%)(85,571)(v^2) \ddot{a}_{65}^{(12)} \\ &\quad + v^{14} {}_{13}p_{50}^{(T)} (1 - q_{63}^{(w)}) q_{64}^{(w)} (1\%)(85,571)(1.03)^1 (v^1) \ddot{a}_{65}^{(12)} \\ &\quad + v^{15} {}_{13}p_{50}^{(T)} (1 - q_{63}^{(w)}) (1 - q_{64}^{(w)}) (1\%)(85,571)(1.03)^2 \ddot{a}_{65}^{(12)} \end{aligned}$$

As the final step, you can collect terms to simplify the final calculation:

$$\begin{aligned} \text{PUC NC} &= v^{15} {}_{13}p_{50}^{(T)} (.10)(1\%)(85,571) \ddot{a}_{65}^{(12)} \\ &\quad + v^{15} {}_{13}p_{50}^{(T)} (1 - .10) (.15)(1\%)(85,571)(1.03)^1 \ddot{a}_{65}^{(12)} \\ &\quad + v^{15} {}_{13}p_{50}^{(T)} (1 - .10) (1 - .15)(1\%)(85,571)(1.03)^2 \ddot{a}_{65}^{(12)} \\ &= [v^{15}(1\%)(85,571) \ddot{a}_{65}^{(12)}] * [(.10) + (1 - .10) (.15) (1.03)^1 + (1 - .10) (1 - .15) (1.03)^2] \\ &= 3,101.49[.10 + .13905 + .81159] \\ &= 3,259 \end{aligned}$$

Answer is A

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Problem 36

Similar to EA-1B 2000 #05

The key to this problem is that the gain / loss calculation is simply the difference between two present value calculations, one as an active employee, and one as a retired employee. Another point is that you must construct the optional form of payment annuity factor.

This problem is unusual because it does not specify a cost method. The reason is that the participant is age 65. At age 65, the accrued liability is equal to the present value of benefits for any cost method (assuming NRA is 65).

Partic. age 65 at 01/01/02

Spouse age 60 at 01/01/02

Accrued benefit 1,500 per month (given)

$$\begin{aligned}\text{Active PVB} &= 1,500(12)\ddot{a}_{65}^{(12)} \\ &= 157,248\end{aligned}$$

$$\text{Retired PVB} = 1,500(12)(90\%)(\text{optional form annuity})$$

The optional form of payment annuity factor is a 66.667% Joint and survivor annuity. The problem gives you a joint and last survivor annuity factor ($\ddot{a}_{60:65}^{(12)}$), which you can use to calculate the value of the optional form of payment annuity factor:

$$\begin{aligned}\text{Annuity} &= \ddot{a}_{65}^{(12)} + (2/3)[\ddot{a}_{60}^{(12)} - \ddot{a}_{60:65}^{(12)}] \\ &= (1/3)\ddot{a}_{65}^{(12)} + (2/3)\ddot{a}_{65}^{(12)} + (2/3)[\ddot{a}_{60}^{(12)} - \ddot{a}_{60:65}^{(12)}] \\ &= (1/3)\ddot{a}_{65}^{(12)} + (2/3)\ddot{a}_{60:65}^{(12)} \\ &= (1/3)(8.736) + (2/3)(11.117) \\ &= 10.323\end{aligned}$$

$$\begin{aligned}\text{Retired PVB} &= 1,500(12)(90\%)(10.323) \\ &= 167,238\end{aligned}$$

The accrued liability as a retiree is greater, so there is a loss upon retirement at 01/01/02. The loss is the difference of $167,238 - 157,248 = 9,990$.

Answer is C

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Problem 37 - Page 1

Similar to 1998 EA-2 #26

Revised 07/14/06

The key point of this problem is that you must calculate the minimum contribution, and compare it to the maximum deductible limit. Due to the contribution of 40,000 for 2001, there is a debit balance in the MFSA at 12/31/01.

You need to calculate the deductible limit, which is defined as 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. There are two limit adjustments for the 01/01/96 Initial Accrued Liability and the 01/01/02 reduction in benefit accruals.

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

$$404 \text{ NC} = 35,000$$

$$\begin{aligned} \text{Limit adjustment} &= (250,000 - 30,000) / \ddot{a}_{10|.07} \\ &= 29,274 \end{aligned}$$

$$\begin{aligned} \text{Deductible limit} &= (35,000 + 29,274) * 1.07 \\ &= 68,773 \end{aligned}$$

The second step is to check the Full Funding Limitation under 404, but you have insufficient information. With an aggregate type cost method, you need market value of assets and Entry Age Normal valuation results to check the Full Funding Limitation.

Now you must check the §412 minimum contribution to see if it is greater. You need to complete the MFSA for 2001 to calculate the funding deficiency at 12/31/01.

$$\text{IAL amortization} = 250,000 / \ddot{a}_{30|.07} = 18,829$$

2001 Minimum Funding Standard Account			
Charges		Credits	
Normal Cost	40,000	Credit Balance	0
IAL amortization	18,829	08/01/01 contribution	40,000
7% interest	4,118	7% interest (simple)	1,167
Total charges	62,947	Total credits	41,167

The interest credit on the contribution was calculated as $(5/12)(.07)(40,000) = 1,167$. The debit balance at 12/31/01 is $62,947 - 41,167 = 21,780$.

