27 VALUATION AND ANALYSIS OF BONDS WITH EMBEDDED OPTIONS

1. Suppose that the stock price of a common stock increases by 10%. Which of the following is most accurate for the price of the recently issued convertible bond? The value of the convertible bond will:
   (A) remain unchanged.
   (B) increase by less than 10%.
   (C) increase by 10%.

2. Which of the following statements about how interest rate volatility affects the value bond is most accurate? When interest rate volatility increases, the value of a:
   (A) callable bond decreases.
   (B) putable bond decreases
   (C) straight bond decreases.

3. Christopher Robinson, chairman of the board of directors for a private endowment fund, believes that the endowment fund for which he is responsible has diverged too far from its stated objectives. Over several years, the board has increased the size of the fund's equity position beyond the stated limits of the investment policy statement. In an effort to realign the fund's investments, Robinson has elected to choose a mortgage-backed security (MBS) for inclusion in the endowment's portfolio. After surveying the MBS market, Robinson has selected four MBS securities to present as potential investments at the next investment committee meeting. Details on the selected MBS securities are presented below:

MBS	Initial Principal ($millions)	Coupon Rate	Underlying Maturity (years)	Nominal Spread	OAS	Z-spread
W	250	7.0%	30	1.21%	0.28%	0.79%
X	175	7.8%	25	1.43%	0.49%	1.16%
Y	225	7.2%	20	1.62%	0.31%	1.12%
Z	190	8.0%	30	1.59%	0.40%	1.14%

At the investment committee meeting, a fellow board member raises his concerns over the potential MBS investments stating, "While we all agree that the fixed-income proportion of the endowment is much too small, I am not sure the suggested MBS securities will fulfill the cash flow requirements of the endowment. What risks are we taking on by allocating a portion of the portfolio to these investments? We cannot afford to end up with a timing

mismatch between the cash needs of the endowment and the cash provided from its investments. Also, we have given no consideration to commercial mortgage-backed securities (CMBS). Isn't our analysis incomplete if we fail to give proper discussion of potential CMBS investment opportunities?"

Robinson responded to his fellow board member by addressing the board member's concerns as follows:

"Because the cash requirements of the endowment fund fluctuate directly with interest rates, the cash flows provided from the MBS will provide adequate protection against cash shortfalls arising from differences in the timing of cash needs and cash sources. In addition, we can further reduce uncertainty surrounding the timing of cash flows by purchasing planned amortization class CMOs, which are securities issued against pools of MBS. CMBS were not presented due to the unacceptable risk profile of the comparable CMBS trading in the marketplace."

Of the four MBS securities under consideration, which MBS will add the most value relative to the risk associated with the security assuming the effective durations of the MBS securities is approximately the same?

(A) MBS-X.

(B) MBS-Y.

(C) MBS-W.

4. A convertible bond has a conversion ratio of 12 and a straight value of $1,010. The market value of the bond is $1,055, and the market value of the stock is $75. What is the market conversion price and premium over straight value of the bond?

The market conversion price is:

Market conversion price		Premium over straight value
(A)	$84.17	0.1222
(B)	$87.92	0.0446
(C)	$75.00	0.1029

5. The value of a callable bond is equal to the:

(A) callable bond value minus the value of the put option minus the value of the call option.

(B) callable bond plus the value of the embedded call option.

(C) option-free bond value minus the value of the call option.

6. The primary benefit of owning a convertible bond over owning the common stock of a corporation is the:

(A) conversion premium.

(B) bond has lower downside risk.

(C) bond has more upside potential.

7. Mary Pierce, CFA, has just joined The James Group as a fixed income security analyst. Pierce has taken over for Katy Williams, who left The James Group to start her own investment firm. Pierce has been reviewing Williams's files, which include data on a number of securities that Williams had been reviewing.

The first file had information on several different asset-backed securities. A summary schedule that Williams had prepared is shown in Exhibit 1.

Exhibit 1: Summary Schedule

Security	Rating	Nominal Spread (bp)
GG Auto Loans	AA	124
KK Auto Loans	AA	118
CC Credit Card Receivables	AA	136
HH Home Equity Loans	AA	168
LL Home Equity Loans	AA	174

The second file included the following schedule of information relating to a specific CMO that Williams had been considering. Exhibit 2 reflects the results of a Monte Carlo simulation based on 15% volatility of interest rates. This security is still available, and Pierce needs to evaluate the investment merit of any or all of the listed tranches.

Exhibit 2: Monte Carlo Simulation Based on 15% Interest Rate Volatility

Tranche	Par Amount ($ million)	OAS (bp)	Z-Spread (bp)	Effective Duration (years)
PAC A	75.0	40	40	1.5
PAC B	40.0	43	95	4.2
PAC C	25.0	65	117	5.0
PAC D	50.0	72	140	7.9
Support S	100.0	51	142	11.8

A third file contained notes Williams had taken at a seminar a couple of months ago on valuing various types of asset-backed and mortgage-backed securities. These notes included the following comments that Pierce found interesting:

"Cash flow yield (CFY) is one method of valuing mortgage-backed securities. An, advantage of the CFY is that it does not rely on any specific prepayment assumptions. An important weakness of CFY is the assumption that interim cash flows will be reinvested at the CFY. This is rarely true for mortgage-backed securities."

