

## Solutions to EA-2(A) Examination Fall, 2002

### Question 1

In general, the deductible limit of IRC section 404(a)(1)(A) is equal to the greater of the minimum funding requirement or the sum of the normal cost and limit adjustment. In this question, the minimum funding requirement is \$445,600, and the normal cost plus limit adjustment is \$534,000. The greater of these is \$534,000.

However, this must be reduced if the full funding limitation is smaller. The full funding limitations are:

$$\begin{aligned} \text{ERISA:} & \quad (2,325,000 + 150,000 - 2,000,000) \times 1.07 = 508,250 \\ \text{OBRA '87:} & \quad (1,625,000 \times 165\%) - (2,000,000 \times 1.07) = 541,250 \\ \text{RPA '94:} & \quad (1,625,000 \times 90\%) - (2,100,000 \times 1.07) = 0 \end{aligned}$$

Note that the actuarial value of assets is used for the RPA '94 full funding limitation, rather than the smaller of the market or actuarial value. Since only one current liability value is given, it is assumed that is the same for both the OBRA '87 and RPA '94 current liabilities (per the general conditions of the examination).

The overall full funding limitation is the smaller of the ERISA and OBRA '87 limits, but not less than the RPA '94 limit. This is the ERISA limit of \$508,250.

The full funding limit is less than the otherwise deductible limit of \$534,000, so only \$508,250 is deductible.

The unfunded current liability (under IRC section 404(a)(1)(D)) may be deducted if that is larger than \$508,250. The unfunded current liability is:

$$1,625,000 - (2,100,000 \times 1.07) = 0$$

Therefore, the deductible limit is \$508,250.

Answer is D.

## Question 2

In general, the deductible limit of IRC section 404(a)(1)(A) is equal to the greater of the minimum funding requirement or the sum of the normal cost and limit adjustment. In order to determine this, the normal cost must be calculated. The balance equation can be used to determine the unfunded liability:

$$\begin{aligned}\text{Unfunded liability} &= \text{Outstanding balance} - \text{Credit balance} \\ &\quad - \text{Reconciliation account balance} \\ &= 500,000 \times \frac{\ddot{a}_{23|}}{\ddot{a}_{30|}} \\ &= 454,193\end{aligned}$$

The normal cost (as of 1/1/2002) is equal to:

$$\begin{aligned}\text{NC} &= \frac{\text{PVFB} - \text{Actuarial assets} - \text{Unfunded balance}}{\text{Present value of future compensation} / \text{2002 compensation}} \\ &= \frac{1,460,000 - 630,000 - 454,193}{1,700,000 / 200,000} \\ &= 44,213\end{aligned}$$

The minimum required contribution for 2002 is:

$$(44,213 + 500,000/\ddot{a}_{30|}) \times 1.07 = (44,213 + 37,657) \times 1.07 = 87,601$$

The normal cost plus limit adjustment for 2002 is:

$$(44,213 + 500,000/\ddot{a}_{10|}) \times 1.07 = (44,213 + 66,532) \times 1.07 = 118,497$$

The greater of these is \$118,497.

However, this must be reduced if the full funding limitation is smaller. The full funding limitations are:

$$\begin{aligned}\text{ERISA:} &\quad (625,000 + 50,000 - 610,000) \times 1.07 = 69,550 \\ \text{OBRA '87:} &\quad (700,000 \times 165\%) - (610,000 \times 1.07) = 502,300 \\ \text{RPA '94:} &\quad (750,000 \times 90\%) - (630,000 \times 1.07) = 900\end{aligned}$$

Note that the actuarial value of assets is used for the RPA '94 full funding limitation, rather than the smaller of the market or actuarial value.

The overall full funding limitation is the smaller of the ERISA and OBRA '87 limits, but not less than the RPA '94 limit. This is the ERISA limit of \$69,550.

The full funding limit is less than the otherwise deductible limit of \$118,497, so only \$69,550 is deductible.

The unfunded current liability (under IRC section 404(a)(1)(D)) may be deducted if that is larger than \$69,550. The unfunded current liability (which is based upon the RPA '94 current liability) is:

$$750,000 - (630,000 \times 1.07) = 75,900$$

Therefore, the deductible limit is \$75,900.

Answer is C.

### Question 3

In order to determine the minimum required contribution, the normal cost must be calculated. The balance equation can be used to determine the unfunded liability:

$$\begin{aligned} \text{Unfunded liability} &= \text{Outstanding balance} - \text{Credit balance} \\ &\quad - \text{Reconciliation account balance} \\ &= (86,000 \times \ddot{a}_{\overline{15}|}) - (15,500 \times \ddot{a}_{\overline{6}|}) + (35,000 \times \ddot{a}_{\overline{30}|}) - 25,000 \\ &= 838,110 - 79,053 + 464,719 - 25,000 \\ &= 1,198,776 \end{aligned}$$

The normal cost (as of 1/1/2002) is equal to:

$$\begin{aligned} \text{NC} &= \frac{\text{PVFB} - \text{Actuarial assets} - \text{Unfunded balance}}{\text{Present value of future compensation} / \text{2002 compensation}} \\ &= \frac{4,000,000 - 2,200,000 - 1,198,776}{8,800,000 / 780,000} \\ &= 53,290 \end{aligned}$$

The minimum required contribution for 2002 (as of 1/1/2002) is:

$$53,290 + 86,000 - 15,500 + 35,000 - 25,000 = 133,790$$

Answer is B.

#### Question 4

The unfunded current liability for the additional funding charge is:

$$\begin{aligned} \text{UCL} &= \text{Current liability} - (\text{Actuarial assets} - \text{Credit balance}) \\ &= 1,850,000 - (1,100,000 - 20,000) = 770,000 \end{aligned}$$

The unfunded new liability is equal to the difference between the unfunded current liability and the balance of the unfunded old liability.

$$\text{Unfunded new liability} = 770,000 - 250,000 = 520,000$$

The unfunded old liability amount and unfunded new liability amount can be determined.

$$\begin{aligned} \text{Unfunded old liability amount} &= 250,000 / \ddot{a}_{\overline{5}|0.0575} = 55,741 \\ \text{Unfunded new liability amount} &= 520,000 \times .3 = 156,000 \end{aligned}$$

The deficit reduction contribution is:

$$\begin{aligned} \text{DRC} &= \text{Unfunded old liability amount} + \text{unfunded new liability amount} \\ &\quad + \text{expected increase in current liability} \\ &= 55,741 + 156,000 + 60,000 \\ &= 271,741 \end{aligned}$$

This is reduced by the normal cost plus net amortization charges in the funding standard account, and increased with interest at the current liability interest rate to the end of the year.

$$[271,741 - (75,000 + 75,000 + 30,000 - 10,000)] \times 1.0575 = 107,591$$

Since the highest number of participants in the prior year (2001) was less than 150 (there were at most 145 participants in 2001), the additional funding charge is prorated based upon the number of participants in excess of 100 but less than 150. The additional funding charge for 2002 is:

$$107,591 \times (45/50) = 96,832$$

Answer is B.

