

Solutions to EA-2(F) Examination Fall, 2017

Question 1

The liquidity shortfall under IRC section 430(j)(4) may be larger than the quarterly contribution requirement under IRC section 430(j)(3). As a result, a contribution that satisfies the quarterly contribution requirement does not necessarily satisfy the liquidity requirement. The statement is false.

Answer is B.

Question 2

The minimum required contribution for a multiemployer plan is equal to the normal cost plus the net amortization charge (amortization charges less amortization credits). This is brought forward using the valuation interest rate to the end of the year.

$$\text{Minimum required contribution}_{12/31/2018} = (750,000 + 250,000) \times 1.07 = 1,070,000$$

The 2018 funding deficiency is equal to the excess of the minimum required contribution over the 2018 contribution of \$1,000,000 (there is no interest credited to the contribution because it is deposited on 12/31/2018). Note that there is no credit balance which would also be used to reduce the funding deficiency.

$$\text{2018 funding deficiency} = 1,070,000 - 1,000,000 = 70,000$$

IRC section 4971(a)(2) provides for an excise tax on funding deficiencies for multiemployer plans in the amount of 5% of the deficiency. IRC section 4971(g) provides additional rules for plans in endangered or critical status, which is not the case in this question.

$$X = 5\% \times 70,000 = 3,500$$

Answer is C.

Question 3

The funding target is equal to the present value of the benefit accrued as of the first day of the year. Smith is age 43 on 1/1/2017, with 3 years of service. Salary cannot be projected for purposes of the funding target, so the final 3-year average salary must be equal to an average of the salary from the years 2014 through 2016. Smith's salary for each of those years is \$285,000. This must be limited to the salary limit under IRC section 401(a)(17), which is \$260,000 for 2014 and \$265,000 for each of 2015 and 2016.

The highest consecutive 3-year average salary as of 1/1/2017 is:

$$\frac{260,000 + 265,000 + 265,000}{3} = 263,333$$

The accrued benefit under the plan's normal retirement benefit formula as of 1/1/2017 is:

$$9\% \times 263,333 \times 3 \text{ years of service} = 71,100$$

The limitation of IRC section 415(b) must be considered with regard to the accrued benefit. Smith entered the plan on 1/1/2015 (this is the plan effective date, and immediate entry is assumed under the plan general conditions) and has 2 years of plan participation as of 1/1/2017. The IRC section 415(b) dollar limit for 2017 is \$215,000. This is reduced when years of plan participation are less than 10, as is the case for Smith.

$$1/1/2017 \text{ IRC section 415(b) dollar limit} = \frac{2}{10} \times 215,000 = 43,000$$

The IRC section 415(b) percent of salary limit is equal to 100% of the high consecutive 3-year average salary, reduced when years of service are less than 10. Smith has 3 years of service as of 1/1/2017.

$$1/1/2017 \text{ IRC section 415(b) percent of salary limit} = \frac{3}{10} \times 263,333 = 79,000$$

The overall 415(b) limit is equal to the smaller of the dollar limit and the percent of salary limit. This is \$43,000. The accrued benefit as of 1/1/2017 under the plan benefit formula must be limited to \$43,000 for purposes of the determination of the funding target.

For purposes of determining the present value, the commutation functions used are found in the tables of supplementary factors provided with the examination, for a male participant using 5% interest (since Smith is more than 20 years from the assumed retirement age of 65, the segment 3 interest rate is used). Note that there are no assumed pre-retirement decrements due to the exam general conditions, and age 65 is the assumed retirement range due to the exam general conditions.

$$\begin{aligned}
X &= 43,000 \times \ddot{a}_{65}^{(12)} \times v_{5\%}^{22} = 43,000 \times \frac{N_{65}^{(12)}}{D_{65}} \times 0.341850 \\
&= 43,000 \times \frac{463,348}{38,875} \times 0.341850 = 175,203
\end{aligned}$$

Answer is A.

Question 4

IRC section 430(f)(3)(C) requires that in order for a plan sponsor to be able to elect to use a funding balance to offset the minimum required contribution, the ratio of the prior year actuarial value of assets (reduced only by the prior year prefunding balance but not by the prior year funding standard carryover balance) to the prior year funding target must be at least 80%. The statement is false because it requires the subtraction of both funding balances from the assets.

Answer is B.

Question 5

- I. IRC section 430(j)(3)(A) states that quarterly contributions are required for a plan year if there was a funding shortfall for the prior plan year. The statement is true.
- II. IRC section 430(j)(3)(A) requires that when a portion of the quarterly contribution is made late, then the interest rate used for the period of underpayment is equal to the plan effective rate for the current year plus 5%. The segment 3 rate has no impact on the interest rate used for the period of underpayment. The statement is false.
- III. Treasury regulation 1.430(j)-1(c)(7)(iii) states that if the prior year is a short year (which required pro-rating the minimum required contribution), then for purposes of determining 100% of the prior year minimum for the current year quarterly contribution requirement, the full year minimum required contribution is used for the prior year. The statement is false.

Answer is B.

Question 6

The average value method under IRC section 430(g)(3)(B), Treasury regulation 1.430(g)-1(c)(2), and Revenue Notice 2009-22 allows for averaging of fair market and adjusted fair market values for up to 25 months ending on the valuation date. The asset method being used in this question averages the fair market value on the valuation date with the adjusted fair market value from the prior year valuation date.

The adjusted fair market value from a particular valuation date is the fair market value on that date, adjusted for all contributions, benefit payments and administrative expenses that occurred between that valuation date and the current valuation date, and further adjusted for expected earnings based upon the actuary's best estimate of the asset rate of return for the year. If this expected rate of return is larger than the segment 3 interest rate, then that segment 3 interest rate is used. In this question, the segment 3 interest rate for 2017 of 5% is used to determine the expected earnings for that year (the assumed rate of return for 2017 of 7% is larger).

The expected earnings for 2017 are:

$$[4,000,000 \times .05] - [(200,000 + 45,000) \times (1.05^{6/12} - 1)] \\ + [200,000 \times (1.05^{3/12} - 1)] = 196,404$$

Note that the benefit payments and administrative expenses occurred on 7/1, so there is $\frac{1}{2}$ of a year of expected earnings associated with those transactions. There is also a 2017 contribution of \$200,000 deposited on 10/1/2017, so there is $\frac{1}{4}$ of a year of expected earnings associated with that contribution.

There is also a receivable contribution (for 2017) of \$500,000 made on 7/1/2018. There are no expected earnings with regard to this contribution, but it must be included in the actuarial value of assets for the 1/1/2018 valuation since it is a receivable for 2017. It must be discounted with interest at the 2017 plan effective rate of 4.5% for 6 months, from the date contributed to 1/1/2018.

$$1/1/2018 \text{ present value of 2017 receivable contribution} = 500,000 \times v_{4.5\%}^{6/12} = 489,116$$

$$1/1/2017 \text{ adjusted fair market value (adjusted to 1/1/2018)} \\ = 4,000,000 - 200,000 - 45,000 + 200,000 + 196,404 + 489,116 = 4,640,520$$

$$1/1/2018 \text{ fair market value (including 2017 receivable contribution)} \\ = 4,180,000 + 489,116 = 4,669,116$$

$$1/1/2018 \text{ actuarial value} = (4,640,520 + 4,669,116)/2 = 4,654,818$$

Under IRC section 430(g)(3)(B)(iii), the actuarial value cannot be less than 90% of the market value of the assets (including receivable contributions). 90% of \$4,669,116 is equal to \$4,202,204.

The 1/1/2018 actuarial value of assets is equal to \$4,654,818.

Answer is B.

Question 7

The minimum required contribution is equal to the target normal cost plus the amortization of the shortfall bases plus the amortization of any waived funding deficiencies.

The outstanding balance of the 2016 shortfall amortization base as of 1/1/2017 can be determined using the 6-year amortization factor for 2017 (there are 6 years left to pay off the 2016 shortfall base). Note that the amortization factors are found in the table of amortization factors provided with the exam, although they can also be developed using the 2017 segment rates.

Outstanding balance of 2016 shortfall amortization base as of 1/1/2017 =

$$\$20,000 \times 5.2932 = \$105,864$$

The funding shortfall is the excess of the funding target over the actuarial value of assets (reduced by the funding standard carryover balance and the prefunding balance – note that there are no funding balances in this question).

$$\text{Funding shortfall}_{1/1/2017} = \$1,000,000 - \$855,000 = \$145,000$$

The 2017 shortfall base is equal to the funding shortfall less the outstanding balance of prior shortfall base, and the base is amortized over 7 years.

$$\text{2017 shortfall amortization base} = \$145,000 - \$105,864 = \$39,136$$

$$\text{Amortization of 2017 shortfall base} = \$39,136 \div 5.9982 = \$6,525$$

$$\text{2017 minimum required contribution} = \$120,000 + \$20,000 + \$6,525 = \$146,525$$

The only contribution made for 2017 was \$15,000 deposited on 1/1/2017.

$$\text{2017 waived deficiency} = \$146,525 - \$15,000 = \$131,525$$

This waived deficiency is amortized under IRC section 430(e) over a period of 5 years, beginning with 2018. The amortization is based upon the 2017 segment rates (the year in which the deficiency was waived). The segment 1 rate applies to the first 4 payments (from 1/1/2018 through 1/1/2021) and the segment 2 rate applies to the final payment on 1/1/2022. Note the use of an annuity-immediate because the first payment is on 1/1/2018, one year after the waived deficiency is created.

$$\text{Amortization of 2017 waived deficiency} = \frac{\$131,525}{a_{\overline{4}|5\%} + v_{6\%}^5} = \$30,636$$

The outstanding balance of the 2017 waived deficiency as of 1/1/2018 is determined using the 2018 segment rates. All 5 installments are still due, and an annuity-due is now used because the first installment is due on 1/1/2018.

Outstanding balance of 2017 waived deficiency as of 1/1/2018 =

$$\$30,636 \times \ddot{a}_{\overline{5}|3\%} = \$30,636 \times 4.7171 = \$144,513$$

The outstanding balance of the 2017 shortfall amortization base as of 1/1/2018 can be determined using the 6-year amortization factor for 2018 (there are 6 years left to pay off the 2017 shortfall base).

Outstanding balance of 2017 shortfall amortization base as of 1/1/2018 =

$$\$6,525 \times 5.539 = \$36,142$$

The outstanding balance of the 2016 shortfall amortization base as of 1/1/2018 can be determined using the 5-year amortization factor for 2018 (there are 5 years left to pay off the 2016 shortfall base).

Outstanding balance of 2016 shortfall amortization base as of 1/1/2018 =

$$\$20,000 \times 4.7171 = \$94,342$$

$$\text{Funding shortfall}_{1/1/2018} = \$1,220,000 - \$920,500 = \$299,500$$

The 2018 shortfall base is equal to the funding shortfall less the outstanding balance of prior shortfall and waiver bases, and the base is amortized over 7 years.

$$\text{2018 shortfall amortization base} = \$299,500 - \$94,342 - \$36,142 - \$144,513 = \$24,503$$

$$\text{Amortization of 2018 shortfall base} = \$24,503 \div 6.3293 = \$3,871$$

$$\begin{aligned} \text{2018 minimum required contribution} &= \$110,000 + \$20,000 + \$6,525 + \$3,871 + \$30,636 \\ &= \$171,032 \end{aligned}$$

This is also the **smallest amount that satisfies the minimum funding standard** because there are no funding balances.