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Now you need to set up the MFSA for 2002, and compare the minimum contribution to the previously calculated deductible limit.

$$\text{PLAN amortization} = 30,000 / \ddot{a}_{\overline{30}|.07} = 2,259$$

2002 Minimum Funding Standard Account			
Charges		Credits	
Debit balance	21,780	Credit Balance	0
Normal Cost	35,000	PLAN amortization	2,259
IAL amortization	18,829	12/31/02 contribution	x
7% interest	5,293	7% interest	158
Total charges	<u>80,901</u>	Total credits	<u>x + 2,418</u>

The minimum contribution at 12/31/02 is $80,901 - 2,418 = 78,483$.

The deductible limit is the greater of the normal cost plus limit adjustments of 68,773 and the minimum contribution of 78,483. The final result is 78,483.

Answer is D

Since you have no current liability values, you can't calculate the Unfunded Current Liability for the deductible limit.

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Problem 38

Revised 07/08/05

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

Under the Aggregate method, the present value of normal costs (PVNC) is defined as the present value of benefits less the assets less the outstanding §412 bases (reduced by the credit balance).

	New assumptions	Old assumptions
Assumed retirement age	64	65
01/01/02 Age	55	55
Past service	30	30
Normal retirement age	64	65
Future service	9	10
Total service	39	40
Projected benefit	$12(\$30)(39)$ $= 14,040$	$12(\$30)(40)$ $= 14,400$
PV Future benefits	$14,040(D_{64} / D_{55}) \ddot{a}_{64}^{(12)}$ $= 14,040v^9 \ddot{a}_{64}^{(12)}$ $= 14,040(1.07)^{-9}(9.48)$ $= 72,397$	$14,400(D_{65} / D_{55}) \ddot{a}_{65}^{(12)}$ $= 14,400v^{10} \ddot{a}_{65}^{(12)}$ $= 14,400(1.07)^{-10}(9.24)$ $= 67,639$
Actuarial asset value	45,000	45,000
Credit balance	0	0
PVNC	27,397	22,639

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

	New assumptions	Old assumptions
Future service	9	10
$\ddot{a}_{\overline{X:ARA-X} }$	$\ddot{a}_{\overline{9 .07}}$ $= 6.9713$	$\ddot{a}_{\overline{10 .07}}$ $= 7.5152$
Normal cost	3,930	3,012

The increase in the normal cost is $3,930 - 3,012 = 918$.

Answer is D

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Problem 39

The key to this problem is using the actuarial balance equation, and calculating the normal cost under the Frozen Initial Liability (FIL) cost method. You have to solve for the value of the initial accrued liability (IAL), and the 30 year amortization payment.

$$\begin{aligned}\text{FIL PVNC} &= \text{PVB} - \text{AAV} - \text{UAL} \\ &= 1,500,000 - 250,000 - \text{UAL}\end{aligned}$$

$$\begin{aligned}\text{UAL} &= \text{O/S } \$412 \text{ bases} - \text{CB} - \text{ARA} \\ &= \text{IAL}(\ddot{a}_{\overline{23}|.07} / \ddot{a}_{\overline{30}|.07}) - 7,500 - 0\end{aligned}$$

$$\begin{aligned}\text{NC} &= \text{PVNC} / (\text{PVE}/\text{E}) \\ \text{PVNC} &= \text{NC} * (\text{PVE}/\text{E}) \\ &= 50,000(1,800,000/180,000) \\ &= 550,000\end{aligned}$$

$$550,000 = 1,500,000 - 250,000 - [\text{IAL}(\ddot{a}_{\overline{23}|.07} / \ddot{a}_{\overline{30}|.07}) - 7,500]$$

$$\begin{aligned}\text{IAL} / \ddot{a}_{\overline{30}|.07} &= [1,500,000 - 250,000 - 550,000 + 7,500] / \ddot{a}_{\overline{23}|.07} \\ &= 707,500 / 12.0612 \\ &= 58,659\end{aligned}$$

Now you can set up the MFSA and calculate the minimum contribution:

2002 Minimum Funding Standard Account			
Charges		Credits	
Normal Cost	55,000	Credit Balance	7,500
IAL amortization	58,659	12/31 contribution	x
7% interest	7,956	7% interest	525
Total charges	<u>121,615</u>	Total credits	<u>x + 8,025</u>

You have no information to calculate the \$412 Full Funding Limitation. The minimum contribution at 12/31/02 is $121,615 - 8,025 = 113,590$.

Answer is C

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Problem 40

Revised 07/09/04

As in earlier problems, this one has a salary scale, and a cost method given as Unit Credit. The key to this problem is knowing that the calculations are done using Projected Unit Credit (PUC).

You need to calculate the PUC normal cost at 01/01/2002. 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 60 at 01/01/02
Past service 20
2002 pay 35,000 (age 60 pay)
Age 64 pay 44,187 = $35,000(1.06)^4$
FAE3 at 65 41,733 = $44,187(\ddot{a}_{\overline{3}|.06})/3$

FAB = $2\%(20)(41,733)$
 Δ FAB = $2\%(41,733)$

NC = PV (Δ FAB)
= $2\%(41,876)(D_{65} / D_{60})\ddot{a}_{65}^{(12)}$
= $2\%(41,876)(1.07)^{-5}(9.70)$
= 5,772

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

Answer is C