## Question 5

In order to determine the minimum required contribution, the normal cost must be calculated. The balance equation can be used to determine the unfunded liability:

$$\begin{aligned}\text{Unfunded liability} &= \text{Outstanding balance} - \text{Credit balance} \\ &\quad - \text{Reconciliation account balance} \\ &= (600,000 \times \frac{\ddot{a}_{\overline{14}|}}{\ddot{a}_{\overline{30}|}}) + (60,000 \times \frac{\ddot{a}_{\overline{4}|}}{\ddot{a}_{\overline{10}|}}) - 30,000 \\ &= 422,859 + 28,936 - 30,000 \\ &= 421,795\end{aligned}$$

The normal cost (as of 1/1/2002) is equal to:

$$\begin{aligned}\text{NC} &= \frac{\text{PVFB} - \text{Actuarial assets} - \text{Unfunded balance}}{\text{Present value of future compensation} / \text{2002 compensation}} \\ &= \frac{2,000,000 - 900,000 - 421,795}{20,000,000 / 1,000,000} \\ &= 33,910\end{aligned}$$

The minimum required contribution for 2002 is:

$$\begin{aligned}&(33,910 + 600,000/\ddot{a}_{\overline{30}|} + 60,000/\ddot{a}_{\overline{10}|} - 30,000) \times 1.07 \\ &= (33,910 + 45,189 + 7,984 - 30,000) \times 1.07 = 61,079\end{aligned}$$

Answer is B.

## Question 6

The present value of the retirement benefit includes a decrement for the turnover assumption:

$$\begin{aligned}\text{PV}_{\text{retirement}} &= \$100 \times 7 \text{ years of service} \times 12 \ddot{a}_{65}^{(12)} \times v^2 \times {}_2p_{63} \\ &= \$8,400 \times 9.24 \times .873439 \times .97 \times .99 \\ &= 65,101\end{aligned}$$

Since it is assumed that withdrawal rates are applied at the beginning of the year, the accrued benefit upon withdrawal does not include a year of service for the withdrawal year. The present value of the withdrawal benefit is:

$$\begin{aligned}
 PV_{\text{withdrawal}} &= (\$100 \times 5 \text{ years of service} \times 12 \ddot{a}_{65}^{(12)} \times v^2 \times q_{63} \times 60\% \text{ vesting}) \\
 &\quad + (\$100 \times 6 \text{ years of service} \times 12 \ddot{a}_{65}^{(12)} \times v^2 \times p_{63} \times q_{64} \times 80\% \text{ vesting}) \\
 &= (\$6,000 \times 9.24 \times .873439 \times .03 \times .6) \\
 &\quad + (\$7,200 \times 9.24 \times .873439 \times .97 \times .01 \times .8) \\
 &= 872 + 451 \\
 &= 1,323
 \end{aligned}$$

The total present value is:

$$65,101 + 1,323 = 66,424$$

Answer is A.

### Question 7

The normal retirement date for Smith is 1/1/2027 (at age 65). The final year that Smith will receive salary is 2026. The 2001 compensation must be projected with salary increases for 25 years.

$$\text{Final salary using 3\% salary scale} = \$20,000 \times 1.03^{25} = \$41,876$$

$$\text{Final salary using 4\% salary scale} = \$20,000 \times 1.04^{25} = \$53,317$$

The increase in the final salary after the change in salary scale assumption is:

$$\$53,317 - \$41,876 = \$11,441$$

Since there is a salary scale, the unit credit method being used here is actually projected unit credit. Under the projected unit credit method, the normal cost is equal to the present value of the benefit accrual for the year (based upon projected final salary). Smith is in his 21<sup>st</sup> year of service in 2002, so he accrues at the 1.45% rate. Since the question is looking for the change in the minimum contribution due to the change in the salary scale, the normal cost attributable to the projected salary increase must be determined. This is:

$$\text{Normal cost increase} = 1.45\% \times 11,441 \times \ddot{a}_{65}^{(12)} \times v^{25} = 282$$

The accrued liability is equal to the present value of the past accruals. Smith accrued for 15 years at the 1.2% rate and 5 years at the 1.45% rate. The increase in the accrued liability is:

$$\begin{aligned} \text{Accrued liability increase} &= [(1.2\% \times 15 \text{ years}) + (1.45\% \times 5 \text{ years})] \\ &\quad \times 11,441 \times \ddot{a}_{65}^{(12)} \times v^{25} \\ &= 4,918 \end{aligned}$$

The increase in the accrued liability is amortized over 10 years due to the assumption change. The total increase in the minimum required contribution for 2002 due to the salary scale change is:

$$(282 + 4,918/\ddot{a}_{10}) \times 1.07 = (282 + 654) \times 1.07 = 1,002$$

Answer is D.

### Question 8

The deficit reduction contribution is reduced by the normal cost plus net amortization charges in the funding standard account, and increased with interest at the current liability interest rate to the end of the year.

$$[270,000 - (30,000 + 25,000 - 15,000 + 5,000 + 20,000 + 10,000)] \times 1.0575 = 206,213$$

Since the highest number of participants in the prior year (2001) was less than 150 (there were at most 146 participants in 2001), the additional funding charge is prorated based upon the number of participants in excess of 100 but less than 150. The additional funding charge for 2002 is:

$$206,213 \times (46/50) = 189,716$$

The additional funding charge is limited (per the last paragraph of IRC section 412(l)(1)(A)) if, together with the regular funding standard account charges, the total required contribution would exceed the amount necessary to increase the funded current liability percentage to 100% (which in this question is \$310,000). The total required contribution for 2002, including the additional funding charge, is:

$$189,716 + (30,000 + 25,000 - 15,000 + 5,000 + 20,000 + 10,000) \times 1.07 = 269,966$$

Since the additional funding charge of \$189,716 will not result in a funded current liability in excess of 100%, it is not reduced.

Answer is B.

## Question 9

The normal retirement date for the participant is 1/1/2017 (at age 65). The final year that the participant will receive salary is 2016. The 2002 compensation must be projected with salary increases to 2014, 2015, and 2016.

$$\text{Final average salary} = \$50,000 \times \frac{1.04^{12} + 1.04^{13} + 1.04^{14}}{3} = \$83,296$$

The normal cost and accrued liability are determined from entry age (age at hire), which is age 35. Note that the funding method is described as a level dollar method, so the normal cost and accrued liability are determined by amortizing using interest only (rather than incorporating the salary scale into the amortization factor).

$$\text{Normal cost} = 2\% \times 30 \text{ years} \times 83,296 \times \ddot{a}_{65}^{(12)} \times v^{30} \div \ddot{a}_{30|0.07} = 4,569$$

$$\text{Accrued liability} = 4,569 \times \ddot{s}_{15|0.07} = 122,852$$

The accrued liability is the initial unfunded liability and is amortized over 30 years for minimum funding.

The minimum required contribution for 2002 as of 12/31/2002 is:

$$(4,569 + 122,852/\ddot{a}_{30}) \times 1.07 = (4,569 + 9,253) \times 1.07 = 14,790$$

Answer is C.

## Question 10

Consider each of the proposed changes.

- I. Changing the actuarial cost method to unit credit. The method was changed to entry age normal on 1/1/1998. Section 6.02(3) of Revenue Procedure 2000-40 provides that the automatic approval does not apply if the funding method was changed in any of the four preceding plan years. The four years preceding 2002 were 1998 through 2001. Therefore, this change is not eligible for automatic approval.
- II. Changing the asset valuation method to market value. The plan has always used the 3-year smoothing method. It is not subject to the four-year look-back rule since the asset valuation method was never changed. A change to fair market value is allowed under section 3.10 of Revenue Procedure 2000-40. Therefore, this change is eligible for automatic approval.