"Cash flow duration is similar to effective duration, but its weakness is that it fails to fully account for changes in prepayment rates as cash flow yields change. Empirical duration suffers two disadvantages as a measure of interest rate exposure: reliance on theoretical formulas and reliance on historical pricing data that may not exist for many mortgage-backed securities."

"The recent increase in the default rate for subprime adjustable rate mortgages can be traced to the structure of these loans. The negative amortization feature of these loans basically gave the borrower an at-the-money call option on their property. Once the property decreased in value, this call option was worthless, and the borrower had no incentive to make any additional payments."

The OAS in Exhibit 2 most likely reflect:

(A) simple spreads over the Treasury yield curve.

(B) average spreads over the Treasury spot rate curve.

(C) average spreads over the Treasury yield curve.

8. An analyst has constructed an interest rate tree for an on-the-run Treasury security. The analyst now wishes to use the tree to calculate the duration of the Treasury security. The usual way to do this is to estimate the changes in the bond's price associated with a:

(A) shift up and down in the current one-year spot rate all else held constant.

(B) parallel shift up and down of the forward rates implied by the binomial model.

(C) parallel shift up and down of the yield curve.

9. The value of a convertible bond is most likely to be calculated as the value of an equivalent straight bond:

(A) plus the value of a call option on the bond.

(B) plus the value of a call option on the stock.

(C) minus the value of a put option on the bond.

10. Bill Moxley, CFA is evaluating three bonds for inclusion in fixed income portfolio for one of his pension fund clients. All three bonds have a coupon rate of 3%, maturity of five years and are generally identical in every respect except that bond A is an option-free bond, bond B is callable in two years and bond C is putable in two years. The yield curve is currently flat.

If the yield curve becomes downward sloping, the bond with the highest price impact is least likely to be:

(A) Bond A

(B) Bond C

(C) Bond B

11. As the volatility of interest rates increases, the value of a putable bond will:

(A) decline.

(B) rise.

(C) rise if the interest rate is below the coupon rate, and fall if the interest rate is above the coupon rate.

MediSoft Inc. develops and distributes high-tech medical software used in hospitals and clinics across the United States and Canada. The firm's software provides an integrated solution to monitoring, analyzing, and managing output from a variety of diagnostic medical equipment including MRIs, CT scans, and EKG machines. MediSoft has grown rapidly since its inception ten years ago, averaging 25% growth in sales over the past decade. The company went public three years ago. Twelve months after its IPO, MediSoft made two semiannual coupon bond offerings, the first of which was a convertible bond. At the time of issuance, the convertible bond had a coupon rate of 7.25%, a par value of $1,000, a conversion price of $55.56, and ten years until maturity. Two years after issuance, the bond became callable at 102% of par value. Soon after the issuance of the convertible bond, the company issued another series of bonds, which were putable but contained no conversion or call features. The putable bonds were issued with a coupon of 8.0%, a par value of $1,000, and 15 years until maturity. One year after their issuance, the put feature of the putable bonds became active, allowing the bonds to be put at a price of 95% of par value, and increasing linearly over five years to 100% of par value. MediSoft's convertible bonds are now trading in the market for a price of $947 with an estimated straight value of $917. The company's putable bonds are trading at a price of $1,052. Volatility in the price of MediSoft's common stock has been relatively high over the past few months. Currently, the stock is priced at $50 on the New York Stock Exchange and is expected to continue its annual dividend in the amount of $1.80 per share.

High-tech industry analysts for Brown & Associates, a money management firm specializing in fixed-income investments, have been closely following MediSoft ever since it went public three years ago. In general, portfolio managers at Brown & Associates do not participate in initial offerings of debt investments, preferring instead to see how the issue trades before considering taking a position in the issue. Because MediSoft's bonds have had ample time to trade in the marketplace, analysts and portfolio managers have taken an interest in the company's bonds. At a meeting to discuss the merits of MediSoft's bonds, the following comments were made by various portfolio managers and analysts at Brown & Associates:

"Choosing to invest in MediSoft's convertible bond would benefit our portfolios in many ways, but the primary benefit is the limited downside risk associated with the bond. Because the straight value will provide a floor for the value of the convertible bond, downside risk is limited to the difference between the market price of the bond and the straight value."

"Decreasing volatility in the price of MediSoft's common stock as well as increasing volatility in the level of interest rates are expected in the near future. The combined in effects of these changes in volatility will be a decrease in the price of MediSoft's putable bonds and an increase the price of the convertible bonds. Therefore, only the convertible bonds would be a suitable purchase."

12. Assuming the common stock of MediSoft underwent a one-for-two reverse split, how would the features of the company's bonds be adjusted? The:
    (A) market conversion price of the convertible bond would be reduced by half.
    (B) conversion value of the convertible bond would be reduced by half.
    (C) conversion ratio of the convertible bond would be reduced by 50%.

