

1. D

$$2,000,000 = .08 \cdot (25,000,000 + .5 \cdot (X - 2,200,000 - 750,000))$$

$$= 1,882,000 + .04 \cdot X$$

$$118,000 = .04 \cdot X$$

$$X = 2,950,000$$

End of year value is given by

$$25,000,000 + 2,000,000 + 2,950,000 - 2,200,000 - 750,000$$

$$= 27,000,000$$

$$27,000,000 = 25,000,000 \cdot (1+i) + (2,950,000 - 2,200,000 - 750,000) \cdot (1+i)^{0.5}$$

$$27,000,000 = 25,000,000 \cdot (1+i) + 0 \cdot (1+i)^{0.5}$$

$$1+i = 1.08$$

$$i = 0.08$$

2. C

$$\frac{(10)(Ia_{\overline{10}|i}) + 800v^8}{10(a_{\overline{10}|i}) + 100v^8} = 5.989$$

with $i = 8\%$ and

$$\text{coupon} = (10\%)(100) = 10$$

3. C

$$50\ddot{s}_{\overline{24}|j}(1+i)^5 + 100\ddot{s}_{\overline{24}|j}(1+i)^3 + 150\ddot{s}_{\overline{24}|j}(1+i) = 10,000$$

$$50\ddot{s}_{\overline{24}|j}(1+i)\left[(1+i)^4 + 2(1+i)^2 + 3\right] = 10,000$$

$$\ddot{s}_{\overline{24}|j}(1+i)\left[(1+i)^4 + 2(1+i)^2 + 3\right] = 200$$

4. D

$$P = Fra_{\overline{n}|i} + Cv^n$$

$$118.2 = 100\left(\frac{0.08}{2}\right)a_{\overline{20}|0.03} + C\left(\frac{1}{1.03^{20}}\right)$$

Using the calculator, enter

$N = 20$, $\%I = 3$, $PV = -118.20$, $PMT = 4$ and then $CPT FV$ to get 106.

The text makes it clear that the redemption value does not have to equal the par (or face) value, but that it often does.

5. Not scored because some of the material asked was not on the syllabus.

6.

A

$$i_5 = 0.09 + (0.002)(5) - (0.001)(25)$$

$$i_5 = 7.5\%$$

$$i_4 = 0.09 + (0.002)(4) - (0.001)(16)$$

$$i_4 = 8.20\%$$

$$j = \frac{(1.075)^5}{(1.082)^4} - 1 = 4.7\%$$

7.

D

There are only two real possibilities:

$$\text{Two consecutive 3 year CDs: } 10,000 \cdot \left(1 + \frac{0.05}{4}\right)^{12} \cdot \left(1 + \frac{0.05}{4}\right)^{12} = 13,473.51$$

$$\text{One 5 year CD and a 1 year CD: } 10,000 \cdot \left(1 + \frac{0.0565}{4}\right)^{20} \cdot \left(1 + \frac{0.04}{4}\right)^4 = 13,775.75$$

13,775.75 is the greater. The annual effective rate is

$$10,000 \cdot (1+i)^6 = 13,775.75$$

$$(1+i)^6 = 1.377575$$

$$i = 5.48\%$$

8.

B

Divide the annuity into the first 10 and last 10 payments.

The present value of the first 10 payments

$$\text{present value} = 100 \cdot \left[\frac{1 - \left(\frac{1.05}{1.07}\right)^{10}}{0.07 - 0.05} \right] \cdot 1.07 = 919.95$$

The present value of the last 10 payments

$$11\text{th payment is } 100 \cdot (1.05)^9 \cdot 0.95 = 147.38$$

$$\text{present value} = 147.38 \cdot \left[\frac{1 - \left(\frac{0.95}{1.07}\right)^{10}}{0.07 + 0.05} \right] \cdot \frac{1}{(1.07)^{10}} \cdot 1.07 = 464.71$$

The total present value of all payments is 1385.

9. E

$$1000 + \frac{150}{i} = \frac{100}{i - 0.05}$$

$$1000 \cdot i \cdot (i - 0.05) + 150 \cdot (i - 0.05) - 100i = 0$$

$$1000 i^2 = 7.5, i = 8.7\%$$

10. C

To exactly match its liabilities, the company will purchase one 1-year bond and two 2-year bonds:

$$\text{Cost} = \frac{1000}{1.1} + 2 \cdot \frac{1000}{(1.12)^2} = 909.09 + 1594.39 = 2503$$