- III. Changing the valuation date to December 31. In general, only a change to the first day of the plan year is eligible for automatic approval (under section 3.13 of Revenue Procedure 2000-40). This is not one of the changes eligible for automatic approval under Revenue Procedure 2000-40.

Only proposed change II is eligible for automatic approval.

Answer is C.

### **Question 11**

The assertion is certainly true, as the definition of disabled lives will affect the mortality experience of the group. For example, a definition that includes lives expected to recover would yield smaller mortality experience than a definition that includes only lives not expected to recover. Similarly, if the administration of the disability rules adopted is not well enforced, then the experience of the group of disabled lives will change. For example, if the definition of disability is “total and permanent disability”, and disabled lives that do not fit the description are allowed to enter the group, then the experience of the group could change.

The reason given, however, is a false statement. If a more liberal interpretation of disability than “total and permanent disability” is used, then the mortality experience could be expected to be lower (since many of the lives would then be expected to recover – generally a less serious form of disability). So, under the “total and permanent disability” definition, the mortality experienced by the disabled lives would be expected to be higher than if a more liberal interpretation is used.

Answer is C.

### **Question 12**

The assertion is false. In setting any actuarial assumption, past experience should be taken into account.

It is true that an extraordinary event may have occurred in the past, so the reason is a true statement. However, these extraordinary events can be accounted for in setting future expense assumptions.

Answer is D.

### Question 13

Unless the actuarial assumptions used to determine the lump sum equivalence are the same as the assumptions being used for minimum funding, it is necessary to consider the number of participants electing a lump sum option. This would result in a more or less valuable benefit based upon the funding assumptions. The assertion is false.

Current liability does not reflect interest rate subsidies in lump sum options since it is always determined using the interest rate required under IRC section 412(l). The reason is a true statement.

Answer is D.

### Question 14

The normal retirement date for the participant is 1/1/2017 (at age 65). The final year that the participant will receive salary is 2016. The 2002 compensation must be projected with salary increases to 2014, 2015, and 2016.

$$\text{Final average salary} = \$30,000 \times \frac{1.04^{12} + 1.04^{13} + 1.04^{14}}{3} = \$49,978$$

The present value of future benefits is:

$$1\% \times 49,978 \times 22 \text{ years} \times \ddot{a}_{65}^{(12)} \times v^{15} = 36,823$$

The normal cost is:

$$\begin{aligned} \text{NC} &= (\text{PVFB} - (\text{Assets} - \text{CB})) / \ddot{a}_{15j} && (\text{where } j = 1.07/1.04 - 1 = .028846) \\ &= (36,823 - (10,000 - 500)) / 12.385435 \\ &= 2,206 \end{aligned}$$

The minimum required contribution for 2002 as of 1/1/2002 is:

$$\text{NC} - \text{CB} = 2,206 - 500 = 1,706$$

Answer is B.

## Question 15

The experience (gain)/loss must be determined prior to the application of plan amendments, changes in actuarial assumptions, and changes in funding methods (see Section 8 of Revenue Ruling 81-213). The accrued liability as of 1/1/2002 prior to the plan amendment is:

$$AL_{1/1/2002} = 1,025,000 \times (1.00/1.15) = 891,304$$

The unfunded liability as of 1/1/2001 (using the balance equation) is:

$$\begin{aligned} UL_{1/1/2001} &= \text{Outstanding balance}_{1/1/2001} - \text{Credit balance}_{1/1/2001} \\ &= 250,000 - \text{Credit balance}_{1/1/2001} \end{aligned}$$

The contribution for 2001 was:

$$\begin{aligned} \text{Contribution}_{2001} &= (\text{NC}_{1/1/2001} + \text{Amortization charge}_{1/1/2001} \\ &\quad - \text{Credit balance}_{1/1/2001}) \times 1.07 \\ &= (\text{NC}_{1/1/2001} + 25,000 - \text{Credit balance}_{1/1/2001}) \times 1.07 \end{aligned}$$

The experience (gain)/loss is equal to the difference between the actual unfunded liability (before the plan amendment is reflected) and the expected unfunded liability.

$$\begin{aligned} \text{Actual } UL_{1/1/2002} &= AL_{1/1/2002} - \text{Actuarial assets}_{1/1/2002} \\ &= 891,304 - 710,000 \\ &= 181,304 \end{aligned}$$

$$\begin{aligned} \text{Expected } UL_{1/1/2002} &= [(UL_{1/1/2001} + \text{NC}_{1/1/2001}) \times 1.07] - \text{Contribution}_{2001} \\ &= [(250,000 - \text{Credit balance}_{1/1/2001} + \text{NC}_{1/1/2001}) \times 1.07] \\ &\quad - [(\text{NC}_{1/1/2001} + 25,000 - \text{Credit balance}_{1/1/2001}) \times 1.07] \\ &= 240,750 \end{aligned}$$

$$2001 \text{ gain} = 240,750 - 181,304 = 59,446$$

Answer is C.

## Question 16

The experience (gain)/loss must be determined prior to the application of plan amendments, changes in actuarial assumptions, and changes in funding methods (see Section 8 of Revenue Ruling 81-213). The actual unfunded liability as of 1/1/2002 prior to the method change is:

$$\begin{aligned} \text{Actual } UL_{1/1/2002} &= \text{Unit credit } AL_{1/1/2002} - \text{Actuarial assets}_{1/1/2002} \\ &= 540,000 - 380,000 \\ &= 160,000 \end{aligned}$$

There have been no gains or losses before 2001, so there is only one amortization base. Therefore, the expected unfunded liability is equal to the unfunded balance of the initial amortization base. This can be determined using the balance equation.

$$\begin{aligned} \text{Expected UL}_{1/1/2002} &= \text{Outstanding balance} - \text{Credit balance} \\ &= (150,000 \times \frac{\ddot{a}_{24|}}{\ddot{a}_{30|}}) - 0 \\ &= 138,641 \end{aligned}$$

There is a loss for 2001 since the actual unfunded liability exceeds the expected liability.

$$2001 \text{ Loss} = 160,000 - 138,641 = 21,359$$

A new amortization base is created equal to the increase in the accrued liability under the entry age normal method over the unit credit method.

$$\text{New base} = 600,000 - 540,000 = 60,000$$

The new base is amortized over 10 years for minimum funding purposes as required by Section 5.01(3) of Revenue Notice 2000-40.

The minimum required contribution for 2002 is:

$$\begin{aligned} &(75,000 + 150,000/\ddot{a}_{30|} + 21,359/\ddot{a}_{5|} + 60,000/\ddot{a}_{10|}) \times 1.07 \\ &= (75,000 + 11,297 + 4,868 + 7,984) \times 1.07 = 106,089 \end{aligned}$$

Answer is D.

## Question 17

The required quarterly contribution for 2002 is equal to 25% of the smaller of 100% of the 2001 minimum funding requirement (as of the end of 2001) or 90% of the 2002 minimum funding requirement (as of the beginning of 2002). For this purpose, the minimum funding requirement does not reflect any credit balance, and the 2002 minimum funding requirement does not include the charge for late quarterly contribution interest.

The minimum required contribution for 2001 (as of 12/31/2001) is:

$$(400,000 + 5,200,000/\ddot{a}_{30|}) \times 1.07 = (400,000 + 391,635) \times 1.07 = 847,049$$

90% of the minimum required contribution for 2002 (as of 1/1/2002) is:

$$(500,000 + 5,200,000/\ddot{a}_{30|}) \times .9 = (500,000 + 391,635) \times .9 = 802,472$$

Note that there are no new amortization bases for 2002 since there was no experience gain or loss.