Answer is A.

Question 8

Revenue Ruling 81-215 provides that for purposes of funding, a plan sponsor can elect to use the IRC section 415 dollar limitation in effect as of the first day of the plan year, or the IRC section 415 dollar limit in effect as of the last day of the plan year, regardless of the valuation date. Once this election is made, it cannot be changed without IRS approval.

The statement is true.

Answer is A.

Question 9

A contribution for 2017 of \$20,000 was made on 2/1/2017. This must be discounted to 1/1/2017 using the 2017 effective interest rate:

$$\$20,000 \times v_{5.5\%}^{1/12} = \$19,911$$

The minimum required contribution for 2017 is \$16,000. Since \$19,911 was paid for with the 2/1/2017 employer contribution of \$20,000, there is an excess contribution of \$3,911 (\$19,911 – \$16,000).

The general conditions of the exam state that the employer elects to add excess contributions to the prefunding balance. This is done as of the first day of the following plan year (1/1/2018), and the excess contribution is increased with interest using the 2017 effective interest rate (IRC section 430(f)(6)(B)(ii)). Any existing unused funding balances are increased from 1/1/2017 to 1/1/2018 using the 2017 asset rate of return (IRC section 430(f)(8)). Note that there was a 15% asset loss in 2017, so the 1/1/2017 funding balances are reduced by 15%,

$$\text{Funding standard carryover balance}_{1/1/2018} = \$6,000 \times 85\% = \$5,100$$

$$\text{Prefunding balance}_{1/1/2018} = (\$1,500 \times 85\%) + (\$3,911 \times 1.055) = \$5,401$$

The **smallest amount that satisfies the minimum funding standard** for 2018 is equal to the minimum required contribution reduced by the funding balances.

$$\$X = \$20,000 - \$5,100 - \$5,401 = \$9,499$$

Answer is B.

Question 10

The frozen initial liability (FIL) cost method consists of a normal cost and various amortization charges and credits. This question concerns the normal cost and not the amortization bases.

The normal cost under the frozen initial liability cost method is equal to:

$$\frac{\text{Present value of future benefits} - \text{Actuarial value of assets} - \text{Unfunded liability}}{\text{Temporary annuity}}$$

Note that the actuarial value of assets is not reduced by the credit balance for purposes of the normal cost calculation under the FIL cost method.

The temporary annuity can be determined by taking the ratio of the present value of future service to the number of active plan participants (there are a number of ways to determine the temporary annuity, but this is the only method that could be used in this question based upon the data provided). This is:

$$\text{Temporary annuity} = 2,160/200 = 10.8$$

The unfunded liability can be developed using the balance equation. The balance equation states that the unfunded liability is equal to the outstanding balance of the amortization bases less the credit balance in the funding standard account. There was an initial amortization base determined as of the plan effective date of 1/1/2006 under the frozen initial liability method. The outstanding balance of the initial base can be determined as of 1/1/2018 by calculating the present value of the future amortization payments with regard to that base. It is given that the amortization payment with regard to the initial base is \$90,000, and the base is being amortized over a period of 30 years (initial bases created prior to 2008 were 30-year amortization bases). As of 1/1/2018 there are 18 years remaining to fully amortize the base.

$$\begin{aligned}\text{Outstanding balance as of 1/1/2018} &= \$90,000 \times \ddot{a}_{\overline{18}|} \\ &= \$90,000 \times 11.477260 = \$1,032,953\end{aligned}$$

Note that the Frozen Initial Liability method generally has no other amortization bases.

$$\text{Unfunded liability as of 1/1/2018} = \$1,032,853 - \$350,000 = \$682,953$$

$$\text{FIL normal cost} = \frac{12,000,000 - 6,950,000 - 682,953}{10.8} = 404,356$$

Answer is B.

Question 11

The 5-year extension of the amortization period for bases established on or before 1/1/2018 requires a reamortization of the outstanding balance of the bases as of 1/1/2018, with an additional 5 years added to the remaining period. Note that the 2017 actuarial loss of \$100,000 is established on 1/1/2018 and is included in the extension of amortization period (gains and losses are amortized over a period of 15 years, so with the extension, this will be amortized over 20 years). In addition, the extension only applies to charge bases, so the given actuarial gain (a credit base) is ignored.

The outstanding balance of the two charge bases established prior to 2018 must be determined as of 1/1/2018. The outstanding balance of those bases as of 1/1/2017 can be amortized over the remaining period as of 1/1/2017, and then multiplied by the annuity due factor for one fewer year to obtain the outstanding balance as of 1/1/2018.

Initial base

$$\text{Amortization as of 1/1/2017} = \frac{\$650,000}{\ddot{a}_{\overline{8}|}} = \$100,239$$

$$\text{Outstanding balance as of 1/1/2018} = \$100,239 \times \ddot{a}_{\overline{7}|} = \$585,497$$

$$\text{New amortization as of 1/1/2018} = \frac{\$585,497}{\ddot{a}_{\overline{12}|}} = \$67,383$$

Actuarial Loss

$$\text{Amortization as of 1/1/2017} = \frac{\$110,000}{\ddot{a}_{\overline{15}|}} = \$10,985$$

$$\text{Outstanding balance as of 1/1/2018} = \$10,985 \times \ddot{a}_{\overline{14}|} = \$105,453$$

$$\text{New amortization as of 1/1/2018} = \frac{\$105,453}{\ddot{a}_{\overline{19}|}} = \$9,224$$

Actuarial Loss for 2017 plan year

$$\text{Amortization as of 1/1/2018 (without extension)} = \frac{\$100,000}{\ddot{a}_{15|}} = \$9,986$$

$$\text{Amortization as of 1/1/2018 (with extension)} = \frac{\$100,000}{\ddot{a}_{20|}} = \$8,522$$

Decrease in minimum required contribution as of 12/31/2018:

$$[(\$100,239 - \$67,383) + (\$10,985 - \$9,224) + (\$9,986 - \$8,522)] \times 1.065 = \$38,426$$

Answer is C.

Question 12

IRC section 436(c)(1) generally prohibits a plan amendment increasing past service benefits when the AFTAP for the plan is less than 80%. However, IRC section 436(c)(3) provides for an exception when the plan benefit formula is not compensation based, and the rate of the increase of the accrued benefit in the benefit formula is not more than the rate of salary increase for the participants affected by the amendment.

In this question, the benefit accrual has increased from \$34 to \$35, a 2.94% increase. However, salaries have increased by 5%. Therefore, the exception of IRC section 436(c)(3) applies, and the amendment can take effect.

The statement is false.

Answer is B.

Question 13

In order to determine the status of the plan on 1/1/2018, it is necessary to determine the plan's funded percentage. This is the ratio of the actuarial value of assets to the accrued liability (see IRC section 432(j)(2)). The actuarial value of assets as of 1/1/2018 is provided in the data for the question, but the accrued liability must be developed. This can be done retrospectively, using the 1/1/2017 data provided.

$$\begin{aligned}\text{Accrued liability}_{1/1/2018} &= (\text{Accrued liability}_{1/1/2017} + \text{Normal cost}_{1/1/2017} \\ &\quad - \text{Benefit payments}_{1/1/2017}) \times 1.075 \\ &= (13,370,000 + 145,000 - 800,000) \times 1.075 \\ &= 13,668,625\end{aligned}$$

$$\text{Funded percentage}_{1/1/2018} = 10,500,000/13,668,625 = 76.8\%$$

IRC section 432(e)(4)(B)(ii)(I) states that a plan that has been in critical status emerges from critical status, if it has been approved for a 5-year automatic extension of amortization periods under IRC section 431(d), there is no projected funding deficiency for the current year or any of the next 9 years, and there is no projected insolvency for the next 30 years. All of these conditions have been satisfied in this question, so the plan is no longer in critical status for 2018.

IRC section 432(b)(1) states that a plan is in endangered status if the funded percentage for the year is less than 80% (as is the case here), or if the plan is projected to have a funding deficiency for the current year or any of the next 6 years (taking into account extensions of amortization periods). Only the first condition is satisfied, so the plan is in **endangered status** for 2018. Note that if both conditions had applied, the plan would have been seriously endangered.

Answer is D.

Question 14

In a cash balance plan, the target normal cost is determined by increasing the current year pay credit using the interest crediting rate to the assumed retirement age, and then discounting it using the segment interest rates. In the case where it is assumed that the form of benefit elected is anything other than a lump sum (e.g. a life annuity), the accumulated cash balance account at assumed retirement age must be converted to an annuity using the plan's cash balance equivalence rates and the funding mortality table and segment rates are then used to determine the present value.

Smith is currently age 42 on 1/1/2018, 20 years before the assumed retirement age of 62. The cash balance interest crediting rate is 6%, and the pay credit rate is 5%, deposited on 12/31/2018.

$$2018 \text{ pay credit} = 5\% \times 260,000 = 13,000$$

Note that Smith's 2018 salary would have been limited if it had been above the 2018 IRC section 401(17) compensation limit, and it is assumed for this question that the 2018 limit is at least as large as the 2017 limit.

The pay credit is deposited on 12/31/2018, so it will receive 19 years of interest credit through age 62.

$$\text{Accumulated 2018 pay credit at retirement age} = 13,000 \times 1.06^{19} = 39,333$$

The commutation functions used are found in the tables of supplementary factors provided with the examination, for a male participant using 5% interest.

$$\begin{aligned} \text{Equivalent life annuity payable at age 62} &= 39,333 \div \frac{N_{62}^{(12)}}{D_{62}} \\ &= 39,333 \div \frac{590,739}{45,973} = 3,061 \end{aligned}$$

The probability of electing a life annuity is given to be 50%, and the probability of electing a lump sum is given to be 50%. These probabilities must be taken into account in determining the present value for the target normal cost. Note that Smith is 20 years from retirement (as of the 1/1/2018 valuation date), so only the segment 3 interest rate of 7% is used. There is no statement of pre-retirement mortality, so it can be assumed that mortality is used only post-retirement for purposes of valuing the life annuity (general conditions of the exam).

$$\begin{aligned} \text{Target normal cost} &= (50\% \times 39,333 \div 1.07^{20}) + (50\% \times 3,061 \times \frac{N_{62}^{(12)}}{D_{62}} \div 1.07^{20}) \\ &= (50\% \times 39,333 \div 1.07^{20}) + (50\% \times 3,061 \times \frac{154,569}{14,271} \div 1.07^{20}) \\ &= 5,082 + 4,284 = 9,366 \end{aligned}$$

Answer is B.

Question 15

Treasury regulation 1.430(j)-1(b)(3)(i) states that when a plan has an unpaid minimum required contribution, then as contributions are made to the plan, they must be used to pay off the earliest year for which there is an unpaid minimum required contribution.

