

**Updates and Errata: ACTEX Study Manual for SOA Exam FM, Fall 2020 Edition
as of May 3, 2021**

Please note the following errors in the Fall 2020 Edition of the manual.
In each case, the change is shown in **red**.

Page M1-70, Solution to Problem 1.

The last two lines of the solution should read as follows:

$$i = \frac{0.009 \pm \sqrt{0.009^2 - 4 \times 1 \cdot (-0.009)}}{2 \times 1} = 0.0995, -0.0905$$

The problem states that $i > 0$, so $i = 9.95\%$.”

Page M7-36, Example (7.64).

Beginning with the 2nd formula on this page, the rest of the page should read as follows:

“**Modified** Duration: $\frac{A_2 \cdot \frac{2}{1.044} + A_{12} \cdot \frac{12}{1.053}}{1.044^2 + 1.053^{12}} = \frac{(120,000) \cdot \frac{6}{1.05}}{1.05^6}$

This reduces to a system of two equations in two unknowns:

$$0.91749 \cdot A_2 + 0.53810 \cdot A_{12} = 89,545.85$$

$$1.75763 \cdot A_2 + 6.13215 \cdot A_{12} = 511,690.56$$

The solution is: $A_2 = 58,493.08$ $A_{12} = 66,678.32$ ”

Now that we have found the face values (A_2 and A_{12}) needed to match the present values and durations of our assets and liabilities, we can check the convexity condition to see whether the portfolio is immunized:

$$\sum t(t+1) \cdot A_t \cdot v_{i_0}^{t+2} = 2 \times 3 \times \left(\frac{58,493.08}{1.044^4} \right) + 12 \times 13 \times \left(\frac{66,678.32}{1.053^{14}} \right) = 5,343,344.42$$

$$\sum t(t+1) \cdot L_t \cdot v_{i_0}^{t+2} = 6 \times 7 \times \left(\frac{120,000}{1.05^8} \right) = 3,411,270.38$$

This shows that the convexity of the assets is greater than that of the liability.
Thus the portfolio is immunized against a parallel shift in the yield curve.”

Page M7-37, Exercise (7.65).

The answers should read as follows:

“Answers:” $A_5 = 56,817.10$, $A_7 = 63,481.60$

$$\sum t \cdot (t+1) \cdot A_t \cdot v_{i_0}^{t+2} = 3,491,488.69 > \sum t \cdot (t+1) \cdot L_t \cdot v_{i_0}^{t+2} = 3,411,270.38$$

Page M7-37, Example (7.66).

The two formulas for Asset value should read as follows:

“For a 50bp shift upward, we have:

$$\text{Asset value} = \frac{58,493.08}{1.049^2} + \frac{66,678.32}{1.058^{12}} = 87,052.79$$

For a 50bp shift downward, we have:

$$\text{Asset value} = \frac{58,493.08}{1.039^2} + \frac{66,678.32}{1.048^{12}} = 92,172.54”$$

Page M7-37, Exercise (7.67).

In the Answers section, the Asset values should be as follows:

50 bp up: Asset value = 87,030.47
50 bp down: Asset value = 92,148.53

Page M7-39, Example (7.68).

The first formula should read as follows:

$$\text{Asset value} = \frac{58,493.08}{1.03^2} + \frac{66,678.32}{1.06^{12}} = 88,272.42$$

Page M7-39, Exercise (7.69).

In the Answers section, the Asset value should be 89,677.35.

Page M7-67, Problem 9.

The table of spot rates should be as follows:

Term (yrs.)	Spot rate
1	3.4%
2	4.4%
3	5.1%
4	5.5%
5	5.7%

Page PE3-2, Problem 7.

The second and third sentences should read as follows:

“For the first 6 years interest is credited at a nominal annual rate of 6% convertible monthly. For the next 4 years interest is credited based on a nominal rate of discount of 8% convertible quarterly.”

Page PE5-4, Problem 19.

The third line of the first paragraph should begin:

“the first deposit will be 1,000.”

Page PE10-3, Problem 9.

The answer choices for this problem should be as follows:

- A) 15,156 B) 15,651 C) 16,156 D) 16,561 E) 16,651

Page PE10-13, Solution to Problem 9.

The solution to this problem should read as follows:

“We know $d^{(4)} = 0.04$, so we can calculate the annual effective interest rate:

$$1 + i = \left(1 - \frac{0.04}{4}\right)^{-4} = 1.04102 \quad i = 0.04102$$

The accumulated value in the account at time 5 is:

$$X \cdot \ddot{s}_{\overline{5}|4.102\%} = X \cdot \frac{1.04102^5 - 1}{0.04102 / 1.04102} = 5.6500 \cdot X$$

Because the total deposits are $5 \cdot X$, we know that the interest earned during the 5 years is $0.6500 \cdot X$. The problem states that 500 is earned during the first 5 years, so we have:

$$0.6500 \cdot X = 500 \quad \rightarrow \quad X = 500 / 0.6500 = 769.22$$

Now we can calculate the balance at the end of 15 years:

$$X \cdot \ddot{s}_{\overline{15}|4.102\%} = 769.22 \cdot \frac{1.04102^{15} - 1}{0.04102 / 1.04102} = 16,156.43$$

Answer: C