The required quarterly contribution for 2002 is:

$$802,472 \times 25\% = 200,618$$

The 12/31/2001 credit balance of \$403,099 can be used to pay for the quarterly contribution requirement. There is no restriction on the use of the credit balance since all contributions for the 2001 plan year were paid by 12/31/2001. The credit balance is increased with interest at the valuation interest rate through the first quarterly due date of April 15, 2002.

$$403,099 \times 1.07^{3.5/12} = 411,133$$

The remaining credit balance after the first quarterly contribution is paid for is:

$$411,133 - 200,618 = 210,515$$

The remaining credit balance is increased with interest at the valuation interest rate through the second quarterly due date of July 15, 2002.

$$210,515 \times 1.07^{3/12} = 214,106$$

The remaining credit balance after the second quarterly contribution is paid for is:

$$214,106 - 200,618 = 13,488$$

The remaining credit balance is increased with interest at the valuation interest rate through the third quarterly due date of October 15, 2002.

$$13,488 \times 1.07^{3/12} = 13,718$$

The remaining credit balance is not enough to pay for the entire third quarterly installment. The balance of the quarterly installment is not paid for until the final contribution for 2002 is paid on 12/31/2002. The late interest on this amount is:

$$(200,618 - 13,718) \times (1.0792^{2.5/12} - 1.07^{2.5/12}) = 338$$

Answer is B.

## Question 18

The initial normal cost under the individual level premium method is determined at the time the participant first enters the plan, based upon the salary and plan provisions at that time. The participant entered the plan on 1/1/2001. The normal cost as of 1/1/2001 is:

$$NC_{1/1/2001} = 50 \times 17 \text{ years of service} \times 12 \ddot{a}_{65}^{(12)} \div \ddot{s}_{14} = 10,200 \times 10 \div 24.129022 = 4,227$$

The increase in normal cost each year under the individual level premium method is equal to the cost of funding the increase in benefit from attained age to retirement age. Since the benefit formula increased in 2002, that increase in benefit is funded over the remaining 13 years of participation that the sole participant will have.

$$\Delta NC_{1/1/2002} = 10 \times 17 \text{ years of service} \times 12 \ddot{a}_{65}^{(12)} \div \ddot{s}_{13} = 2,040 \times 10 \div 21.550488 = 947$$

Since there is no change in the participant base during 2001, the only experience gain or loss could be an asset gain or loss. This is equal to the difference between the expected assets and the actual assets. Note that the contribution for 2001 must have been the minimum (which is simply the normal cost – there is no initial unfunded liability under the individual level premium method) since the credit balance is \$0.

$$\text{Expected assets} = 4,227 \times 1.07 = 4,523$$

$$\text{Actual assets} = 1,800$$

$$\text{Loss} = 4,523 - 1,800 = 2,723$$

The minimum required contribution for 2002 is:

$$(4,227 + 947 + 2,723/\ddot{a}_{51}) \times 1.07 = (4,227 + 947 + 621) \times 1.07 = 6,201$$

Answer is D.

## Question 19

Waived funding deficiencies are amortized over 5 years using the greater of 150% of the Federal mid-term rate or the valuation interest rate. In this case, the valuation interest rate of 7% is used.

The minimum required contribution for 2002 is:

$$(45,000 + 400,000/\ddot{a}_{30} + 47,800/\ddot{a}_{51}) \times 1.07 = (45,000 + 30,126 + 10,895) \times 1.07 \\ = 92,042$$

Answer is D.

## Question 20

The employer's normal cost is the total normal cost less the employee mandatory contributions. In order to determine the total normal cost, all liabilities (employer and employee paid) are used, as well as both employer and employee assets.

$$\begin{aligned}\text{Present value of future benefits} &= 1,280,000 + 100,000 = 1,380,000 \\ \text{Valuation assets} &= 195,000 + 30,000 = 225,000\end{aligned}$$

The normal cost (as of 1/1/2002) is equal to:

$$\begin{aligned}\text{NC} &= \frac{\text{PVFB} - \text{Valuation assets}}{\text{Present value of future compensation} / \text{2002 compensation}} \\ &= \frac{1,380,000 - 225,000}{5,400,000 / 600,000} \\ &= 128,333\end{aligned}$$

The employee contributions are equal to 1% of compensation:

$$\text{Employee contribution} = 1\% \times 600,000 = 6,000$$

It can be assumed that the employee contributions are paid at the end of the year (since 2002 compensation is not known until the end of the year). The minimum required employer contribution for 2002 is:

$$(128,333 \times 1.07) - 6,000 = 131,316$$

It could also be assumed that the employee contributions are paid at the beginning of the year (since you are not told one way or the other in the question). In that case, the minimum required employer contribution for 2002 is:

$$(128,333 - 6,000) \times 1.07 = 130,896$$

It would appear that is the intended assumption since the question can be solved using another approach. Rather than determining the total normal cost and reducing it by the employee contribution, the employer normal cost can be solved for directly by including as part of the assets the present value of future employee contributions. Since the present value of future salary is \$5,400,000, and the employee contributions are 1% of salary, the present value of the future employee contributions must be equal to 1% of the present value of future salary, which is \$54,000. The valuation assets, including the future employee contributions, would then be \$279,000 (\$225,000 + \$54,000).

The employer normal cost (as of 1/1/2002) is equal to:

$$\begin{aligned} \text{NC} &= \frac{\text{PVFB - Valuation assets}}{\text{Present value of future compensation / 2002 compensation}} \\ &= \frac{1,380,000 - 279,000}{5,400,000 / 600,000} \\ &= 122,333 \end{aligned}$$

As of the end of the year this is \$130,896.

To summarize, based upon the information provided, the minimum required employer contribution for 2002 is either \$130,896 or \$131,316, depending upon whether it is assumed that the employee contribution is made on the first or last day of the year. Note that it may be best to assume that the employee contribution is made on the valuation date (the beginning of the year in this case).

In either case, the answer is C.

## Question 21

A description of the smoothed market value method (without phase-in) can be found in Section 3.15 of Revenue Procedure 2000-40. Under this method, the actuarial value of assets is equal to the market value of assets as of the valuation date, less a fraction of the gain (or plus a fraction of the loss) for each prior year (up to 4 years). The fraction decreases each year. In this case, there is a 3-year smoothing period, so that includes the current year and the two prior years (2000 and 2001). The fractions used are  $\frac{2}{3}$  for 2001 and  $\frac{1}{3}$  for 2000.

For each year, the expected assets must be compared to the actual assets. It is assumed that all contributions and benefit payments are made uniformly throughout the year, so they can be assumed made on June 30 each year.

In 2000, the contributions and benefit payments offset each other, so the expected assets are equal to the asset value at the beginning of the year increased with one year's interest at the valuation interest rate.

$$\text{Expected assets on 12/31/2000} = 6,900,000 \times 1.07 = 7,383,000$$

$$\text{Actual assets on 12/31/2000} = 6,900,000$$

$$\text{2000 asset loss} = 7,383,000 - 6,900,000 = 483,000$$

In 2001, the benefit payments exceed the contributions by 200,000, so the expected assets are equal to the asset value at the beginning of the year increased with one year's interest at the valuation interest rate less the offset benefit payment of 200,000 increased with one-half year's interest (either simple or compound interest can be used). Note that the actual investment return is irrelevant to the determination of the expected asset value.