The unpaid minimum required contribution for 2015 was paid on 9/1/2017. The amount of the 9/1/2017 contribution needed to pay for the 2015 minimum required contribution of \$100,000 is:

$$\$100,000 \times 1.06^{32/12} = \$116,811$$

Note that the 2015 plan effective rate of 6% is used to increase the minimum required contribution to the actual contribution date, as required by Treasury regulation 1.430(j)-1(b)(4)(i).

The remaining contribution made on 9/1/2017 that can be used to pay for the 1/1/2016 minimum required contribution is:

$$\$140,000 - \$116,811 = \$23,189$$

The quarterly contribution requirement applies under IRC section 430(j)(3)(A) when the FTAP in the prior year is less than 100% (meaning the plan had a funding shortfall in the prior year). There were no quarterly contributions due in 2015, but they are due for 2016.

The amount of the quarterly contribution under IRC section 430(j)(3)(D) is equal to 25% of the smaller of 90% of the minimum required contribution for the current year or 100% of the minimum required contribution for the preceding year.

$$90\% \text{ of } 2016 \text{ minimum required contribution} = 90\% \times \$120,000 = \$108,000$$

The quarterly contribution due on 4/15/2016 is equal to 25% of \$100,000 (because the 2015 minimum required contribution is less than 90% of the 2016 minimum):

$$25\% \times \$100,000 = \$25,000$$

The remaining contribution of \$23,189 made on 9/1/2017 is less than the required quarterly contribution due 4/15/2016. This contribution is late by 16½ months, and an additional 5 percentage points (for a total 12% rate) must be used to discount the \$23,189 contribution needed to partially satisfy that quarterly contribution requirement for those 16½ months (and then discounted using the 2016 plan effective rate of 7% for the remaining period).

$$\text{Discounted value of 9/1/2017 contribution} = \$23,189 \times v_{12\%}^{16.5/12} \times v_{7\%}^{3.5/12} = \$19,455$$

$$\text{2016 funding deficiency} = \$120,000 - \$19,455 = \$100,545$$

IRC section 4971(a)(1) requires payment of an excise tax equal to 10% of the funding deficiency, for single employer plans.

$$\$X = \$100,545 \times 10\% = \$10,055$$

Answer is E.

Question 16

IRC section 430(h)(2)(C)(iv) describes the rules regarding stabilization of segment rates. A segment rate cannot be less than an applicable minimum percentage or more than an applicable maximum percentage of an average of segment rates ending on the 25-year period that ends on 9/30 of the year preceding the calendar year during which the plan year begins. So, for the plan year beginning 1/1/2018, this would be a 25-year period ending on 9/30/2017. The applicable minimum percentage for the 2018 calendar year is 90% and the applicable maximum percentage is 110%.

The average first segment rate for the 25-year period ending on 9/30/2017 is 4.25%. The non-stabilized interest rate for the 1/1/2018 valuation date is 2%. Since 2% is less than 3.825% (90% of 4.25%), the stabilized first segment rate for 2018 is 3.825%.

Answer is B.

Question 17

The entry age normal method amortizes costs from hire age through retirement age. As a result, an assumption change is amortized over all of those years, including the change in the disability assumption. The accrued liability is the accumulation of past normal costs, so the accrued liability will change when the disability assumption is changed. The statement is false.

Answer is B.

Note: the only cost method that does not amortize normal costs is the unit credit method, and that is the only method for which this statement would be true.

Question 18

The conditions described in this question are the exact conditions described in IRC section 432(b)(2)(A) for a plan in critical status. The statement is true.

Answer is A.

Question 19

The funding target is equal to the present value of the benefit accrued as of the first day of the year. Smith is age 60 on 1/1/2018, with 14 years of service.

$$1/1/2018 \text{ accrued benefit} = 2\% \times \$60,000 \times 14 \text{ years of service} = \$16,800$$

Smith is 5 years from normal retirement age 65 (assumed per the general conditions of the exam), so the segment 2 interest rate of 4% is used to discount retirement benefits paid from age 65 through age 80, and the segment 3 interest rate of 5% is used to discount benefits paid at age 80 and later. Note that the discount for years prior to normal retirement age is based on interest only because there is no mention of any preretirement decrements (the general conditions for the exam state that there are no preretirement decrements). The commutation functions used are found in the tables of supplementary factors provided with the examination, for a male participant using 4% and 5% interest.

Since the normal form of benefit is a 10-year certain and life annuity, the payments from ages 65 through 75 are certain payments. The certain factor must be developed, as that is not provided in the question. Note that the certain payments fall within the period of time that the segment 2 interest rate applies, so 4% is used as the annual effective rate.

$$\ddot{a}_{10|4\%}^{(12)} = 8.285578$$

$$\begin{aligned} \text{Funding target} &= \$16,800 \times \left[\left(\ddot{a}_{10|4\%}^{(12)} \times v_{4\%}^5 \right) + \frac{N_{75@4\%}^{(12)} - N_{80@4\%}^{(12)}}{D_{65@4\%}} v_{4\%}^5 + \frac{N_{80@5\%}^{(12)}}{D_{65@5\%}} v_{5\%}^5 \right] \\ &= \$16,800 \times \left[\left(\ddot{a}_{10|4\%}^{(12)} \times v_{4\%}^5 \right) + \frac{375,032 - 198,530}{72,412} (0.821927) + \frac{88,005}{38,875} (0.783526) \right] \\ &= \$177,867 \end{aligned}$$

Answer is B.

Question 20

When a funding balance is used to pay for a quarterly required contribution, the plan effective rate for the year is used to increase the funding balance from the first day of the plan year to the quarterly due date (Treasury regulation 1.430(j)-1(c)(4)). The statement is true.

Answer is A.

Question 21

The minimum required contribution under the Entry Age Normal cost method is equal to the normal cost plus the amortization charges of the various bases less the amortization credits of the various bases. The **smallest amount that satisfies the minimum funding standard** is equal to the minimum required contribution reduced by any credit balance in the funding standard account, and increased with interest to the end of the plan year.

$$\$X = (\$40,000 + \$160,000 - \$100,000 - \$10,000) \times 1.07 = \$96,300$$

The normal cost under the Aggregate cost method is equal to:

$$\frac{\text{Present value of future benefits} - \text{Actuarial value of assets (reduced by the credit balance)}}{\text{Temporary annuity}}$$

The temporary annuity is equal to the ratio of the present value of future compensation to current compensation because the cost method is said to be based upon a level percent of compensation.

$$\text{Normal cost} = \frac{\$4,500,000 - (\$3,100,000 - \$10,000)}{\$2,500,000 / \$250,000} = \$141,000$$

The **smallest amount that satisfies the minimum funding standard** is equal to the normal cost, reduced by the credit balance, and increased with interest to the last day of the year.

$$\$Y = (\$141,000 - \$10,000) \times 1.07 = \$140,170$$

$$\$Y - \$X = \$140,170 - \$96,300 = \$43,870$$

Answer is B.

Question 22

The accrued liability under the entry age normal funding method is equal to the accumulated value of the prior normal costs (as of the valuation date). The normal costs are based upon the projected benefit at assumed retirement age (65 in this question, per the general conditions of the exam), and are assumed to begin at hire age. The 4% salary scale is incorporated into the determination of the projected benefit. Smith is age 54 as of the 1/1/2018 valuation date, so the 2017 salary must be projected 11 years to obtain the projected final salary.

$$\begin{aligned}\text{Final salary} &= \$100,000 \times 1.04^{11} = \$153,945 \\ \text{Projected benefit} &= 40\% \times \$153,945 = \$61,578\end{aligned}$$

The present value of future benefits (PVFB) must be determined at entry age (age at hire). Smith was hired at age 34. Note that the discount for years prior to normal retirement age is based on interest only because there is no mention of any preretirement decrements (the general conditions for the exam state that there are no preretirement decrements).

The commutation functions used for the post-retirement annuity are found in the tables of supplementary factors provided with the examination, for a female participant using 7% interest.

$$\begin{aligned}\text{PVFB}_{34} &= \$61,578 \times \ddot{a}_{65}^{(12)} \times v^{31} = \$61,578 \times \frac{N_{65}^{(12)}}{D_{65}} \times 0.122773 \\ &= \$61,578 \times \frac{121,532}{11,524} \times 0.122773 \\ &= \$79,729\end{aligned}$$

The normal cost is equal to the PVFB amortized over the total years to retirement. Since there is a salary scale, and the normal cost must be determined as a level percentage of salary (per the general conditions of the exam), an implicit interest rate is used incorporating both the 7% interest rate and the 4% salary scale.

$$\text{Implicit interest rate for amortizing} = (1.07/1.04) - 1 = .028846, \text{ or } 2.8846\%$$

$$\text{NC}_{34} = \text{PVFB}_{34} / \ddot{a}_{31|.028846} = \$79,729 / 20.896040 = \$3,815.50$$

The normal cost as of 1/1/2018 (when Smith is age 54) is equal to the normal cost at age 34, increased by 4% per year (since the normal cost increases by the same percentage as does the salary under the exam general conditions).

$$\text{NC}_{54} = \text{NC}_{34} \times 1.04^{20} = \$3,815.50 \times 2.191123 = \$8,360$$

The accrued liability is equal to the accumulation of the past normal costs through Smith's current age on 1/1/2018 (20 years of accumulation from age 34 to 54). This accumulation also uses the implicit interest rate.

$$\text{AL}_{54} = \text{NC}_{54} \times \ddot{s}_{20|.028846} = \$8,360 \times 27.323287 = \$228,423$$

Answer is C.

Question 23

The accrued liability under the projected unit credit cost method is equal to the present value of the benefit accrued to date, based upon salary projected to retirement. The retirement benefit of 25% is pro-rated over the first 25 years of service. Smith has 5 years of past service and will have only 20 years of service at age 65, so the 25% benefit at retirement age 65 is reduced by a fraction of 20/25, to a benefit of only 20% of final 3-year average salary. Note that under the general conditions of the exam, it can be assumed that normal retirement age is 65.

Smith's 2017 salary is \$125,000, and must be projected to retirement for purposes of the final 3-year average salary.

$$\text{Final 3-year average projected salary} = \$125,000 \times \frac{1.03^{13} + 1.03^{14} + 1.03^{15}}{3} = \$189,129$$

$$\text{Projected normal retirement benefit} = 20\% \times \$189,129 = \$37,826$$

The "projected" benefit accrued as of 1/1/2018 is equal to 5/20 of this projected normal retirement benefit (the pro-rata 5 years of service to date divided by the total 20 years of service at retirement).

$$1/1/2018 \text{ "projected" accrued benefit} = \$37,826 \times (5/20) = \$9,456$$

The commutation functions used to determine the accrued liability are found in the tables of supplementary factors provided with the examination, for a male participant using 6% interest. It can be assumed that there are no pre-retirement decrements based upon the exam general conditions.

$$\begin{aligned} \text{Accrued liability} &= \$9,456 \times \ddot{a}_{65}^{(12)} \times v^{15} = \$9,456 \times \frac{N_{65}^{(12)}}{D_{65}} \times 0.417265 \\ &= \$9,456 \times \frac{230,685}{20,994} \times 0.417265 = \$43,355 \end{aligned}$$

Answer is B.