13. Under what circumstances will the analyst's comments regarding the limited downside risk of MediSoft's convertible bonds be accurate?
    (A) Short-term and long-term interest rates are expected to remain the same.
    (B) The Federal Reserve Bank decides to pursue a restrictive monetary policy.
    (C) The convertible bond is trading in the market as a common stock equivalent.

14. Subsequent to purchasing one of the putable bonds for his portfolio, one of the managers at Brown & Associates realized that the bond contained a soft put. Which of the following securities cannot be used to redeem the bond in the event the bond becomes putable?
    (A) Shares of MediSoft's common stock.
    (B) MediSoft's 9.0% subordinated notes with a maturity of 10 years.
    (C) Thirty-year Treasury notes with a coupon of 4.5%.

15. For a convertible bond with a call provision, with respect to the bond's convertibility feature and the call feature, the Black-Scholes option model can apply to:
    (A) only one feature.
    (B) neither features.
    (C) both features.

16. What is the market conversion price of a convertible security?
    (A) The price that an investor pays for the common stock if the convertible bond is purchased and then converted into the stock.
    (B) The value of the security if it is converted immediately.
    (C) The price that an investor pays for the common stock in the market.

17. Joseph Dentice, CFA is evaluating three bonds. All three bonds have a coupon rate of 3%, maturity of five years and are generally identical in every respect except that bond A is an option- free bond, bond B is callable in two years and bond C is putable in two years.
    The bond with the lowest duration is least likely to be:
    (A) Bond C.
    (B) Bond A.
    (C) Bond B.

18. Sharon Rogner, CFA is evaluating three bonds for inclusion in fixed income portfolio for one of her pension fund clients. All three bonds have a coupon rate of 3%, maturity of five years and are generally identical in every respect except that bond A is an option-free bond, bond

B is callable in two years and bond C is putable in two years. Rogner computes the OAS of bond A to be 50bps using a binomial tree with an assumed interest rate volatility of 15%.

If Rogner revises her estimate of interest rate volatility to 10%, the computed OAS of Bond B would most likely be:

(A) higher than 50bps.

(B) lower than 50bps.

(C) equal to 50bps.

19. For a convertible bond, which of the following is least accurate?

(A) The issuer can decide when to convert the bonds to stock.

(B) A convertible bond may be putable.

(C) The conversion ratio times the price per share of common stock is a lower limit on the bond's price.

20. Which of the following scenarios will lead to a convertible bond underperforming the underlying stock? The:

(A) stock price falls.

(B) stock price rises.

(C) stock price is stable.

21. Sharon Rogner, CFA is evaluating three bonds for inclusion in fixed income portfolio for one of her pension fund clients. All three bonds have a coupon rate of 3%, maturity of five years and are generally identical in every respect except that bond A is an option-free bond, bond B is callable in two years and bond C is putable in two years. Rogner computes the OAS of bond A to be 50bps using a binomial tree with an assumed interest rate volatility of 15%.

If Rogner revises her estimate of interest rate volatility to 20%, the computed OAS of Bond B would most likely be:

(A) equal to 50bps.

(B) lower than 50bps.

(C) higher than 50bps.

22. Which of the following is the appropriate "nodal decision" within the backward induction methodology of the interest tree framework for a putable bond?

(A) Min (put value, discounted value).

(B) Max (put price, discounted value).

(C) Max (par value, discounted value).

23. Which of the following is equal to the value of a noncallable / nonputable convertible bond? The value of the corresponding:

(A) callable bond plus the value of the call option on the stock.

(B) straight bond.

(C) straight bond plus the value of the call option on the stock.

24. A callable bond and an option-free bond have the same coupon, maturity and rating. The callable bond currently trades at par value. Which of the following lists correctly orders the values of the indicated items from lowest to highest?

(A) $0, embedded call, callable bond, option-free bond.

(B) Embedded call, callable bond, $0, option-free bond.

(C) Embedded call, $0, callable bond, option-free bond.

25. Patrick Wall is a new associate at a large international financial institution. His boss, C.D. Johnson, is responsible for familiarizing Wall with the basics of fixed income investing. Johnson asks Wall to evaluate the two otherwise identical bonds shown in Table 1. The callable bond is callable at 100 and exercisable on the coupon dates only.

Wall is told to evaluate the bonds with respect to duration and convexity when interest rates decline by 50 basis points at all maturities over the next six months.

Johnson supplies Wall with the requisite interest rate tree shown in Figure 1. Johnson explains to Wall that the prices of the bonds in Table 1 were computed using the interest rate lattice. Johnson instructs Wall to try and replicate the information in Table 1 and use his analysis to derive an investment decision for his portfolio.