Expected assets on 12/31/2001 =  $(6,900,000 \times 1.07) - (200,000 \times 1.035) = 7,176,000$   
 Actual assets on 12/31/2001 = 5,800,000  
 2001 asset loss =  $7,176,000 - 5,800,000 = 1,376,000$

Since these are losses, a fraction of the losses are added to the 1/1/2002 assets to get the smoothed value.

Smoothed market value =  $5,800,000 + (\frac{2}{3} \times 1,376,000) + (\frac{1}{3} \times 483,000) = 6,878,333$

Answer is E.

Note: The actuarial value of assets cannot exceed 120% of the fair market value. This is:

$5,800,000 \times 1.2 = 6,960,000$

## Question 22

Under the aggregate funding method, the total present value of future benefits must include benefits for all participants, whether active or retired.

$PVFB_{\text{Smith}} = 1,000 \times 12 \ddot{a}_{69}^{(12)} = 12,000 \times 7.83 = 93,960$

$PVFB_{\text{Jones}} = 50\% \times 28,500 \times 1.04^{10} \times \ddot{a}_{65}^{(12)} \times v^{10} = 21,093 \times 9.70 \times .508349 = 104,009$

Total PVFB =  $93,960 + 104,009 = 197,969$

The normal cost is determined by amortizing only over the future working lifetime of the active participants (in this case Jones). Since there is a salary scale, the amortization is based upon the interest rate  $j$ , where

$$j = 1.07/1.04 - 1 = .028846$$

The normal cost (as of 1/1/2002) is equal to:

$$\begin{aligned} NC &= \frac{PVFB - (\text{Actuarial assets} - \text{Credit balance})}{\ddot{a}_{10j}} \\ &= \frac{197,969 - (95,000 - 1,500)}{8.828173} \\ &= 11,834 \end{aligned}$$

The minimum required contribution for 2002 is:

$$(NC - CB) \times 1.07 = (11,834 - 1,500) \times 1.07 = 11,057$$

Answer is B.

### Question 23

The present value of benefits as of 1/1/2001 can be adjusted to 1/1/2002 with interest (since there are no retired participants), and for the fact that salaries increased by only 2% instead of the expected 4%.

$$PVFB_{1/1/2002} = 2,000,000 \times 1.07 \times (1.02/1.04) = 2,098,846$$

The ratio of the present value of future salary as of 1/1/2001 to the 2001 salary is 10 (20,000,000/2,000,000). This can be adjusted to obtain an amortization factor for the 1/1/2002 valuation:

$$1/1/2002 \ddot{a}_{\overline{n}|} = (10 - 1) \times (1.07/1.04) = 9.259615$$

Note that the interest rate for this amortization factor is actually equal to  $j\%$ , where  $j = 1.07/1.04 - 1$ . As a result, the actual salary increase has no effect on the amortization factor.

The normal cost (as of 1/1/2002) is equal to:

$$\begin{aligned} NC &= \frac{PVFB - \text{Actuarial assets} - \text{Unfunded liability}}{\ddot{a}_{\overline{n}|}} \\ &= \frac{2,098,846 - 1,335,000 - 615,000}{9.259615} \\ &= 16,075 \end{aligned}$$

Answer is C.

## Question 24

Since the valuation interest rate has changed for the 2002 plan year, the outstanding balance of each amortization base must be re-amortized using the new interest rate. In addition, a new 10-year amortization base is established equal to the increase in the entry age normal accrued liability as of 1/1/2002 due to the new interest rate.

There are 8 years remaining to amortize the initial base, and 27 years remaining to amortize the plan amendment base.

The outstanding balance of each base (before the interest rate change) is:

$$\begin{aligned}\text{Initial base:} & \quad 50,000 \ddot{a}_{8|0.085} = 305,926 \\ \text{Amendment base:} & \quad 8,500 \ddot{a}_{27|0.085} = 96,510\end{aligned}$$

The new amortization base due to the change in assumed interest rate is:

$$\begin{aligned}\text{Assumption base} &= \text{Accrued liability @6.75\%} - \text{Accrued liability @8.50\%} \\ &= 1,100,000 - 900,000 \\ &= 200,000\end{aligned}$$

The minimum required contribution for 2002 is:

$$\begin{aligned}& (60,000 + 305,926/\ddot{a}_{8|0.0675} + 96,510/\ddot{a}_{27|0.0675} + 200,000/\ddot{a}_{10|0.0675}) \times 1.0675 \\ &= (60,000 + 47,529 + 7,365 + 26,368) \times 1.0675 = 150,797\end{aligned}$$

Answer is C.

## Question 25

All amortization bases in the funding standard account for this plan were eliminated after the end of 2001 due to the application of the ERISA full funding limitation. However, the experience loss in 2001 results in a new amortization base for the 2002 plan year. The loss is equal to the unfunded accrued liability as of 1/1/2002. Note that the expected unfunded liability is deemed to be zero as a result of the ERISA full funding limitation (see Section 10 of Revenue Ruling 81-213).

$$\begin{aligned}\text{2001 Loss} &= \text{Accrued liability}_{1/1/2002} - \text{Actuarial assets}_{1/1/2002} \\ &= 209,000,000 - 205,000,000 \\ &= 4,000,000\end{aligned}$$

The experience loss for a multiemployer plan is amortized over 15 years. The minimum required contribution for 2002 is:

$$(7,000,000 + 4,000,000/\ddot{a}_{\overline{15}|}) \times 1.07 = (7,000,000 + 410,447) \times 1.07 = 7,929,178$$

Answer is A.

## Question 26

The normal cost (as of 12/31/2002) is equal to:

$$\begin{aligned} \text{NC} &= \frac{\text{PVFB - Actuarial assets}}{\text{Present value of future compensation / 2002 compensation}} \\ &= \frac{2,000,000 - 880,000}{1,400,000 / 140,000} \\ &= 112,000 \end{aligned}$$

This would be the deductible limit under IRC section 404(a)(1)(A), subject to the full funding limitation.

The full funding limitations are:

$$\begin{aligned} \text{ERISA:} & \quad 950,000 - 850,000 = 100,000 \\ \text{OBRA '87:} & \quad (1,025,000 \times 165\%) - 850,000 = 841,250 \\ \text{RPA '94:} & \quad (1,000,000 \times 90\%) - 880,000 = 20,000 \end{aligned}$$

Note that the actuarial value of assets is used for the RPA '94 full funding limitation, rather than the smaller of the market or actuarial value.

The overall full funding limitation is the smaller of the ERISA and OBRA '87 limits, but not less than the RPA '94 limit. This is the ERISA limit of \$100,000.

The full funding limit is less than the otherwise deductible limit of \$112,000, so only \$100,000 is deductible.

The unfunded current liability (under IRC section 404(a)(1)(D)) may be deducted if that is larger than \$100,000. The unfunded current liability (which is based upon the RPA '94 current liability) is:

$$1,000,000 - 880,000 = 120,000$$

Therefore, the deductible limit is \$120,000.

Answer is C.

## Question 27

Each valuation item from the 1/1/2001 valuation must be adjusted to 1/1/2002 to reflect actual experience during 2001.