11. B

$$\text{Price of a bond: } 1000 \cdot \left[(1.03)^{-20} + 0.04 a_{\overline{20}|3\%} \right] = 1148.77 = \text{loan principal}$$

$$\text{Loan principal and interest paid: } 1148.77 \cdot (1.05)^{10} = 1871.23$$

$$\text{Accumulated bond payments: } 1000 \cdot \left(1 + 0.04 s_{\overline{20}|2\%} \right) = 1971.89$$

$$\text{Net gain} = 100.66$$

12. B

Use the formula for a perpetuity-immediate, $\frac{P}{i} + \frac{Q}{i^2}$, to determine $i = 4\%$. Then use the annuity-immediate formula with $Q = 15$, $(Ia)_{\overline{n}|} = 3250$, $i = 4\%$, $n = 20$, to obtain $P = 116$.

$$3250 = \frac{130}{i} \Rightarrow i = 0.04$$

$$3250 = P a_{\overline{20}|0.04} + 15v(Ia)_{\overline{19}|0.04}$$

$$P = 116$$

13. A

$$j = \frac{i^{(4)}}{4}$$

$$10,000 = 400 a_{\overline{40}|j} \Rightarrow \text{calculator: } N = 40, PV = 10,000, PMT = -400$$

$$\text{CPT } i = 2.52\% \text{ per quarter}$$

$$(1.0252)^{1/3} = 0.833\% \text{ per month}$$

$$12(0.833\%) = 9.996\% = 10.0\%$$

14. B

$$X \left[20 + 0.08 \left(\frac{s_{\overline{21}|6\%} - 21}{0.06} \right) \right] = 5600$$

$$X(45.3236) = 5600$$

$$X = 123.56$$

15. B

$$PV = 5000 \cdot 1.05 \cdot \left(\frac{1}{(1.0575)^2} + \frac{1}{(1.0625)^3} + \frac{1}{(1.065)^4} \right) = 13,152.5$$

16. C

$$\text{Solve the following: } 925(1+i)^{20} = 45s_{\overline{20}|0.035} + 1000.$$

This gives $i = 0.046$.

Times two is 9.2%.

17. D

Profit on transaction has two pieces:

(1) The profit on the short sale = $25,000 - X$

(2) Interest on the margin deposit of $40\% \cdot 25,000 = 10,000 \cdot 0.08 = 800$

Margin deposited is $40\% \cdot 25,000 = 10,000$.

So, yield rate = profit/margin deposited

$$25\% = \frac{25,000 - X + 800}{10,000}$$

$$X = 23,300$$

18. D

$$\text{Total payment} = 789 + 211 = 1000$$

$$\text{Principal in 18}^{\text{th}} \text{ payment} = \text{Principal in 8}^{\text{th}} \text{ payment} \cdot [1.07^{(18-8)}]$$

$$\text{Principal in 18}^{\text{th}} \text{ payment} = 211 \cdot (1.07^{10}) = 415$$

$$\text{Interest in 18}^{\text{th}} \text{ payment} = 1000 - 415 = 585$$

19. E

I. is true.

II. is true.

III is false because the interest rates on the risk-free yield curve are called spot rates.

20. D

$$1 \times a_{\overline{5}|0.06} + 2v^5 a_{\overline{5}|0.06} + \frac{2.04 v^{10}}{(0.06 - 0.02)} = 4.21 + 6.30 + 28.48 = 38.99$$

21. D

I is false. To achieve immunization, the duration of the assets must equal the duration of the liabilities.

II is true.

III is true.

22. B

$$P = Fra_{\overline{n}|} + Cv^n,$$

$$918 = 45 \left(\frac{1 - 0.9524^n}{0.05} \right) + 1100(0.9524)^n,$$

$$1.02 = 1 - 0.9524^n + 1.222(0.9524)^n,$$

$$0.02 = 0.2222(0.9524)^n, \quad 0.09 = (0.9524)^n,$$

$$\ln(0.09) = n \cdot \ln(0.9524), \quad \ln(0.09) = n \cdot (-0.04877), \quad N = 49.37,$$

$$\text{Years to maturity} = \frac{n}{2} = 25$$

23. C

$$X = 100(Da)_{\overline{25}|} = 100 \left(\frac{25 - a_{\overline{25}|}}{i} \right) = 100 \left(\frac{25 - 9.077}{0.10} \right) = 15,923$$

24. C

$$P = Fra_{\overline{n}|} + Cv^n$$

$$850 = 1000 \left(\frac{0.12}{4} \right) a_{\overline{120}|i} + 1000v^{120}$$

$$850 = 30a_{\overline{n}|} + 1000v^{120}$$

Using the calculator, enter

$PV = -850$, $FV = 1000$, $N = 120$, $PMT = 30$, and then $CPT i$ to get 3.54% .

The answer is $3.54(4) = 14.2\%$ annual.

25. E

$$X[v^{17} + v^{15} + v^{12}] + Y[v^{20} + v^{18} + v^{15}]$$