Question 24

IRC section 430(f)(3) provides rules allowing for a plan sponsor to make an election to use a prefunding balance to pay for the minimum required contribution. The plan sponsor in this question makes such an election on 1/1/2017. When a plan sponsor makes an election to use a prefunding balance in an amount that exceeds the minimum required contribution, Treasury regulation 1.430(f)-1(f)(3) allows the plan sponsor to revoke the election to the extent that it exceeds the minimum required contribution, as long as the revocation occurs by the end of the plan year. In this question, the plan sponsor makes the revocation timely on 12/1/2017, so the prefunding balance to be used to pay for the 2017 minimum required contribution is only \$100,000.

When a contribution is made for a plan year after the valuation date, it must be discounted with the plan effective rate for that plan year from the date contributed to the valuation date. The \$250,000 contribution for 2017 is deposited on 7/1/2018.

$$\text{Discounted 2017 contribution} = \$250,000 \div 1.07^{18/12} = \$225,873$$

The total excess contribution is equal to the difference between the sum of the discounted contribution and the prefunding balance used for the 2017 minimum required contribution, and the minimum required contribution.

$$\text{2017 excess contribution} = (\$225,873 + \$100,000) - \$100,000 = \$225,873$$

Generally, excess contributions are increased with interest using the plan effective rate, and added to the prefunding balance on the first day of the following year (IRC section 430(f)(6)(B)). However, Treasury regulation 1.430(f)-1(b)(3)(iii) requires that to the extent that part of the excess contribution came from an election to use a funding balance to pay for the minimum required contribution, that part of the excess contribution is increased using the asset rate of return for the year instead of the plan effective rate. So, of the \$225,873 excess contribution for 2017, \$100,000 is increased using the 2017 asset return rate of -6%, and the remaining \$125,873 is increased using the plan effective rate of 7%.

$$\$X = (\$125,873 \times 1.07) + (\$100,000 \times 0.94) = \$228,684$$

Answer is C.

Question 25

The normal cost under the entry age normal funding method is based upon the projected benefit at assumed retirement age (65 in this question, per the general conditions of the exam), and is assumed to begin at hire age. The 5% salary scale is incorporated into the determination of the projected benefit. Smith is age 63 as of the 1/1/2018 valuation date, so the 2017 salary must be projected 2 years to obtain the projected final salary. Smith will have 5 years of service at age 65.

$$\text{Final salary} = \$55,125 \times 1.05^2 = \$60,775$$

$$\text{Projected benefit} = 2\% \times \$60,775 \times 5 \text{ years of service} = \$6,078$$

The present value of benefits must be determined at entry age (age at hire, not the age of entry into the plan). Smith was hired at age 60. Note that the discount for years prior to normal retirement age is based on interest only because there is no mention of any preretirement decrements (the general conditions for the exam state that there are no preretirement decrements).

The commutation functions used for the post-retirement annuity are found in the tables of supplementary factors provided with the examination, for a male participant using 7% interest.

$$\begin{aligned} \text{PVFB}_{60} &= \$6,078 \times \ddot{a}_{65}^{(12)} \times v^5 = \$6,078 \times \frac{N_{65}^{(12)}}{D_{65}} \times 0.712986 \\ &= \$6,078 \times \frac{116,056}{11,403} \times 0.712986 = \$44,105 \end{aligned}$$

The normal cost is equal to the PVFB amortized over the total years to retirement. Since there is a salary scale, and the normal cost must be determined as a level percentage of salary (per the general conditions of the exam), an implicit interest rate is used incorporating both the 7% interest rate and the 5% salary scale.

$$\text{Implicit interest rate for amortizing} = (1.07/1.05) - 1 = .0190476, \text{ or } 1.90476\%$$

$$\text{NC}_{60} = \text{PVFB}_{60} / \ddot{a}_{5,0.0190476} = \$44,105 / 4.816545 = \$9,157$$

The normal cost as of 1/1/2018 (when Smith is age 63) is equal to the normal cost at age 60, increased by 5% per year (since the normal cost increases by the same percentage as does the salary under the exam general conditions).

$$\text{NC}_{63} = \text{NC}_{60} \times 1.05^3 = \$9,157 \times 1.157625 = \$10,600$$

Answer is B.

Question 26

The minimum required contribution is equal to the target normal cost plus the amortization of the shortfall amortization bases. For 2017, the minimum required contribution (MRC) is:

$$\text{MRC}_{1/1/2017} = \$100,000 + \$30,000 = \$130,000$$

The employer contributes \$99,750 on 12/31/2017. This contribution is discounted back to the valuation date using the plan effective rate of 5%. Note that there is no penalty interest rate used for late quarterly contributions since no quarterly contributions are required for 2017.

$$\text{Discounted 2017 contribution} = \$99,750 \div 1.05 = \$95,000$$

The funding balances are elected to be used to satisfy the minimum funding requirement, so \$35,000 of the funding balances must be used.

The funding standard carryover balance must be used first to reduce the MRC (IRC section 430(f)(3)(B)), so the entire \$30,000 funding standard carryover balance is used, as well as \$5,000 of the prefunding balance. That leaves \$45,000 of the prefunding balance unused as of 1/1/2017.

IRC section 430(f)(8) requires that any unused prefunding balance be adjusted with the actual asset rate of return for the year in determining the remaining balance as of the first day of the following year. The asset rate of return for 2017 is 3%.

$$1/1/2018 \text{ prefunding balance} = \$45,000 \times 1.03 = \$46,350$$

Answer is D.

Question 27

The deductible limit for a single employer plan under IRC section 404(o)(2)(A) is equal to the sum of the funding target, the target normal cost, and the cushion amount, with the sum being reduced by the actuarial value of assets. The cushion amount under IRC section 404(o)(3)(A) is equal to the sum of 50% of the funding target plus the increase in the funding target if future compensation increases were taken into account. The plan is not at-risk.

$$\text{Cushion amount} = (50\% \times 525,000) + (580,000 - 525,000) = 317,500$$

The IRC section 404(o)(2)(A) deductible limit is:

$$320,000 + 525,000 + 317,500 - 700,000 = 462,500$$

For plans that are not at-risk, the deductible limit can be determined under IRC section 404(o)(2)(B), if that gives a larger result than the deductible limit under IRC section 404(o)(2)(A). The deductible limit under IRC section 404(o)(2)(B) is equal to the sum of the funding target and target normal cost, if each were determined as if the plan was at-risk, with the sum being reduced by the actuarial value of assets.

The IRC section 404(o)(2)(B) deductible limit is:

$$400,000 + 750,000 - 700,000 = 450,000$$

The deductible limit is the larger of the IRC section 404(o)(2)(A) and 404(o)(2)(B) limits, which is 462,500.

Answer is C.

Note: Without regulations for IRC section 404(o), it is unclear as to whether the deductible limit is determined as of the valuation date, or as of the close of the employer's fiscal year (which has traditionally been when the deductible limit is determined). In this question, if 462,500 is increased using the 5.5% effective interest rate to 12/31/2018, the result is 487,938. This is in the same answer range. Also note that it is given that there have always been more than 500 participants. The cushion amount is adjusted in certain cases for HCEs if the plan has no more than 100 participants, and that exception does not apply to this question.

Question 28

The minimum required contribution under the Unit Credit cost method is equal to the normal cost plus the amortization charges of the various bases less the amortization credits of the various bases.

$$\text{Minimum required contribution}_{1/1/2016} = \$75,000 + \$55,000 - \$15,000 = \$115,000$$

The credit balance as of the close of 2016 is equal to the credit balance as of 12/31/2015 rolled forward with interest to 12/31/2016, plus the \$85,000 contribution for 2016 made 12/31/2016, less the minimum required contribution increased with interest to 12/31/2016.

$$\text{CB}_{12/31/2016} = (\$200,000 \times 1.065) + \$85,000 - (\$115,000 \times 1.065) = \$175,525$$

The unit credit method is an immediate gain method, so the experience gain or loss for 2016 is determined as a new base to be amortized over 15 years beginning on 1/1/2017.

The experience gain or loss is equal to the difference between the actual unfunded liability and the expected unfunded liability.

The actual unfunded liability is equal to the excess of the accrued liability over the actuarial value of the assets. Note that the actuarial value of assets is not reduced by the credit balance for this purpose.

$$\text{Actual UAL}_{1/1/2017} = \$770,000 - \$680,000 = \$90,000$$

The expected unfunded liability is equal to the prior year unfunded accrued liability plus the prior year normal cost, increased with interest at the valuation interest rate to the current year, and then reduced by the prior year contribution (no interest is given to the 2016 contribution since it was contributed on the last day of the year).

$$\text{Expected UAL}_{1/1/2017} = [(\$770,000 - \$620,000) + \$75,000] \times 1.065 - \$85,000 = \$154,625$$

$$\text{2016 Gain} = \$154,625 - \$90,000 = \$64,625$$

$$\text{Amortization of 2016 gain (credit base)} = \$64,625 / \ddot{a}_{\overline{15}|} = \$6,454$$

$$\begin{aligned} \text{Minimum required contribution}_{1/1/2017} &= \$65,000 + \$55,000 - \$15,000 - \$6,454 \\ &= \$98,546 \end{aligned}$$

$$\text{CB}_{12/31/2017} = (\$175,525 \times 1.065) + \$80,000 - (\$98,546 \times 1.065) = \$161,983$$

Answer is D.

Question 29

The **minimum required contribution** is equal to the target normal cost plus the amortization of the shortfall amortization bases.

The funding shortfall for 2018 is equal to the excess, if any, of the funding target over the actuarial value of the assets (reduced by the prefunding balance and the funding standard carryover balance).

The funding shortfall as of 1/1/2018 is:

$$\$1,925,000 - (\$2,000,000 - \$150,000) = \$75,000$$

IRC section 430(c)(5)(A) states that a plan is exempt from creating a new shortfall amortization base only if the plan's assets reduced by the prefunding balance (if the employer elects to use any portion of the prefunding balance to reduce the minimum required contribution) is at least as large as the funding target. In this question, there is a prefunding balance, and the employer has elected to use a portion of it to reduce the minimum required contribution. The actuarial value of assets reduced by the prefunding balance is less than the funding target, so the plan is not exempt from creating a new shortfall amortization base in 2018.

The new 2018 shortfall base is equal to the funding shortfall, less the outstanding balance of the prior shortfall amortization bases. The outstanding balance of the prior bases is determined by multiplying the amortization installments by a present value factor using the current (2018) segment rates.

$$\begin{aligned} 1/1/2018 \text{ outstanding balance of prior bases} &= \$558,480 - \$568,250 + \$132,330 \\ &= \$122,560 \end{aligned}$$

$$2018 \text{ shortfall amortization base} = \$75,000 - \$122,560 = (\$47,560)$$

$$2018 \text{ shortfall installment for new base} = (\$47,560)/5.9982 = (\$7,929)$$

$$\text{Total 2018 shortfall installment} = \$150,000 - \$125,000 + \$25,000 - \$7,929 = \$42,071$$

Note that the 7-year amortization factor of 5.9982 was provided in a table with the exam when the segment rates are (5%, 6%, 7%).

$$1/1/2018 \text{ minimum required contribution} = \$75,000 + \$42,071 = \$117,071$$

Answer is D.