The present value of future benefits as of 1/1/2001 can be adjusted to 1/1/2002 with interest (since there are no retired participants), and for the fact that salaries increased by 8% instead of the expected 4%.

$$PVFB_{1/1/2002} = 500,000 \times 1.07 \times (1.08/1.04) = 555,577$$

The actuarial value of assets as of 1/1/2002 is equal to the actuarial value of assets as of 1/1/2001, increased by the actual earnings of 8.5%, and further increased by the 2001 contribution of \$7,000 deposited on 12/31/2001.

$$\text{Assets}_{1/1/2002} = (350,000 \times 1.085) + 7,000 = 386,750$$

The ratio of the present value of future salary as of 1/1/2001 to the 2001 salary is 6.666667 (2,000,000/300,000). This can be adjusted to obtain an amortization factor for the 1/1/2002 valuation:

$$1/1/2002 \ddot{a}_{\overline{n}|} = (6.666667 - 1) \times (1.07/1.04) = 5.830129$$

Note that the interest rate for this amortization factor is actually equal to  $j\%$ , where  $j = 1.07/1.04 - 1$ . As a result, the actual salary increase has no effect on the amortization factor.

Next, the credit balance as of 12/31/2001 must be developed. In order to calculate this, the normal cost for 2001 must be determined.

The 2001 normal cost (as of 1/1/2001) is equal to:

$$\begin{aligned} NC_{1/1/2001} &= \frac{PVFB - (\text{Actuarial assets} - \text{Credit balance})}{\text{Present value of future compensation} / 2001 \text{ compensation}} \\ &= \frac{500,000 - (350,000 - 20,000)}{2,000,000 / 300,000} \\ &= 25,500 \end{aligned}$$

The credit balance as of 12/31/2001 is:

$$\begin{aligned} CB_{12/31/2001} &= (CB_{12/31/2000} \times 1.07) + \text{Contribution}_{2001} - (NC_{1/1/2001} \times 1.07) \\ &= (20,000 \times 1.07) + 7,000 - (25,500 \times 1.07) \\ &= 1,115 \end{aligned}$$

The 2002 normal cost (as of 1/1/2002) is equal to:

$$\begin{aligned} \text{NC}_{1/1/2002} &= \frac{\text{PVFB} - (\text{Actuarial assets} - \text{Credit balance})}{\text{Present value of future compensation} / 2002 \text{ compensation}} \\ &= \frac{555,577 - (386,750 - 1,115)}{5.830129} \\ &= 29,149 \end{aligned}$$

The minimum required contribution for 2002 is:

$$(\text{NC}_{1/1/2002} - \text{CB}_{12/31/2001}) \times 1.07 = (29,149 - 1,115) \times 1.07 = 29,996$$

Answer is C.

## Question 28

The deductible limit for the tax year ending 9/30/2002 is based upon the valuation for the plan year that begins within that fiscal year. The valuation date is 1/1/2002. The normal cost using the aggregate method for deduction purposes uses actuarial assets unadjusted by the credit balance in the funding standard account. However, the assets must be reduced by any contributions that have not yet been deducted, but already used for funding standard account purposes. Similarly, the assets must be increased by any contributions that have already been deducted (but not yet used for funding standard account purposes). In this case, the contribution of \$50,000 deposited on 6/15/2002 has been deducted for the 9/30/2001 fiscal year, but was not used for the 2001 funding standard account (as it is listed as a 2002 contribution). The assets must be increased by this amount. (Note that under the general exam conditions, assets include receivable contributions for IRC section 412 purposes, but not for IRC section 404 purposes.)

$$\text{IRC section 404 actuarial assets} = 750,000 + 50,000 = 800,000$$

The IRC section 404 normal cost for 2002 (as of 1/1/2002) is equal to:

$$\begin{aligned} \text{NC}_{1/1/2002} &= \frac{\text{PVFB} - \text{IRC section 404 actuarial assets}}{\text{Present value of future compensation} / 2002 \text{ compensation}} \\ &= \frac{4,000,000 - 800,000}{3,000,000 / 250,000} \\ &= 266,667 \end{aligned}$$

This is increased with valuation interest to the earlier of the plan year end or the fiscal year end (see IRS regulation 1.404(a)-14(f)(3)). In this case, the fiscal year end occurs first.

$$\text{The deductible limit is: } 266,667 \times 1.07^{9/12} = 280,548$$

Answer is B.

Note: The deductible limit is actually equal to the greater of the minimum funding requirement for the 2002 plan year or the IRC section 404 normal cost determined here. The normal cost under IRC section 412 will be different (and larger) than the normal cost under IRC section 404, since the assets for IRC section 412 are not increased by the \$50,000 contribution for 2002, and are decreased by the credit balance. However, due to the large credit balance, the total minimum funding requirement will clearly be less than the IRC section 404 normal cost (as increased with interest). But in general, the minimum funding requirement should be determined as follows.

The assets must be reduced by the credit balance.

$$\text{IRC section 412 actuarial assets} = 750,000 - 75,000 = 675,000$$

The IRC section 412 normal cost for 2002 (as of 1/1/2002) is equal to:

$$\begin{aligned} \text{NC}_{1/1/2002} &= \frac{\text{PVFB} - \text{IRC section 412 actuarial assets}}{\text{Present value of future compensation} / \text{2002 compensation}} \\ &= \frac{4,000,000 - 675,000}{3,000,000 / 250,000} \\ &= 277,083 \end{aligned}$$

The minimum required contribution for 2002 is:

$$(\text{NC}_{1/1/2002} - \text{CB}_{12/31/2001}) \times 1.07 = (277,083 - 75,000) \times 1.07 = 216,229$$

Clearly, the minimum funding requirement is less than the IRC section 404 normal cost. This will generally be the case when there is a large credit balance.

## Question 29

The funded current liability percent as of 1/1/2002 is:

$$\text{Actuarial assets/Current liability} = 275,000/800,000 = 34.375\%$$

Adjusted disbursements are equal to the plan disbursements made during the one-year period ending on March 31, 2002, reduced by the product of the funded current liability percentage and the sum of the disbursements used to pay single lump sums and purchase annuities. The disbursements made during this 12-month period are the single sum disbursement of \$8,000 on 3/1/2002, the monthly annuity and expense payments totaling \$7,050 paid from April through December of 2001, and the monthly annuity and expense payments totaling \$7,200 paid from January through March of 2002. Only the \$8,000 was used to pay a single lump sum or purchase an annuity.

The adjusted disbursements are:

$$(8,000 + (7,050 \times 9) + (7,200 \times 3)) - (.34375 \times 8,000) = 90,300$$

The liquidity shortfall is equal to three times the adjusted disbursements, less the market value of the assets as of March 31, 2002:

$$(3 \times 90,300) - 250,000 = 20,900$$

The quarterly contribution payable on 4/15/2001, including the liquidity shortfall, is equal to the greater of the liquidity shortfall of \$20,900 and the quarterly contribution requirement of \$5,000, which is \$20,900.

Answer is B.

### Question 30

The deductible limit is generally equal to the greater of the minimum funding requirement or the normal cost plus limit adjustment. Since there are no amortization bases other than the initial base in this situation, the deductible limit will clearly be equal to the normal cost plus limit adjustment (due to the fact that the base is amortized over 30 years for minimum funding, rather than 10 years for the deductible limit).