Table 1 Bond Descriptions

	Non-callable Bond	Callable Bond
Price	$100.83	$98.79
Time to Maturity (years)	5	5
Time to First Call Date	–	0
Annual Coupon	$6.25	$6.25
Interest Payment	Semi-annual	Semi-annual
Yield to Maturity	6.0547%	6.5366%
Price Value per Basis Point	428.0360	–

Figure 1

									15.44%
								14.10%	
							12.69%		12.46%
						11.58%		11.38%	
					9.75%		10.25%		10.05%
				8.95%		9.57%		9.19%	
			7.91%		7.88%		8.28%		8.11%

		7.35%		7.23%		7.74%		7.42%	
	6.62%		6.40%		6.37%		6.69%		6.54%
6.05%		5.95%		5.85%		6.25%		5.99%	
	5.36%		5.17%		5.15%		5.40%		5.28%
		4.81%		4.73%		5.05%		4.83%	
			4.81%		4.16%		4.36%		4.26%
				3.82%		4.08%		3.90%	
					3.37%		3.52%		3.44%
						3.30%		3.15%	
							2.84%		2.77%
								2.54%	
									2.24%
Year	0.5	1.0	1.5	2.0	2.5	3.0	3.5	4.0	4.5

Given the following relevant part of the interest rate tree, the value of the callable bond at node A is closest of:

		3.44%
A	3.15%	
		2.77%

(A) $100.00.
(B) $101.53.
(C) $103.56

26. Which of the following correctly describes one of the basic features of a convertible bond? A convertible bond is a security that can be converted into:
(A) another bond at the option of the issuer.
(B) common stock at the option of the issuer.
(C) common stock at the option of the investor.

27. How does the value of a callable bond compare to a noncallable bond? The callable bond value is:
(A) lower or higher.
(B) lower.
(C) higher.

28. For a convertible bond without any other options, the call feature implied by the convertibility feature will do all of the following EXCEPT:
(A) place a lower limit on the possible values of the bond.
(B) increase the value of the bond over that of a comparable option-free bond.
(C) cause negative convexity.

29. For a putable bond, callable bond, or putable/callable bond, the nodal-decision process within the backward induction methodology of the interest rate tree framework requires that at each node the possible values will:

(A) not be higher than the call price or lower than the put price.

(B) be, in number, two plus the number of embedded options.

(C) include the face value of the bond.

30. Using the following tree of semiannual interest rates what is the value of a 5% callable bond that has one year remaining to maturity, a call price of 99 and pays coupons semiannually?

	7.76%
6.20%	
	5.45%

(A) 98.29.

(B) 97.17.

(C) 99.01.

Alnoor Hudda, CFA, is valuing two floaters issued by Mateo Bank. Both floaters have a par value of $100, three year life and pay based on annual MRR. Hudda has generated the following binomial tree for MRR.

1-year forward rates starting in year:

0	1	2
2%	5.7798%	6.0512%
	3.8743%	4.0562%
		2.7190%

31. Value of a capped floater with a cap of 4% is closest to:

(A) $98.70

(B) $97.38

(C) $96.71

32. Value of the cap in a capped floater with a cap of 4% is closest to:

(A) $1.29

(B) $4.41

(C) $1.23

33. A callable bond with an 8.2% annual coupon will mature in two years at par value. The current one-year spot rate is 7.9%. For the second year, the yield-volatility model forecasts that the one-year rate will be either 6.8% or 7.6%. The call price is 101. Using a binomial interest rate tree, what is the current price?
    (A) 101.000.
    (B) 100.558.
    (C) 100.279.

34. Joseph Dentice, CFA is evaluating three bonds. All three bonds have a coupon rate of 3%, maturity of five years and are generally identical in every respect except that bond A is an option-free bond, bond B is callable at any time at par and bond C is putable at any time at par. Yield curve is currently flat at 3%.
    The bond with the lowest one-sided down-duration is most likely to be:
    (A) Bond A.
    (B) Bond C.
    (C) Bond B.

35. Which of the following is the appropriate "nodal decision" within the backward induction methodology of the interest tree framework for a callable bond?
    (A) Min(call price, discounted value).
    (B) Max(call price, discounted value).
    (C) Min(par value, discounted value).

36. On a given day, a bond with a call provision rose in value by 1%. What can be said aboute) level and volatility of interest rates?
    (A) The only possible explanation is that level of interest rates fell.
    (B) A possibility is that the level of interest rates remained constant, but the volatility of interest rates fell.
    (C) A possibility is that the level of interest rates remained constant, but the volatility of interest rates rose.

37. Bill Moxley, CFA is evaluating three bonds for inclusion in fixed income portfolio for one of his pension fund clients. All three bonds have a coupon rate of 3%, maturity of five years and are generally identical in every respect except that bond A is an option-free bond, bond B is callable in two years and bond C is putable in two years. The yield curve is currently flat.
    If the yield curve becomes upward sloping, the bond least likely to have the highest price impact would be:
    (A) Bond C
    (B) Bond B
    (C) Bond A

38. A CFA charter holder observes a 12-year 7¾ percent semiannual coupon bond trading at 102.9525. If interest rates rise immediately by 50 basis points the bond will sell for 99.0409. If interest rates fall immediately by 50 basis points the bond will sell for 107.0719. What are the bond's effective duration (ED) and effective convexity (EC).
    (A) ED = 40.368, EC = 7.801.
    (B) ED = 7.801, EC = 80.73.
    (C) ED = 8.031, EC = 2445.120.