Question 30

- I. Treasury regulation 1.430(d)-1(f)(2) provides that if a plan has fewer than 100 participants and beneficiaries, then the actuarial assumptions can assume no pre-retirement mortality if it is reasonable to do so. The plan has fewer than 100 participants on 1/1/2017, so the actuary can assume no pre-retirement mortality for the 2017 valuation if it is a reasonable assumption. The statement is true.
- II. Treasury regulation 1.430(h)(3)-1(b)(2) provides that if a plan has 500 or fewer total participants on the valuation date, then a combined static table is allowed to be used for both annuitants and non-annuitants. The plan has 500 or fewer participants on 1/1/2018, so the actuary can use the combined static table for the 2018 valuation. The statement is false.
- III. The plan has more than 100 participants on 1/1/2018, so the plan's actuary does not have the option to assume no pre-retirement mortality for the 2018 valuation, based upon the regulation described in the solution for statement I. The statement is false.

Answer is E.

Question 31

The balance equation under the entry age normal method states that the unfunded liability is equal to the outstanding balance of the amortization bases less the credit balance in the funding standard account. The unfunded liability under entry age normal is equal to the difference between the accrued liability and the actuarial value of assets.

$$UL_{1/1/2018} = \$114,000 - \$95,000 = \$19,000$$

Using the balance equation:

$$\$19,000 = (\$73,000 - \$37,000) - \text{Credit balance} \quad \rightarrow \quad \text{Credit balance} = \$17,000$$

Note that the credit balance as of 1/1/2018 is the same as the credit balance as of 12/31/2017.

Answer is B.

Question 32

IRC section 430(f)(3)(c) provides that if the funding target attainment percentage (FTAP) for the prior year is at least 80%, then the plan sponsor may elect to use a portion of the funding balances to pay for the minimum required contribution. Since the 2017 FTAP was 89%, the employer can make that election for 2018.

Treasury regulation 1.430(f)-1()(2)(i) provides that when an election is made to use a funding balance to pay for the minimum required contribution, the election must be made no later than the minimum funding due date (8½ months after the end of the plan year). That is different from the due date for filing form 5500 (9½ months after the end of the plan year, with extension). The statement is false.

Answer is B.

Question 33

The asset valuation method described in this question is the smoothed value method that is detailed in Revenue Procedure 2000-40. The actuarial value of assets under this method is equal to the current market value of assets, adjusted by adding a percentage of past year losses and subtracting a percentage of past year gains, with a smoothing period of no more than 5 years. This question uses a 3-year smoothing period.

The adjustment to the 1/1/2018 market value of assets is equal to $\frac{2}{3}$ of the gain/loss during 2017, plus/minus $\frac{1}{3}$ of the gain/loss during 2016.

The asset gain/loss must be determined for each year. The asset gain/loss for 2016 is equal to the difference between the actual market value of assets as of 1/1/2017 (315,000) and the expected value of assets. The expected value is determined by calculating the expected 2016 earnings using the valuation interest rate of 7%.

$$\begin{aligned} \text{Expected AVA}_{1/1/2017} \\ = (250,000 \times 1.07) + (35,000 \times 1.07^{9/12}) - (16,500 \times 1.07^{6/12}) = 287,254 \end{aligned}$$

There is a gain for 2016 because the actual value of assets is greater than the expected value of assets.

$$2016 \text{ experience gain} = 315,000 - 287,254 = 27,746$$

The asset gain/loss for 2017 is equal to the difference between the actual market value of assets as of 1/1/2018 (385,000) and the expected value of assets.

$$\begin{aligned} \text{Expected AVA}_{1/1/2018} \\ = (315,000 \times 1.07) + (75,000 \times 1.07^{4/12}) - (18,000 \times 1.07^{6/12}) = 395,141 \end{aligned}$$

There is a loss for 2017 because the actual value of assets is less than the expected value of assets.

$$2017 \text{ experience loss} = 395,141 - 385,000 = 10,141$$

In no event can the actuarial value of assets exceed 120% of the market value of assets, or be less than 80% of the market value of assets.

$$\begin{aligned} \text{AVA}_{1/1/2018} &= 385,000 + \left(\frac{2}{3} \times 10,141\right) - \left(\frac{1}{3} \times 27,746\right) \\ &= 382,512, \text{ but not less than } 308,000 (385,000 \times 80\%) \end{aligned}$$

The actuarial value of assets as of 1/1/2018 is 382,512.

Answer is D.

Question 34

IRC section 430(a)(1) states that the minimum required contribution for a single employer plan is generally equal to the sum of the target normal cost, the amortization of any shortfall bases, and the amortization of any waived deficiency bases. However, IRC section 430(a)(2) provides an exception when the actuarial value of assets, reduced by any funding balances, exceeds the funding target. In this question, there are no funding balances, and the funding target exceeds the actuarial value of assets, so the exception does not apply. The statement is true.

Answer is A.

Question 35

IRC section 430(e) provides rules with regard to the amortization of the waiver bases. The waiver base is amortized with 5 annual installments beginning with the valuation date for the next year. The 2018 waiver base will first be amortized on 1/1/2019, so the last payment will be on 1/1/2023 (the fifth and final payment). The statement is false.

Answer is B.

Question 36

The funding target is equal to the present value of the benefit accrued as of the first day of the year. Each participant is age 60 on 1/1/2018, with 10 years of service.

$$1/1/2018 \text{ accrued benefit per participant} = \$83.33 \times 10 \text{ years of service} = \$833.30$$

When a plan is at-risk, the funding target must be based upon an assumption that the participants elect the most valuable form of benefit (a life annuity in this question), and for those who are within 11 years of the earliest date that they can retire must be assumed to retire at the earliest possible retirement date (but not before the end of the current year). See IRC section 430(i)(1)(B). For each of the plan participants, they could retire immediately at age 60, so it must be assumed that they will elect to retire on 12/31/2018 (essentially at age 61). The accrued benefit must be reduced at the rate of 7% per year prior to age 65 (28% reduction at age 61).

$$\text{Accrued benefit payable at age 61} = \$833.30 \times 0.72 = \$600$$

Each participant is 1 year from age 61, so the segment 1 interest rate of 5% is used to discount retirement benefits paid from age 61 through age 65, the segment 2 interest rate of 6% is used to discount retirement benefits paid from age 65 through age 80, and the segment 3 interest rate of 7% is used to discount benefits paid at age 80 and later. Note that the discount for years prior to normal retirement age is based on interest only because there is no mention of any preretirement decrements (the general conditions for the exam state that there are no preretirement decrements). The commutation functions used are found in the tables of supplementary factors provided with the examination, for a female participant using 5%, 6%, and 7% interest.

The funding target (per participant) using the special assumptions required due to the plan being at-risk in 2018 is:

$$\begin{aligned} & \$600 \times 12 \times \left[\frac{N_{61@5\%}^{(12)} - N_{65@5\%}^{(12)}}{D_{61@5\%}} v_{5\%} + \frac{N_{65@6\%}^{(12)} - N_{80@6\%}^{(12)}}{D_{61@6\%}} v_{6\%} + \frac{N_{80@7\%}^{(12)}}{D_{61@7\%}} v_{7\%} \right] \\ &= \$7,200 \times \left[\frac{666,591 - 490,115}{48,988} (0.9524) + \frac{242,703 - 47,737}{27,478} (0.9434) + \frac{21,406}{15,496} (0.9346) \right] \\ &= \$82,193.44 \end{aligned}$$

IRC section 430(i)(5) provides for a phase-in when the plan has been at-risk for fewer than 5 consecutive years. The plan has been at-risk only in 2014, 2017 and 2018. A new 5-year phase-in began in 2017, and in the second year (2018), the funding target is equal to 40% of the funding target using at-risk assumptions plus 60% of the funding target without the at-risk assumptions. The general conditions of the exam state that it is assumed that normal retirement age is 65, so without using the additional assumptions required for at-risk plans, the funding target would be determined assuming a retirement age of 65.

The funding target (per participant) without the at-risk assumptions is:

$$\begin{aligned}
 & \$833.30 \times 12 \times \left[\frac{N_{65@6\%}^{(12)} - N_{80@6\%}^{(12)}}{D_{65@6\%}} v_{6\%}^5 + \frac{N_{80@7\%}^{(12)}}{D_{65@7\%}} v_{7\%}^5 \right] \\
 & = \$9,999.60 \times \left[\frac{242,703 - 47,737}{21,217} (0.747258) + \frac{21,406}{11,524} (0.712986) \right] \\
 & = \$81,907.13
 \end{aligned}$$

IRC section 430(i)(1)(C) requires a load on the at-risk funding target if the plan has been at-risk in at least two of the past 4 years. In the past 4 years (2014 through 2017) the plan was at-risk in 2014 and 2017. So, a load factor must be included. The load is equal to \$700 per participant, plus 4% of the funding target calculated without the special at-risk assumptions.

The loaded at-risk funding target (per participant) is:

$$\$82,193.44 + \$700 + (4\% \times \$81,907.13) = \$86,169.73$$

The phased in funding target (per participant) is:

$$(40\% \times \$86,169.73) + (60\% \times \$81,907.13) = \$83,612.17$$

$$\$X = \$83,612.17 \times 1,000 \text{ participants} = \$83,612,170$$

Answer is C.

Note: Although the general conditions of the exam state that there are no assumed preretirement decrements unless the question states otherwise, Treasury regulation 1.430(d)-1(f)(2) only allows the use of no preretirement decrements when there are fewer than 100 active participants or beneficiaries. The plan in this question has 1,000 participants, all active, and so legally must use a preretirement mortality assumption. As an alternative solution, the funding target has been recalculated using preretirement mortality when discounting from the assumed retirement age to age 60.

The funding target (per participant) using the special assumptions required due to the plan being at-risk in 2018 is:

$$\begin{aligned}
 & \$600 \times 12 \times \left[\frac{N_{61@5\%}^{(12)} - N_{65@5\%}^{(12)}}{D_{60@5\%}} + \frac{N_{65@6\%}^{(12)} - N_{80@6\%}^{(12)}}{D_{60@6\%}} + \frac{N_{80@7\%}^{(12)}}{D_{60@7\%}} \right] \\
 &= \$7,200 \times \left[\frac{666,591 - 490,115}{51,667} + \frac{242,703 - 47,737}{29,256} + \frac{21,406}{16,655} \right] \\
 &= \$81,828.28
 \end{aligned}$$

The funding target (per participant) without the at-risk assumptions is:

$$\begin{aligned}
 & \$833.30 \times 12 \times \left[\frac{N_{65@6\%}^{(12)} - N_{80@6\%}^{(12)}}{D_{60@6\%}} + \frac{N_{80@7\%}^{(12)}}{D_{60@7\%}} \right] \\
 &= \$9,999.60 \times \left[\frac{242,703 - 47,737}{29,256} + \frac{21,406}{16,655} \right] \\
 &= \$79,490.79
 \end{aligned}$$

The loaded at-risk funding target (per participant) is:

$$\$81,828.28 + \$700 + (4\% \times \$79,490.79) = \$85,707.91$$

The phased in funding target (per participant) is:

$$(40\% \times \$85,707.91) + (60\% \times \$79,490.79) = \$81,977.64$$

$$\$X = \$81,977.64 \times 1,000 \text{ participants} = \$81,977,639$$

This is in answer range A, which is not the correct Joint Board solution.