The normal cost plus limit adjustment (as of the end of the year) is:

$$(1,660 + 106,000/\ddot{a}_{10}) \times 1.07 = (1,660 + 14,105) \times 1.07 = 16,869$$

Note that even though it has been more than 10 years since the base was established, the unamortized balance of the base may still be greater than the 10-year amortization of \$14,105. It is important to check that the unamortized balance of the base is not less than \$14,105, since that would require that the limit adjustment be reduced to that smaller balance. Since there is a zero credit balance in the funding standard account, that implies that the actual contributions to the plan have been in amounts that would amortize the base over 30 years. The unamortized balance for IRC section 404 is equal to the outstanding balance under IRC section 412.

$$\text{Outstanding balance} = 106,000 \times \frac{\ddot{a}_{51}}{\ddot{a}_{30}} = 35,025$$

This is larger than the 10-year amortization of the base, verifying that the correct limit adjustment is \$14,105.

The deductible limit under IRC section 404(a)(1)(A) is subject to the full funding limitation.

The full funding limitations are:

$$\begin{aligned} \text{ERISA:} & \quad (118,000 + 2,000 - 92,500) \times 1.07 = 29,425 \\ \text{OBRA '87:} & \quad ((62,000 + 4,000) \times 165\% \times 1.06) - (92,500 \times 1.07) = 16,459 \\ \text{RPA '94:} & \quad ((62,000 + 4,000) \times 90\% \times 1.06) - (92,500 \times 1.07) = 0 \end{aligned}$$

Note that the current liability is increased using the 6% current liability interest rate rather than the 7% valuation interest rate.

The overall full funding limitation is the smaller of the ERISA and OBRA '87 limits, but not less than the RPA '94 limit. This is the OBRA '87 limit of \$16,459.

The full funding limit is less than the otherwise deductible limit of \$16,869, so only \$16,459 is deductible.

The unfunded current liability (under IRC section 404(a)(1)(D)) may be deducted if that is larger than \$16,459. However, this will not apply since the assets exceed the current liability.

Therefore, the deductible limit is \$16,459.

Answer is D.

### Question 31

The deductible limit is generally equal to the greater of the minimum funding requirement or the normal cost plus limit adjustment. Since the initial amortization base is amortized over 30 years for minimum funding (as compared to 10 years for the limit adjustment) and the assumption change base is amortized over 10 years for minimum funding (as compared to 10 years for the limit adjustment), the normal cost plus limit adjustment will be the larger of the two.

The normal cost plus limit adjustment for 2002 is:

$$\begin{aligned} & (112,273 + 2,100,000/\ddot{a}_{\overline{10}|0.07} + 340,000/\ddot{a}_{\overline{10}|0.07}) \times 1.07 \\ & = (112,273 + 279,432 + 45,241) \times 1.07 = 467,532 \end{aligned}$$

However, this must be reduced if the full funding limitation is smaller. The full funding limitations are:

$$\begin{aligned} \text{ERISA:} & \quad (2,150,000 - 1,740,000) \times 1.07 = 438,700 \\ \text{OBRA '87:} & \quad (2,180,000 \times 165\% \times 1.06) - (1,740,000 \times 1.07) = 1,951,020 \\ \text{RPA '94:} & \quad (2,180,000 \times 90\% \times 1.06) - (1,740,000 \times 1.07) = 217,920 \end{aligned}$$

Note that the current liability is increased using the 6% current liability interest rate rather than the 7% valuation interest rate.

It must be assumed that there were no benefit payments in 2002 since that information is not provided.

The overall full funding limitation is the smaller of the ERISA and OBRA '87 limits, but not less than the RPA '94 limit. This is the ERISA limit of \$438,700.

The full funding limit is less than the otherwise deductible limit of \$467,532, so only \$438,700 is deductible.

The unfunded current liability (under IRC section 404(a)(1)(D)) may be deducted if that is larger than \$438,700. The unfunded current liability is:

$$(2,180,000 \times 1.06) - (1,740,000 \times 1.07) = 449,000$$

Therefore, the deductible limit is \$449,000.

Answer is B.

### Question 32

The monthly accrued benefit as of 1/1/2002 is:

$$AB_{1/1/2002} = \$35 \times 33 \text{ years} = \$1,155$$

The accrued liability is the present value of the accrued benefit. The present value is dependent on the probability of retirement at each of the possible retirement ages. An early retirement reduction must be applied if retirement occurs before age 65.

$$\begin{aligned} AL_{1/1/2002} &= 1,155 \times \{ [q_{63}^{(r)} \times 12 \ddot{a}_{63}^{(12)} \times (1 - (.06)(2 \text{ years})] \\ &\quad + [p_{63}^{(r)} \times q_{64}^{(r)} \times 12 \ddot{a}_{64}^{(12)} \times (1 - (.06)(1 \text{ year}) \times v] \\ &\quad + [p_{63}^{(r)} \times p_{64}^{(r)} \times 12 \ddot{a}_{65}^{(12)} \times v^2] \} \\ &= 1,155 \times 12 \times \{ [.2 \times 9.72 \times .88] + [.8 \times .4 \times 9.48 \times .94 \times .934579] \\ &\quad + [.8 \times .6 \times 9.24 \times .873439] \} \\ &= 13,860 \times (1.71072 + 2.66503 + 3.87388) \\ &= 114,340 \end{aligned}$$

Answer is A.

### Question 33

The normal cost for 2002 (as of 1/1/2002) is equal to:

$$\begin{aligned} NC_{1/1/2002} &= \frac{\text{PVFB - Actuarial assets}}{\text{Present value of future compensation} / \text{2002 compensation}} \\ &= \frac{8,500,000 - 6,600,000}{32,500,000 / 2,700,000} \\ &= 157,846 \end{aligned}$$

The minimum required contribution as of the end of the year is:

$$157,846 \times 1.07 = 168,895$$

However, this must be reduced if the full funding limitation is smaller. The full funding limitations are:

$$\begin{aligned} \text{ERISA:} & \quad 7,275,000 - (6,500,000 \times 1.07) = 320,000 \\ \text{OBRA '87:} & \quad (4,300,000 \times 165\%) - (6,500,000 \times 1.07) = 140,000 \\ \text{RPA '94:} & \quad (4,300,000 \times 90\%) - (6,600,000 \times 1.07) = 0 \end{aligned}$$

Note that the actuarial value of assets is used for the RPA '94 full funding limitation, rather than the smaller of the market or actuarial value.

The overall full funding limitation is the smaller of the ERISA and OBRA '87 limits, but not less than the RPA '94 limit. This is the OBRA '87 limit of \$140,000.

The full funding limit is less than the minimum funding requirement of \$168,895. The full funding credit is equal to the difference between the minimum funding requirement (before the full funding limit is taken into account) and the full funding limit.

$$\text{Full funding credit} = 168,895 - 140,000 = 28,895$$

Answer is B.

### Question 34

The accrued liability as of 1/1/2001 is equal to the sum of the unfunded accrued liability and the actuarial value of assets.

$$AL_{1/1/2001} = 195,000 + 225,000 = 420,000$$

The experience loss for 2001 is equal to the excess of the actual accrued liability (as of 1/1/2002) over the expected accrued liability (as of 1/1/2002).

$$\begin{aligned}\text{Expected } AL_{1/1/2002} &= (AL_{1/1/2001} + NC_{1/1/2001}) \times 1.07 \\ &= (420,000 + 25,000) \times 1.07 \\ &= 476,150\end{aligned}$$

Since there was no change in the participants covered under the plan, the actual unfunded liability is equal to the expected accrued liability, adjusted for the fact that salary increased by 8.75% in 2001 rather than the expected 5%.

$$\begin{aligned}\text{Actual } AL_{1/1/2002} &= \text{Expected } AL_{1/1/2002} \times (1.0875/1.05) \\ &= 476,150 \times (1.0875/1.05) \\ &= 493,155\end{aligned}$$

The loss is:  $493,155 - 476,150 = 17,005$

Answer is C.