39. Which of the following is equal to the value of the putable bond? The putable bond value is equal to the:
    (A) callable bond plus the value of the put option.
    (B) option-free bond value plus the value of the put option.
    (C) option-free bond value minus the value of the put option.

Philip Bagundang, CFA, is an experienced analyst working for the corporate credit department of a global investment bank.

Bagundang is evaluating the proposed two-year, zero coupon, £100 par Shumensko bond. Using a 2% probability of default assumption, Bagundang calculates the CVA on the bond to be £1.820. Two-year, risk-free zero-coupon bonds currently yield 0.8%.

Bagundang is evaluating a three-year, zero-coupon bond issued by Alligator, Inc. Using a hazard rate of 2% and estimated recovery rate of 70%, and a flat 2.5% benchmark yield curve, a partial table of analysis is completed as shown in Exhibit 1.

Exhibit 1: Alligator, Inc. Bond

Year	Exposure	Loss given default	Probability of survival	Probability of default	Expected loss
1	95.18	28.55	98.00%	2.00%	0.5711
2					
3	100.00	30.00	94.12%		

Bagundang asks his assistant, Diane Monera, to summarize how structural models can be viewed as options on the firm's assets. Monera states that shareholders have limited liability and can, therefore, be viewed as having a long call option on the firm's assets with a strike price equal to the par value of debt. In addition, she adds, debtholders can be viewed as having a long position in a risk-free zero-coupon bond and a position in another instrument she can't quite remember.

Finally, Bagundang asks Monera to prepare a short summary table of structural versus reduced form models. Exhibit 2 shows her summary.

Exhibit 2: Structural vs. Reduced Form Models

	Structural	Reduced Form
Default risk	Exogenous	Endogenous
Parameter estimation	Option pricing theory	Default intensity

40. Based on Exhibit 1, and the stated risk-free rate on two-year zero-coupon bonds, the credit spread on the Shumensko bond is closest to:
    (A) 0.12%.
    (B) 0.18%.
    (C) 0.95%.

41. Based on Exhibit 1 and a par value of $100, the expected loss on the Alligator bond in year 2 is closest to:
    (A) $0.5718.
    (B) $0.5737.
    (C) $0.5789.

42. In relation to structural models, the instrument that Monera cannot recall is most likely a:
    (A) long put with a strike price equal to the value of assets.
    (B) short put with a strike price equal to the value of debt.
    (C) short put with a strike price equal to the value of assets.

43. The summary provided in Exhibit 2 is best described as:
    (A) accurate.
    (B) inaccurate in regards to default risk.
    (C) inaccurate in regards to parameter estimation.

44. A callable bond and an option-free bond have the same coupon, maturity and rating. The callable bond currently trades at par value. Which of the following lists correctly orders the values of the indicated items from lowest to highest?
    (A) Embedded call, $0, callable bond, option-free bond.
    (B) Embedded call, callable bond, $0, option-free bond.
    (C) $0, embedded call, callable bond, option-free bond.

45. Which of the following represent the correct values that should be within the tree in the places marked by A and B?
    (A) A = 99.041 B = 100.000
    (B) A = 99.041 B = 100.315
    (C) A = 100.000 B = 100.000

46. Which of the following represent the correct value that should be within the tree in the place marked by D?
    (A) 102.000.
    (B) 101.723.
    (C) 101.000.

47. Which of the following is most accurate regarding the use of a binomial tree to calculate the option adjusted spread (OAS) of bonds with embedded options?
    (A) The binomial tree can be used to calculate the OAS of a callable corporate bond but not a mortgage backed security (MBS), as the MBS does not contain an option.
    (B) The spot rate curve cannot be used to calculate the OAS of a callable corporate bond but can be used for a mortgage backed security (MBS).
    (C) The binomial tree can be used to calculate the OAS of a callable corporate bond but not a mortgage backed security (MBS), as the MBS value is path dependent.

48. Which of the following represent the correct value that should be within the tree in the place marked by G?
    (A) 96.352.
    (B) 102.000.
    (C) 102.576.

49. If a bond's key rate durations for maturity points shorter than the bond's maturity are negative, it is most likely that the bond being analyzed is a:
    (A) Zero coupon bond.
    (B) Putable bond
    (C) Callable bond

50. For an option-free bond trading at par, it is least likely that:
    (A) The rate durations for all the rates other than the maturity-matched rate are zero.
    (B) The spot rate for the maturity of the bond is least important rate affecting the value of the bond.
    (C) Its maturity key rate duration is the same as its effective duration.