Question 37

The **minimum required contribution** is equal to the target normal cost plus the amortization of the shortfall amortization bases.

The funding shortfall for 2018 is equal to the excess, if any, of the funding target over the actuarial value of the assets (reduced by the prefunding balance and the funding standard carryover balance).

The funding shortfall (which cannot be less than zero) as of 1/1/2018 is:

$$\$56,000,000 - (\$56,400,000 - \$200,000) = \$0$$

There are no bases prior to 2018, and with a funding shortfall of \$0 there is no new base in 2018.

In addition, when the actuarial value of assets reduced by the funding balances exceeds the funding target, the target normal cost is reduced by the amount of the excess (IRC section 430(a)(2)).

$$\begin{aligned} \text{Minimum required contribution as of 1/1/2018} \\ = \$2,200,000 - [(\$56,400,000 - \$200,000) - \$56,000,000] = \$2,000,000 \end{aligned}$$

This is increased using the 2018 plan effective rate to 12/31/2018 to determine the contribution that would satisfy the 2018 minimum required contribution.

$$\$X = \$2,000,000 \times 1.06 = \$2,120,000$$

Answer is C.

Question 38

Generally, the increase in the liability due to a plan amendment in a multiemployer plan is amortized over a period of 15 years. However, IRC section 431(b)(7)(G) provides that when the benefits provided by the amendment not payable as a life annuity and are payable over a period of less than 15 years from the effective date of the amendment, then the amortization period is shortened to the period of time that the increased benefits will be paid.

- I. IRC section 431(b)(2)(B)(ii) requires the amortization of a base resulting from a plan amendment over a period of 15 years. The statement is true.
- II. The benefit increases under this plan amendment are payable over a period of less than 15 years, so the amortization period must be 13 years. The statement is true.

Answer is D.

Question 39

The normal cost under the projected unit credit cost method is equal to the present value of the increase in the accrued benefit during the current year, based upon salary projected to retirement. Smith's 2018 accrual is based upon the 1.5% portion of the benefit formula.

Smith's 2017 salary is \$72,000, and must be projected to retirement for purposes of the final 3-year average salary. Note that under the general conditions of the exam, it can be assumed that normal retirement age is 65. Smith is age 60 as of 1/1/2018.

$$\text{Final 3-year average projected salary} = \$72,000 \times \frac{1.05^3 + 1.05^4 + 1.05^5}{3} = \$87,586$$

$$\text{2018 "projected" accrual} = 1.5\% \times \$87,586 = \$1,314$$

The commutation functions used to determine the accrued liability are found in the tables of supplementary factors provided with the examination, for a female participant using 7% interest. It can be assumed that there are no pre-retirement decrements based upon the exam general conditions.

$$\begin{aligned} \text{Normal cost} &= \$1,314 \times \ddot{a}_{65}^{(12)} \times v^5 = \$1,314 \times \frac{N_{65}^{(12)}}{D_{65}} \times 0.712986 \\ &= \$1,314 \times \frac{121,532}{11,524} \times 0.712986 = \$9,880 \end{aligned}$$

Answer is C.

Question 40

When a funding balance is used to pay for required quarterly contributions, the funding balance is increased using the plan effective interest rate from the first day of the plan year to the quarterly due date. The due dates of quarterly contributions for a calendar year plan are April 15, July 15, October 15, and January 15 of the following year.

The employer elects to use the 1/1/2018 prefunding balance to pay for the 2018 quarterly installments. The prefunding balance must be increased with interest using the 2018 plan effective rate of 6% to the first quarterly due date of 4/15/2018:

$$\$600,000 \times 1.06^{3.5/12} = \$610,284$$

The remaining prefunding balance after applying the 4/15/2018 quarterly installment of \$500,000 is:

$$\$610,284 - \$500,000 = \$110,284$$

This balance is then increased for 3 months to the next quarterly due date of 7/15/2018:

$$\$110,284 \times 1.06^{3/12} = \$111,902$$

The balance of the 7/15/2018 quarterly installment that cannot be paid by the remaining prefunding balance must be paid by a contribution made on 7/15/2018.

$$\$X = \$500,000 - \$111,902 = \$388,098$$

Answer is C.

Question 41

The normal cost under the frozen initial liability cost method is equal to:

$$\frac{\text{Present value of future benefits} - \text{Actuarial value of assets} - \text{Unfunded liability}}{\text{Temporary annuity}}$$

The temporary annuity for 2017 can be determined by taking the ratio of the present value of future compensation to the present value of 2017 compensation (there are a number of ways to determine the temporary annuity, but this is the only method that could be used in this question based upon the data provided). This is:

$$\text{Temporary annuity} = 60,000,000 / 8,000,000 = 7.5$$

$$1/1/2017 \text{ FIL normal cost} = \frac{15,000,000 - 2,500,000 - 5,000,000}{7.5} = 1,000,000$$

In 2017 all assumptions were realized, all participants were under age 63 (so none have retired), and there were no other changes in the participant group. So, the normal cost as of 1/1/2018 is equal to the 2017 normal cost increased by 3% (funding using a temporary annuity with regard to future salary implies that normal costs will increase at the same rate as the expected salary increases).

$$1/1/2018 \text{ normal cost} = 1,000,000 \times 1.03 = 1,030,000$$

Answer is D.

Alternative solution: The funding items for determining the 2018 normal cost can be updated from the 2017 valuation results and experience, with the normal cost for 2018 then being determined directly.

It is given that there are no participants in pay status, and the participant base is otherwise the same in 2018 as in 2017.

The present value of future benefits as of 1/1/2018 is equal to the present value of future benefits from 1/1/2017, increased with interest using the valuation rate of 7% (each participant is one year closer to retirement).

$$PVFB_{1/1/2018} = 15,000,000 \times 1.07 = 16,050,000$$

The assets earned exactly 7%, and the 2017 contribution of \$750,000 was deposited on 6/30/2017 (getting one-half of a year's interest).

$$AVA_{1/1/2018} = (2,500,000 \times 1.07) + (750,000 \times 1.035) = 3,451,250$$

Note that compound interest could also be used to accumulate the mid-year contribution.

The unfunded liability increases by the amount of the 2017 normal cost, along with interest at the 7% valuation rate, and then is reduced by the amount of the 2017 contribution deposited on 6/30/2017 (getting one-half of a year's interest).

$$\begin{aligned} \text{Unfunded liability}_{1/1/2018} \\ = [(5,000,000 + 1,000,000) \times 1.07] - (750,000 \times 1.035) = 5,643,750 \end{aligned}$$

The present value of future salary as of 1/1/2018 is equal to the present value of future salary on 1/1/2017 reduced by the 2017 salary paid, with the difference increased to 1/1/2018 with one year's interest at 7%.

$$PVFS_{1/1/2018} = (60,000,000 - 8,000,000) \times 1.07 = 55,640,000$$

The 2018 salary is equal to the 2017 salary increased using the assumed salary increase of 3%.

$$2018 \text{ salary} = 8,000,000 \times 1.03 = 8,240,000$$

$$1/1/2018 \text{ normal cost} = \frac{16,050,000 - 3,451,250 - 5,643,750}{55,640,000 / 8,240,000} = 1,030,000$$

Question 42

The **minimum required contribution** is equal to the target normal cost plus the amortization of the shortfall amortization bases.

The funding shortfall for 2018 is equal to the excess, if any, of the funding target over the actuarial value of the assets (reduced by the prefunding balance and the funding standard carryover balance). The funding shortfall cannot be less than zero.

The funding shortfall as of 1/1/2018 (before the revision in the asset value) is:

$$\$560,000 - \$564,000 = \$0$$

There are no bases prior to 2018, and with a funding shortfall of \$0 there is no new base this year.

In addition, when the actuarial value of assets reduced by the funding balances exceeds the funding target, the target normal cost is reduced by the amount of the excess (IRC section 430(a)(2)).

$$\begin{aligned} \text{Minimum required contribution as of 1/1/2018} \\ = \$22,000 - (\$560,000 - \$564,000) = \$18,000 \end{aligned}$$

This is increased using the 2018 plan effective rate to 7/1/2018 to determine the contribution that would satisfy the 2018 minimum required contribution (which is the same as the **smallest amount that satisfies the minimum funding standard** since there is no funding balance to use to reduce the minimum required contribution).

$$\$X = \$18,000 \times 1.06^{6/12} = \$18,532$$

The funding shortfall as of 1/1/2018 (after the revision in the asset value) is:

$$\$560,000 - \$514,000 = \$46,000$$

IRC section 430(c)(5)(A) states that a plan is exempt from creating a new shortfall amortization base only if the plan's assets reduced by the prefunding balance (if the employer elects to use any portion of the prefunding balance to reduce the minimum required contribution) is at least as large as the funding target. In this question, there is no prefunding balance, so the plan is not exempt from creating a new shortfall amortization base in 2018. The shortfall amortization base is amortized over 7 years.

The new 2018 shortfall base is equal to the funding shortfall, less the outstanding balance of the prior shortfall amortization bases. There are no prior bases in this question.

2018 shortfall installment for new base = $\$46,000/5.9982 = \$7,669$

Note that the 7-year amortization factor of 5.9982 was provided in a table with the exam when the segment rates are (5%, 6%, 7%).

Minimum required contribution as of 1/1/2018 = $\$22,000 + \$7,669 = \$29,669$

This is increased using the 2018 plan effective rate to 7/1/2018 to determine the contribution that would satisfy the 2018 minimum required contribution (which is the same as the **smallest amount that satisfies the minimum funding standard** since there is no funding balance to use to reduce the minimum required contribution).

$$\$Y = \$29,669 \times 1.06^{6/12} = \$30,546$$

$$\$Y - \$X = \$30,546 - \$18,532 = \$12,014$$

Answer is E.

Question 43

The fact that each employer that is a member of a controlled group is joint and severally responsible for required contributions is taken from IRC section 412(b)(2). The statement is true.

Answer is A.

Question 44

The funding target is equal to the present value of the benefit accrued as of the first day of the year. Smith is age 45 on 1/1/2018. For purposes of determining the present value, the commutation functions used are found in the tables of supplementary factors provided with the examination, for a male participant using 7% interest (since Smith is at least 20 years from the assumed retirement age of 65, the segment 3 interest rate is used). Note that there are no assumed pre-retirement decrements other than the age 45 withdrawal decrement, and age 65 is the assumed retirement range due to the exam general conditions.