### Question 35

The participant will be age 65 on 1/1/2017. The final year that the participant will receive salary is 2016. The 2001 compensation must be projected with salary increases to 2014, 2015, and 2016.

$$\text{Final average salary}_{65} = \$60,000 \times \frac{1.03^{13} + 1.03^{14} + 1.03^{15}}{3} = \$90,782$$

Since it is also possible that the participant will terminate employment at ages 63 and 64, it is also necessary to calculate the final average salary at those ages.

$$\text{Final average salary}_{64} = \$60,000 \times \frac{1.03^{12} + 1.03^{13} + 1.03^{14}}{3} = \$88,138$$

$$\text{Final average salary}_{63} = \$60,000 \times \frac{1.03^{11} + 1.03^{12} + 1.03^{13}}{3} = \$85,571$$

The normal cost is equal to the present value of 1% of final average salary at each possible termination age, multiplied by the probability of terminating at that age. Note that regardless of the age at termination, the benefit is not payable until age 65.

$$\begin{aligned}NC &= 1\% \times \ddot{a}_{65}^{(12)} \times v^{15} \times [(q_{63}^{(w)} \times 85,571) \\ &\quad + (p_{63}^{(w)} \times q_{64}^{(w)} \times 88,138) + (p_{63}^{(w)} \times p_{64}^{(w)} \times 90,782)] \\ &= 1\% \times 10.00 \times .362446 \times [(.1 \times 85,571) \\ &\quad + (.9 \times .15 \times 88,138) + (.9 \times .85 \times 90,782)] \\ &= 3,259\end{aligned}$$

Answer is A.

### Question 36

Recall from the formula for a joint and survivor annuity:

$$\begin{aligned}\ddot{a}_{60:65}^{(12)} &= \ddot{a}_{60}^{(12)} + \ddot{a}_{65}^{(12)} - \ddot{a}_{60:65}^{(12)} \\ 11.117 &= 9.815 + 8.736 - \ddot{a}_{60:65}^{(12)} \\ \ddot{a}_{60:65}^{(12)} &= 7.434\end{aligned}$$

The loss is equal to the difference between the present value of the actual form of benefit elected and the present value of the normal form of benefit.

The present value of the benefit under the normal form of a life annuity is:

$$\$1,500 \times 12 \ddot{a}_{65}^{(12)} = \$157,248$$

The present value of the benefit under the optional joint and survivor benefit elected is:

$$\$1,500 \times .9 \times 12 \times (\ddot{a}_{65}^{(12)} + \rho(\ddot{a}_{60}^{(12)} - \ddot{a}_{60:65}^{(12)})) = \$167,238$$

The loss is:

$$\$167,238 - \$157,248 = \$9,990$$

Answer is C.

### Question 37

The minimum required contribution for 2001 (as of 12/31/2001) is:

$$(40,000 + 250,000/\ddot{a}_{30}) \times 1.07 = (40,000 + 18,829) \times 1.07 = 62,947$$

Since only \$40,000 was contributed for the 2001 plan year (on 8/1/2001), the 2001 funding deficiency is:

$$62,947 - (40,000 \times 1.07^{5/12}) = 21,803$$

The deductible limit for 2002 is equal to the greater of the minimum funding requirement or the normal cost plus limit adjustment. The new amortization base attributable to the 1/1/2002 plan amendment is amortized over 30 years for minimum funding and 10 years for the limit adjustment. The funding deficiency from 2001 is used only to determine the 2002 minimum funding requirement.

The minimum required contribution for 2002 (as of 12/31/2002) is:

$$\begin{aligned} & (21,803 + 35,000 + 250,000/\ddot{a}_{\overline{30}|} - 30,000/\ddot{a}_{\overline{30}|}) \times 1.07 \\ & = (21,803 + 35,000 + 18,829 - 2,259) \times 1.07 = 78,509 \end{aligned}$$

The normal cost plus limit adjustment for 2002 (as of 12/31/2002) is:

$$\begin{aligned} & (35,000 + 250,000/\ddot{a}_{\overline{10}|} - 30,000/\ddot{a}_{\overline{10}|}) \times 1.07 \\ & = (35,000 + 33,266 - 3,992) \times 1.07 = 68,773 \end{aligned}$$

The greater of these is the deductible limit for 2002, which is \$78,509.

Answer is D.

### Question 38

Normal cost based upon retirement age of 65:

$$\begin{aligned} \text{PVFB} & = \$30 \times 40 \text{ years of service} \times 12 \ddot{a}_{65}^{(12)} \times v^{10} = 67,639 \\ \text{Normal cost} & = (\text{PVFB} - \text{Actuarial assets})/\ddot{a}_{\overline{10}|} \\ & = (67,639 - 45,000)/7.515232 \\ & = 3,012 \end{aligned}$$

Normal cost based upon retirement age of 64:

$$\begin{aligned} \text{PVFB} & = \$30 \times 39 \text{ years of service} \times 12 \ddot{a}_{64}^{(12)} \times v^9 = 72,397 \\ \text{Normal cost} & = (\text{PVFB} - \text{Actuarial assets})/\ddot{a}_{\overline{9}|} \\ & = (72,397 - 45,000)/6.971299 \\ & = 3,930 \end{aligned}$$

The increase in the normal cost is:

$$3,930 - 3,012 = 918$$

Answer is D.

### Question 39

The unfunded liability can be determined using the formula for calculating the normal cost.

$$\begin{aligned} NC_{1/1/2002} &= \frac{\text{PVFB} - \text{Actuarial assets} - \text{Unfunded liability}}{\text{Present value of future compensation} / \text{2002 compensation}} \\ 55,000 &= \frac{1,500,000 - 250,000 - \text{Unfunded liability}}{1,800,000/180,000} \\ \text{Unfunded liability} &= 700,000 \end{aligned}$$

The outstanding balance of the initial unfunded liability can be determined using the balance equation:

$$\begin{aligned} \text{Unfunded liability} &= \text{Outstanding balance} - \text{Credit balance} \\ &\quad - \text{Reconciliation account balance} \\ 700,000 &= \text{Outstanding balance} - 7,500 \\ \text{Outstanding balance} &= 707,500 \end{aligned}$$

There are 23 years remaining to amortize the initial unfunded liability. Note that there are no other amortization bases in this question.

The minimum required contribution for 2002 (as of 12/31/2002) is:

$$\begin{aligned} (55,000 + 707,500/\ddot{a}_{\overline{23}|} - 7,500) \times 1.07 &= (55,000 + 58,659 - 7,500) \times 1.07 \\ &= 113,590 \end{aligned}$$

Answer is C.

### Question 40

The participant will be age 65 on 1/1/2007. The final year that the participant will receive salary is 2006. The 2002 compensation must be projected with salary increases to 2004, 2005, and 2006.

$$\text{Final average salary} = \$35,000 \times \frac{1.06^2 + 1.06^3 + 1.06^4}{3} = \$41,733$$

The normal cost is equal to the present value of the benefit accruing in the current year (using final average salary).

$$\text{Normal cost} = 2\% \times 41,733 \times \ddot{a}_{65}^{(12)} \times v^5 = 5,772$$

Answer is C.