

## Corrections and Modifications to 2017 EA-2F Exam Solutions

Question 44: There are two errors in this solution.

1. The description of the determination of the annuity-due factor in the fourth paragraph of the solution is incorrect, as it does not take mortality into account, only interest. The correct identity from life contingencies is:

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

The solution has been corrected to reflect this.

2. The plan in this question offers a lump sum equal to the greater of the amount determined under IRC section 417(e) or the amount using the applicable mortality table and 5% interest. When the lump sum offered by a plan is greater than the 417(e) lump sum, then for funding purposes, the post-retirement interest rate for funding is either the IRC segment rate applicable to the lump sum or the plan interest rate used to determine the lump sum benefit, whichever provides for a greater present value. In this case, the 5% plan interest rate provides for the greater present value, so that must be used as the post-retirement funding interest rate.

The corrected solution follows on the next page.

### Corrected solution to 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 when the plan equivalence for determining the lump sum value (at retirement age) exceeds the lump sum value (at retirement age) using 417(e) applicable interest and mortality, then the lump sum is valued using the applicable mortality table for post-retirement mortality, and the plan interest rate (5% in this question) for post-retirement interest. The 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.

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

Answer is B.