The present value of a life annuity using the 1/1/2018 accrued benefit for Smith is:

$$\begin{aligned} \$1,000 \times 12 \times \ddot{a}_{65}^{(12)} \times v_{7\%}^{20} &= \$12,000 \times \frac{N_{65}^{(12)}}{D_{65}} \times 0.258419 \\ &= \$12,000 \times \frac{116,056}{11,403} \times 0.258419 \\ &= \$31,561 \end{aligned}$$

Treasury regulation 1.430(d)-1(f)(4)(ii)(B) requires that for funding purposes, a lump sum must be valued using the 417(e) mortality (post-retirement) and using the funding segment rates. In addition, regulation 1.430(d)-1(f)(4)(iii)(D) provides that if the plan provides that the lump sum is determined using an interest rate other than the applicable interest rate, then the post-retirement interest rate for funding is either the IRC section 430(h)(2) segment rate applicable to the lump sum (7% in this question) or the plan interest rate used to determine the lump sum benefit (5% in this question), whichever provides for a greater present value. Using the plan interest rate of 5% provides the larger value in this question. The funding segment rates are used to discount prior to retirement age.

The annuity factors provided in the question using 417(e) mortality are immediate annuity factors, and annuity-due factors are needed to determine the present value of the lump sum. The factors are for benefits payable monthly (although this is not stated explicitly, it must be assumed).

Recall the following identity from life contingencies:

$$\ddot{a}_{65}^{(12)} = a_{65}^{(12)} + \frac{1}{12}$$

The annuity due at age 65 using 5% interest and the 417(e) mortality table is:

$$\ddot{a}_{65}^{(12)} = 12.18 + \frac{1}{12} = 12.2633$$

For purposes of the funding target, the present value of a lump sum using the 1/1/2018 accrued benefit for Smith is:

$$\$1,000 \times 12 \times \ddot{a}_{65}^{(12)} \times v_{7\%}^{20} = \$12,000 \times 12.2633 \times 0.258419 = \$38,029$$

Smith is fully vested, so the funding target for Smith can ignore the 5% assumed rate of withdrawal at age 45, since Smith will receive the accrued benefit regardless of whether or not withdrawal occurs. However the question is asking for the portion of the funding target attributable to withdrawal. That is equal to 5% of the total funding target. The total funding target is equal to 25% of the life annuity present value plus 75% of the lump sum present value, based upon the assumed probabilities of electing the two forms of benefit.

$$\text{\$X} = 5\% \times [(\$31,561 \times 25\%) + (\$38,029 \times 75\%)] = 1,821$$

Answer is B.

Question 45

The target normal cost is equal to the present value of the increase in the accrued benefit during 2018. The accrued benefit as of the first day of the 2018 plan year is determined using only salary history through 2017. The accrued benefit determined as of 12/31/2018 includes assumed salary increases for 2018. In this question the assumed salary increase is 3%, so Smith's assumed 2018 salary is \$103,000 ($\$100,000 \times 1.03$).

Smith has 18 years of service as of 1/1/2018, and 19 years of service as of 12/31/2018.

$$\begin{aligned} \text{Accrued benefit}_{1/1/2018} &= 1.5\% \times \$100,000 \times 18 \text{ years of service} = \$27,000 \\ \text{Accrued benefit}_{12/31/2018} &= 1.5\% \times \$103,000 \times 19 \text{ years of service} = \$29,355 \\ \text{Benefit for target normal cost} &= \$29,355 - \$27,000 = \$2,355 \end{aligned}$$

Smith is 17 years from normal retirement age 65 (assumed per the general conditions of the exam), so the segment 2 interest rate of 6% is used to discount retirement benefits paid from age 65 through age 68, and the segment 3 interest rate of 7% is used to discount benefits paid at age 68 and later. Note that the discount for years prior to normal retirement age is based on interest only because there is no mention of any preretirement decrements (the general conditions for the exam state that there are no preretirement decrements). The commutation functions used are found in the tables of supplementary factors provided with the examination, for a male participant using 6% and 7% interest.

$$\begin{aligned} \text{Target normal cost} &= \$2,355 \times \left[\frac{N_{65@6\%}^{(12)} - N_{68@6\%}^{(12)}}{D_{65@6\%}} v_{6\%}^{17} + \frac{N_{68@7\%}^{(12)}}{D_{65@7\%}} v_{7\%}^{17} \right] \\ &= \$2,355 \times \left[\frac{230,685 - 173,545}{20,994} (0.371364) + \frac{85,422}{11,403} (0.316574) \right] \\ &= \$7,965 \end{aligned}$$

The funding target is equal to the present value of the benefit accrued as of the first day of the year.

$$\begin{aligned} \text{Funding target} &= \$27,000 \times \left[\frac{N_{65@6\%}^{(12)} - N_{68@6\%}^{(12)}}{D_{65@6\%}} v_{6\%}^{17} + \frac{N_{68@7\%}^{(12)}}{D_{65@7\%}} v_{7\%}^{17} \right] \\ &= \$27,000 \times \left[\frac{230,685 - 173,545}{20,994} (0.371364) + \frac{85,422}{11,403} (0.316574) \right] \\ &= \$91,321 \end{aligned}$$

$$\$X = \$7,965 + \$91,321 = \$99,286$$

Answer is B.

Question 46

- I. Treasury regulation 1.430(d)-1(e)(3) allows the actuary's assumptions to include current employees not yet eligible to participate in the plan for purposes of determining the funding target and target normal cost. The statement is false.
- II. IRC section 430(h)(1)(A) requires that each assumption be reasonable (taking into account the experience of the plan and reasonable expectations). The statement is true.
- III. Treasury regulation 1.430(d)-1(f)(2) allows that plans with fewer than 100 participants and beneficiaries not in pay status can assume no pre-retirement mortality (if reasonable). The plan in this question has only 70 non-retired participants, so the actuary has the option of not using pre-retirement mortality. The statement is false.

Answer is C.

Question 47

The minimum required contribution is equal to the target normal cost plus the amortization of the shortfall amortization bases.

The funding shortfall for 2018 is equal to the excess, if any, of the funding target over the actuarial value of the assets (reduced by the prefunding balance and the funding standard carryover balance). The funding shortfall cannot be less than zero.

The funding shortfall as of 1/1/2018 is:

$$\$770,000 - (\$812,000 - \$30,000) = \$0$$

There are no bases prior to 2018, and with a funding shortfall of \$0 there is no new base in 2018.

In addition, when the actuarial value of assets reduced by the funding balances exceeds the funding target, the target normal cost is reduced by the amount of the excess (IRC section 430(a)(2)).

$$\begin{aligned} &\text{Minimum required contribution as of 1/1/2018} \\ &= \$185,000 - [(\$812,000 - \$30,000) - \$770,000] = \$173,000 \end{aligned}$$

When a contribution is made for a plan year after the valuation date, it must be discounted with the plan effective rate for that plan year from the date contributed to the valuation date. The \$250,000 contribution for 2018 is deposited on 7/1/2019.

$$\text{Discounted 2018 contribution} = \$250,000 \div 1.0525^{18/12} = \$231,530$$

The total excess contribution is equal to the difference between the sum of the discounted contribution and the minimum required contribution.

$$\text{2018 excess contribution} = \$231,530 - \$173,000 = \$58,530$$

Excess contributions are increased with interest using the plan effective rate, and added to the prefunding balance on the first day of the following year (IRC section 430(f)(6)(B)). The 1/1/2018 prefunding balance is increased with interest using the 2018 actual asset rate of return (see IRC section 430(f)(8)).

$$\$X = (\$58,530 \times 1.0525) + (\$30,000 \times 1.035) = \$92,653$$

Answer is B.

Question 48

The outstanding balance of the 1/1/2017 amortization bases on 1/1/2018 is equal to the present value on 1/1/2018 of the remaining amortization payments. Each of the three 1/1/2017 amortization bases can be amortized at the valuation interest rate of 7.5% using their remaining amortization periods as of 1/1/2017:

$$\text{Combined charge base:} \quad \frac{\$8,500,000}{\ddot{a}_{\overline{4}|}} = \$2,360,766$$

$$\text{Actuarial gain:} \quad \frac{\$950,000}{\ddot{a}_{\overline{11}|}} = \$120,802$$

$$\text{Actuarial loss:} \quad \frac{\$950,000}{\ddot{a}_{\overline{15}|}} = \$100,114$$

The outstanding balance of each base on 1/1/2018 is:

$$\text{Combined charge base:} \quad \$2,360,766 \times \ddot{a}_{\overline{3}|} = \$6,599,675$$

$$\text{Actuarial gain:} \quad \$120,802 \times \ddot{a}_{\overline{10}|} = \$891,384$$

$$\text{Actuarial loss:} \quad \$100,114 \times \ddot{a}_{\overline{14}|} = \$913,624$$

$$\$X = \$6,599,675 - \$891,384 + \$913,624 = \$6,621,915$$

Answer is D.

Question 49

The minimum required contribution is equal to the target normal cost plus the amortization of the shortfall amortization bases. The target normal cost is equal to the present value of the increase in the accrued benefit during 2018 (an accrual of \$75 without regard to the plan amendment, and \$100 taking into account the plan amendment). The funding target is equal to the present value of the benefit accrued as of the first day of the year (a benefit of \$75 per year of service before 2018 without regard to the plan amendment, and \$100 per year of service before 2018 taking into account the plan amendment).

Smith, with one year of service as of 1/1/2018, is age 35, 30 years from normal retirement age 65 (assumed per the general conditions of the exam), so the segment 3 interest rate of 5% is used to discount benefits paid beginning at age 65. Note that the discount for years prior to normal retirement age is based on interest only because there is no mention of any preretirement decrements (the general conditions for the exam state that there are no preretirement decrements). The commutation functions used are found in the tables of supplementary factors provided with the examination, for a male participant using 5% interest.

Jones, with 15 years of service as of 1/1/2018, is age 50, 15 years from normal retirement age 65, so the segment 2 interest rate of 4% is used to discount retirement benefits paid from age 65 through age 70, and the segment 3 interest rate of 5% is used to discount benefits paid at age 70 and later. The commutation functions used are found in the tables of supplementary factors provided with the examination, for a male participant using 4% and 5% interest.