51. An analyst has constructed an interest rate tree for an on-the-run Treasury security. The analyst now wishes to use the tree to calculate the convexity of a callable corporate bond with maturity and coupon equal to that of the Treasury security. The usual way to do this is to calculate the option-adjusted spread (OAS):
    (A) shift the Treasury yield curve, compute the new forward rates, add the OAS to those forward rates, enter the adjusted values into the interest rate tree, and then use the usual convexity formula.
    (B) compute the convexity of the Treasury security, and divide by (1+OAS).
    (C) compute the convexity of the Treasury security, and add the OAS.

52. Using the following binomial interest rate tree, calculate the value of a two-year, 2.5% putable bond. The American style embedded put option can be exercised anytime and has a strike price of 99. The value is closest to:

	3.75%

3.175%	
	2.665%

(A) 98.75.

(B) 97.92.

(C) 99.00.

53. The effective convexity of a bond is most likely to be negative if the bond is:

(A) putable.

(B) callable.

(C) option-free.

Mike Diffle has been asked to evaluate the bonds of Hardin, Inc. The specific issue Diffle is considering has an 8% annual coupon and matures in two years. The bonds are currently callable at 101, and beginning in six months, they are callable at par. Bratton Corporation, Hardin's competitor, also has bonds outstanding which are identical to Hardin's except that they are not callable. Diffle believes the AA rating of both bonds is an accurate reflection of their credit risk. Diffle is wondering if the Bratton bonds might be a better investment than the Hardin bonds. Assume that the following 1-year interest rate tree is used to value bonds with a maturity of up to three years (this tree assumes interest rate volatility of 10%).

Today	Year 1	Year 2
		9.324%
	8.530%	
7.250%		7.634%
	6.983%	
		6.250%

Also, assume that the appropriate spot rates for securities maturing in one, two, and three years are 7.25%, 7.5%, and 7.80%, respectively.

Diffle believes he should begin his analysis with the option-free Bratton bonds. He decides to consider two different approaches to valuing the Bratton Bonds—one that uses the current spot rate curve and another that uses the interest rate tree given above.

For the next step in his analysis, Diffle has decided to calculate the value of the Hardin bonds using the interest rate tree. His assumption is that the bond will be called at any node of the tree where the calculated value exceeds the call price. Diffle summarizes the results of his bond valuation analysis in a memo to his supervisor, Luke Puldo. In this memo, Diffle makes the following statements:

Statement 1: The value of the option embedded in the Hardin bonds can be derived by simply subtracting the interest rate tree value of the Hardin bonds from the interest rate tree value of the Bratton bonds.

Statement 2: I am concerned that the 10% volatility assumption used to develop the interest rate tree might be too low. A higher volatility assumption would result in a lower value for the Hardin bonds.

After reviewing Diffle's analysis, Puldo notes that Diffle has not included any information on the option adjusted spread (OAS) for the Hardin bonds. Puldo suggests that Diffle should evaluate the OAS in order to get an idea of the liquidity risk of the Hardin bonds. Diffle counters that the OAS may not be very informative in this case, since he is uncertain as to the reliability of the interest rate volatility assumption.

To finish his analysis, Diffle would like to use his binomial model to evaluate the interest rate risk of both the Hardin bonds and the Bratton bonds. Diffle has shocked interest rates by 25 basis points throughout the interest rate tree he has been using to value the two bond issues. Using the new rates, Diffle has calculated values for the bonds assuming a 25–basis-point increase or decrease in rates. He plans to use these values as inputs into the following formulas for duration and convexity:

$$\text{Duration} = \frac{V_- - V_+}{2 \times V_0 \times \Delta y} \qquad \text{convexity} = \frac{V_+ - V_+ - 2V_0}{2 \times V_0 \times (\Delta y)^2}$$

54. Puldo still believes that Diffle must include the OAS for the Hardin bonds in his report. Puldo points out that a proper benchmark is critical to any OAS analysis. Which of the following statements regarding benchmark interest rates and OAS is most accurate? Since liquidity risk is a critical issue, the OAS calculation for the Hardin bonds should:

(A) be based on a benchmark that has no credit risk.

(B) use on-the-run interest rates for other callable Hardin bonds as a benchmark in order to isolate the liquidity risk of the 2-year bond issue.

(C) use on-the-run U.S. Treasury rates as a benchmark in order to isolate the credit risk of the Hardin bonds.

55. Which of the following statements is most accurate regarding Diffle's calculation of duration and convexity?

(A) The duration estimate for the Bratton bonds will reflect the projected percentage change in price for a 100-basis-point change in interest rates.

(B) The estimates for both duration and convexity will be inaccurate because the OAS was not estimated again after the rate shock.

(C) The duration estimate will be inaccurate since it does not account for any change in cash flows due to the call option embedded in the Hardin bond.

56. Puldo notes that the duration estimate for the two bonds is not directly comparable. Assuming that the underlying option is at-or near-the-money, the duration of one of the bonds will be lower than the other one.

Which of the following most accurately critiques the OAS discussion between Diffle and Puldo? Puldo is:

(A) correct that the OAS will provide insight into the liquidity risk of the Hardin bonds, and Diffle is correct that different volatility assumptions would change the OAS.