Target normal cost and funding target for Smith and Jones without regard to the plan amendment:

$$\begin{aligned} \text{Smith target normal cost} &= \$75 \times 12 \times \ddot{a}_{65@5\%}^{(12)} \times v_{@5\%}^{30} = \$900 \times \frac{N_{65@5\%}^{(12)}}{D_{65@5\%}} \times 0.231377 \\ &= \$900 \times \frac{463,348}{38,875} \times 0.231377 = \$2,482 \end{aligned}$$

$$\begin{aligned} \text{Jones target normal cost} &= \$75 \times 12 \times \left[\frac{N_{65@4\%}^{(12)} - N_{70@4\%}^{(12)}}{D_{65@4\%}} v_{4\%}^{15} + \frac{N_{70@5\%}^{(12)}}{D_{65@5\%}} v_{5\%}^{15} \right] \\ &= \$900 \times \left[\frac{940,882 - 619,776}{72,412} (0.555265) + \frac{294,765}{38,875} (0.481017) \right] \\ &= \$5,499 \end{aligned}$$

$$\text{Total target normal cost} = \$2,482 + \$5,499 = \$7,981$$

$$\begin{aligned} \text{Smith funding target} &= \$75 \times 12 \times \ddot{a}_{65@5\%}^{(12)} \times v_{@5\%}^{30} = \$900 \times \frac{N_{65@5\%}^{(12)}}{D_{65@5\%}} \times 0.231377 \\ &= \$900 \times \frac{463,348}{38,875} \times 0.231377 = \$2,482 \end{aligned}$$

$$\begin{aligned} \text{Jones funding target} &= \$75 \times 15 \text{ years} \times 12 \times \left[\frac{N_{65@4\%}^{(12)} - N_{70@4\%}^{(12)}}{D_{65@4\%}} v_{4\%}^{15} + \frac{N_{70@5\%}^{(12)}}{D_{65@5\%}} v_{5\%}^{15} \right] \\ &= \$13,500 \times \left[\frac{940,882 - 619,776}{72,412} (0.555265) + \frac{294,765}{38,875} (0.481017) \right] \\ &= \$82,479 \end{aligned}$$

$$\text{Total funding target} = \$2,482 + \$82,479 = \$84,961$$

The funding shortfall without regard to the plan amendment is equal to the excess, if any, of the funding target over the actuarial value of the assets (reduced by the prefunding balance and the funding standard carryover balance). The funding shortfall cannot be less than zero.

$$\text{Funding shortfall} = \$84,961 - \$90,000 = \$0$$

There are no bases prior to 2018, and with a funding shortfall of \$0 there is no new base in 2018.

In addition, when the actuarial value of assets reduced by the funding balances exceeds the funding target, the target normal cost is reduced by the amount of the excess (IRC section 430(a)(2)).

$$\$X = \$7,981 - (\$90,000 - \$84,961) = \$2,942$$

Target normal cost and funding target for Smith and Jones taking into account the plan amendment:

$$\begin{aligned} \text{Smith target normal cost} &= \$100 \times 12 \times \ddot{a}_{65@5\%}^{(12)} \times v_{@5\%}^{30} = \$1,200 \times \frac{N_{65@5\%}^{(12)}}{D_{65@5\%}} \times 0.231377 \\ &= \$1,200 \times \frac{463,348}{38,875} \times 0.231377 = \$3,309 \end{aligned}$$

$$\begin{aligned}
\text{Jones target normal cost} &= \$100 \times 12 \times \left[\frac{N_{65@4\%}^{(12)} - N_{70@4\%}^{(12)}}{D_{65@4\%}} v_{4\%}^{15} + \frac{N_{70@5\%}^{(12)}}{D_{65@5\%}} v_{5\%}^{15} \right] \\
&= \$1,200 \times \left[\frac{940,882 - 619,776}{72,412} (0.555265) + \frac{294,765}{38,875} (0.481017) \right] \\
&= \$7,331
\end{aligned}$$

$$\text{Total target normal cost} = \$3,309 + \$7,331 = \$10,640$$

$$\begin{aligned}
\text{Smith funding target} &= \$100 \times 12 \times \ddot{a}_{65@5\%}^{(12)} \times v_{5\%}^{30} = \$1,200 \times \frac{N_{65@5\%}^{(12)}}{D_{65@5\%}} \times 0.231377 \\
&= \$1,200 \times \frac{463,348}{38,875} \times 0.231377 = \$3,309
\end{aligned}$$

$$\begin{aligned}
\text{Jones funding target} &= \$100 \times 15 \text{ years} \times 12 \times \left[\frac{N_{65@4\%}^{(12)} - N_{70@4\%}^{(12)}}{D_{65@4\%}} v_{4\%}^{15} + \frac{N_{70@5\%}^{(12)}}{D_{65@5\%}} v_{5\%}^{15} \right] \\
&= \$18,000 \times \left[\frac{940,882 - 619,776}{72,412} (0.555265) + \frac{294,765}{38,875} (0.481017) \right] \\
&= \$109,972
\end{aligned}$$

$$\text{Total funding target} = \$3,309 + \$109,972 = \$113,281$$

$$\text{Funding shortfall} = \$113,281 - \$90,000 = \$23,281$$

IRC section 430(c)(5)(A) states that a plan is exempt from creating a new shortfall amortization base only if the plan's assets reduced by the prefunding balance (if the employer elects to use any portion of the prefunding balance to reduce the minimum required contribution) is at least as large as the funding target. In this question, there is no prefunding balance, so the plan is not exempt from creating a new shortfall amortization base in 2018. The shortfall amortization base is amortized over 7 years.

$$\text{2018 shortfall installment for new base} = \$23,281 / 6.3293 = \$3,678$$

Note that the 7-year amortization factor of 6.3293 was provided in a table with the exam when the segment rates are (3%, 4%, 5%).

$$\$Y = \$10,640 + \$3,678 = \$14,318$$

$$\$Y - \$X = \$14,318 - \$2,942 = \$11,376$$

Answer is E.

Question 50

IRC section 430(i)(1)(C) requires a load on the at-risk target normal cost if the plan has been at-risk in at least two of the past 4 years. In the past 4 years (2014 through 2017) the plan was at-risk in 2014, 2016, and 2017. So, a load factor must be included. The load is equal to 4% of the target normal cost calculated without the special at-risk assumptions.

The loaded at-risk target normal cost is:

$$\$700,000 + (4\% \times \$600,000) = \$724,000$$

IRC section 430(i)(5) provides for a phase-in when the plan has been at-risk for fewer than 5 consecutive years. The plan has been at-risk only in 2014, 2016, 2017 and 2018. A new 5-year phase-in began in 2016, and in the third year (2018), the target normal cost is equal to 60% of the target normal cost using at-risk assumptions plus 40% of the target normal cost without the at-risk assumptions.

The phased in target normal cost is:

$$(60\% \times \$724,000) + (40\% \times \$600,000) = \$674,400$$

Answer is D.

Question 51

The target normal cost is equal to the present value of the increase in the accrued benefit during 2018. The accrued benefit as of the first day of the 2018 plan year is determined using only salary history through 2017. The accrued benefit determined as of 12/31/2018 includes assumed salary increases for 2018. In this question the assumed salary increase for purposes of the target normal cost \$X is 3%, so Smith's assumed 2018 salary is \$61,800 (\$60,000 × 1.03). The assumed salary increase for purposes of the target normal cost \$Y is 4%, so Smith's assumed 2018 salary is \$62,400 (\$60,000 × 1.04).

Smith has 14 years of service as of 1/1/2018, and 15 years of service as of 12/31/2018.

$$\begin{aligned}\text{Accrued benefit}_{1/1/2018} &= 2\% \times \frac{\$55,000 + \$58,000 + \$60,000}{3} \times 14 \text{ years of service} \\ &= \$16,147\end{aligned}$$

Using the 3% salary scale,

$$\begin{aligned}\text{Accrued benefit}_{12/31/2018} &= 2\% \times \frac{\$58,000 + \$60,000 + \$61,800}{3} \times 15 \text{ years of service} \\ &= \$17,980\end{aligned}$$

Using the 4% salary scale,

$$\begin{aligned}\text{Accrued benefit}_{12/31/2018} &= 2\% \times \frac{\$58,000 + \$60,000 + \$62,400}{3} \times 15 \text{ years of service} \\ &= \$18,040\end{aligned}$$

The beginning of year accrued benefit is the same for purposes of both \$X and \$Y, so the difference is due to the increase in the end of year accrued benefit.

The increase in the benefit for purposes of the target normal cost using the 4% salary scale instead of the 3% salary scale is:

$$\$18,040 - \$17,980 = \$60$$

Smith is 5 years from normal retirement age 65 (assumed per the general conditions of the exam), so the segment 2 interest rate of 4% is used to discount retirement benefits paid from age 65 through age 80, and the segment 3 interest rate of 5% is used to discount benefits paid at age 80 and later. Note that the discount for years prior to normal retirement age is based on interest only because there is no mention of any preretirement decrements (the general conditions for the exam state that there are no preretirement decrements). The commutation functions used are found in the tables of supplementary factors provided with the examination, for a male participant using 4% and 5% interest.

$$\begin{aligned}
\$Y - \$X &= \$60 \times \left[\frac{N_{65@4\%}^{(12)} - N_{80@4\%}^{(12)}}{D_{65@4\%}} v_{4\%}^5 + \frac{N_{80@5\%}^{(12)}}{D_{65@5\%}} v_{5\%}^5 \right] \\
&= \$60 \times \left[\frac{940,882 - 198,530}{72,412} (0.821927) + \frac{88,005}{38,875} (0.783526) \right] \\
&= \$612
\end{aligned}$$

Answer is D.

Question 52

Treasury regulation 1.430(f)-1(d)(1)(ii) provides ordering rules with regard to funding balance elections. Any election made to use a funding balance to pay for a prior year minimum required contribution is deemed to be made before any current year election. Therefore, election II made in this question is deemed to be made first.

Any election to reduce a funding balance is deemed to be made as of the valuation date for the current year and before any election for the current year to use a funding balance to reduce the minimum required contribution. Therefore, election III is deemed to have been made before election I.

The deemed order of the elections is: II, III, I

Answer is C.

Question 53

The minimum required contribution is equal to the target normal cost plus the amortization of the shortfall amortization bases. For 2018, the minimum required contribution (MRC) is:

$$\text{MRC}_{1/1/2018} = \$400,000 + \$100,000 = \$500,000$$

The employer contributes \$100,000 on 12/31/2018. This contribution is discounted back to the valuation date using the plan effective rate of 6%. Note that there is no penalty interest rate used for late quarterly contributions since no quarterly contributions are required for 2018.

$$\text{Discounted 2018 contribution} = \$100,000 \div 1.06 = \$94,340$$

The funding balances are elected to be used to satisfy the minimum funding requirement, so \$405,660 of the funding balances must be used (\$500,000 – \$94,340).

The funding standard carryover balance must be used first to reduce the minimum (IRC section 430(f)(3)(B)), so the entire \$20,000 funding standard carryover balance is used, as well as \$385,660 of the prefunding balance. That leaves \$114,340 of the prefunding balance unused as of 1/1/2018 (\$500,000 – \$385,660).

IRC section 430(f)(8) requires that any unused prefunding balance be adjusted with the actual asset rate of return for the year in determining the remaining balance as of the first day of the following year. The asset rate of return for 2018 is 15%.

$$1/1/2019 \text{ prefunding balance} = \$114,340 \times 1.15 = \$131,491$$

Answer is E.

Question 54

The minimum funding requirement for 2018 is not satisfied, so there is a funding deficiency for 2018. IRC section 4971(g)(1)(A) states that the excise tax due to failure to satisfy minimum funding is waived for a multiemployer plan in critical status. The statement is false,

Answer is B.