(B) incorrect that the OAS will provide insight into the liquidity risk of the Hardin Bonds, but Diffle is correct that different volatility assumptions would change the OAS.

(C) correct that the OAS will provide insight into the liquidity risk of the Hardin Bonds, but Diffle is incorrect since OAS implicitly adjusts for the volatility of interest rates.

57. Puldo notes that the duration estimate for the two bonds is not directly comparable. Assuming than the underlying option is at-or near-the-money, the duration of one of the bonds will be lower than the other one.

Indicate whether the statements made by Diffle in his memo regarding the value of the embedded option and the effect of the volatility assumption are correct.

(A) Only the statement regarding the effect of the volatility assumption is correct.

(B) Both statements are correct.

(C) Only the statement regarding the value of the embedded option is correct.

Kate Inka is a new hire for Maya Incorporated, a fixed income fund manager. On her first week on the job, she is asked to prepare a presentation on valuation and analysis of bonds with embedded options.

Inka starts her presentation with the following three statements:

Statement 1: "In times of increased expectations of interest rate volatility the value of callable bonds will fall."

Statement 2: "When trying to analyze the return for credit and liquidity risk on a corporate callable bond relative to a government bond, the Z-spread must be calculated. The Z-spread can be viewed as the constant spread added to treasury spot rates such that the present value of the callable bonds coupons and principal equate to its market price."

Statement 3: "When analyzing the interest rate risk of a callable bond it is worth keeping in mind that its effective convexity will be less than or equal to the equivalent option free bond."

Inka is analyzing a three-year, 6% annual coupon, $100 par callable bond. The bond has a European call feature allowing it to be called at 101% of par in two years' time. Inka uses a binomial tree assuming interest rate volatility of 20% as shown in Exhibit 1.

Exhibit 1: Binomial Lattice

T_0	T_1	T_2
		6.34%
	5.45%	
3%		?????
	3.65%	

		2.85%

Inka makes the following three comments about her binomial tree exercise:

Comment 1: "If the spot and expected future 1-period rates in the binomial tree have been derived from treasury securities we should be aware that the backwardly induced value of a corporate bond would be too high relative to its market price."

Comment 2: "For a corporate callable bond, the option adjusted spread must be added as a fixed margin to all the treasury spot and expected future 1-period rates so that the backwardly induced price converges with market price."

Comment 3: "If we were to increase our assumption of interest rate volatility used to create the binomial tree, the estimated option adjusted spread would be smaller."

Finally, Inka makes three comments on her use of effective duration:

Comment 1: "Given that a corporate callable bond will exhibit negative convexity when yields are low, care must be taken when interpreting effective duration, as essentially the computation averages the impact of the up and down shock on bond price. Perhaps the non-symmetrical price reaction to yield increases and decreases would be better captured by looking at one-sided durations."

Comment 2: "Effective duration is an incomplete measure of interest rate risk as it fails to adequately capture option risk. For example, callable bonds are more sensitive to interest rate risk due to embedded options and as such have a higher effective duration."

Comment 3: "One method of capturing shaping risk is to compute one-sided durations. A 20-year bond callable after 10 years with a low coupon is likely to have the highest one-sided duration corresponding to the call date. If the coupon is increased the one-sided duration corresponding to the call date declines but the maturity matched 20-year one-sided duration increases."

58. How many of Inka's opening statements are correct?

(A) Two.
(B) One.
(C) Three.

59. Which value for the backwardly induced price of the corporate callable bond using the binomial tree in Exhibit 1 is most accurate?

(A) $104.89.
(B) $105.69.
(C) $105.20.

60. How many of Inka's comments about her binomial tree exercise are correct?

(A) One.
(B) Two.
(C) Three.

61. How many of Inka's comments about duration are accurate?
(A) Two.
(B) One.
(C) Three.

62. Bill Moxley, CFA is evaluating three bonds for inclusion in fixed income portfolio for one of his pension fund clients. All three bonds have a coupon rate of 3%, maturity of five years and are generally identical in every respect except that bond A is an option-free bond, bond B is callable in two years and bond C is putable in two years. The yield curve is currently flat.
If the yield curve is expected to have a parallel downward shift, the bond with the highest price appreciation is least likely to be:
(A) Bond C
(B) Bond A
(C) Bond B

63. Joseph Dentice, CFA is evaluating three bonds. All three bonds have a coupon rate of 3%, maturity of five years and are generally identical in every respect except that bond A is an option-free bond, bond B is callable at any time at par and bond C is putable at any time at par. Yield curve is currently flat at 3%.
The bond least likely to have the highest one-sided down-duration is:
(A) Bond B.
(B) Bond C.
(C) Bond A.

64. Joseph Dentice, CFA is evaluating three bonds. All three bonds have a coupon rate of 3%, maturity of five years and are generally identical in every respect except that bond A is an option-free bond, bond B is callable in two years and bond C is putable in two years.
If interest rates increase, the duration of which bond is most likely to decrease?
(A) Bond C.
(B) Bond A.
(C) Bond B.

65. A putable bond with a 6.4% annual coupon will mature in two years at par value. The current one-year spot rate is 7.6%. For the second year, the yield volatility model forecasts that the one-year rate will be either 6.8% or 7.6%. The bond is putable in one year at 99. Using a binomial interest rate tree, what is the current price?
(A) 98.190.
(B) 98.885.
(C) 98.246.

66. Sharon Rogner, CFA is evaluating three bonds for inclusion in fixed income portfolio for one of her pension fund clients. All three bonds have a coupon rate of 3%, maturity of five years and are generally identical in every respect except that bond A is an option-free bond, bond B is callable in two years and bond C is putable in two years. Rogner computes the OAS of bond A to be 50bps using a binomial tree with an assumed interest rate volatility of 15%.

If Rogner revises her estimate of interest rate volatility to 10%, the computed OAS of Bond C would most likely be:

(A) higher than 50bps.

(B) equal to 50bps.

(C) lower than 50bps.

67. As the volatility of interest rates increases, the value of a callable bond will:

(A) decline.

(B) rise if the interest rate is below the coupon rate, and fall if the interest rate is above the coupon rate.

(C) rise.

68. For a callable bond, the value of an embedded option is the price of the option-free bond:

(A) plus the price of a callable bond of the same maturity, coupon and rating.

(B) minus the price of a callable bond of the same maturity, coupon and rating.

(C) plus the risk-free rate.

69. Which of the following statements is most accurate concerning a convertible bond? A convertible bond's value depends:

(A) on both interest rate changes and changes in the market price of the stock.

(B) only on interest rate changes.

(C) only on changes in the market price of the stock.

70. How is the value of the embedded call option of a callable bond determined? The value of the embedded call option is:

(A) determined using the standard Black-Scholes model.

(B) the difference between the value of the option-free bond and the callable bond.

C) equal to the amount by which the callable bond value exceeds the option-free bond value.

71. Joseph Dentice, CFA is evaluating three bonds. All three bonds have a coupon rate of 3%, maturity of five years and are generally identical in every respect except that bond A is an option-free bond, bond B is callable in two years and bond C is putable in two years.

If interest rates decrease, the duration of which bond is most likely to decrease?

(A) Bond A.

(B) Bond C.
(C) Bond B.

72. Generally speaking, an analyst would like the option adjusted spread (OAS) to be large, controlling for:
(A) Credit and liquidity risk.
(B) Credit, liquidity and option risk.
(C) Option risk.

73. A callable bond, a putable bond, and an option-free bond have the same coupon, maturity and rating. The call price and put price are 98 and 102 respectively. The option-free bond trades at par. Which of the following lists correctly orders the values of the three bonds from lowest to highest?
(A) Callable bond, option-free bond, putable bond.
(B) Option-free bond, putable, callable bond.
(C) Putable bond, option-free bond, callable bond.

74. How do the risk-return characteristics of a newly issued convertible bond compare with the risk-return characteristics of ownership of the underlying common stock? The convertible bond has:
(A) higher risk and higher return potential.
(B) lower risk and higher return potential.
(C) lower risk and lower return potential.

George Nagy is a fixed income manager with Luna Securities. Nagy is analyzing several securities issued by Redna, Inc. First, he is looking at a three-year, annual-pay floating rate note with an embedded cap of 6.5% paying coupons in arrears.
Nagy's assistant has provided him with the binomial interest rate tree below (computed with assumed volatility of 25%) to aid in her analysis.

T_0	T_1	T_2
		9.892%
	7.704%	
6%		6%
	4.673%	
		3.639%

A three-year, Redna, Inc., callable bond is currently trading at a price of $102. An otherwise identical straight bond is also trading. Nagy obtains the report of the firm's chief economist indicating that rates are trending lower.

75. What is the value of the capped floater using Nagy's line manager's binomial tree of interest rate expectations?
(A) $98.80.

(B) $99.26.
(C) $101.44.

76. Which of the following statements is/are correct?
Statement I: The straight bond should trade for less than $102.
Statement II: If interest rate volatility were to increase then the price differential between the two Redna bonds would widen.
(A) Both statements are correct.
(B) Statement I is correct but Statement ll is incorrect.
(C) Statement I is incorrect but Statement II is correct.

77. Suppose Redna were to issue a bond that was identical in all respects to the existing callable bond except that instead it was putable. How would a binomial tree valuation be adapted?
(A) The put option becomes an effective floor price at each applicable node, instead of the call's effective ceiling price.
(B) The put option becomes an effective floor price at each applicable node, as well as the call's effective ceiling price.
(C) The put option becomes an effective ceiling price at each applicable node.

78. Which of the following most accurately explains how the effective convexity is computed using the binomial model. In order to compute the effective convexity the:
(A) binomial tree has to be shifted upward and downward by the same amount for all nodes.
(B) yield curve has to be shifted upward and downward in a parallel manner and the binomial tree recalculated each time.
(C) volatility has to be shifted upward and downward and the binomial tree recalculated each time.

79. Using the following interest rate tree, what is the value of a callable bond that has two years remaining to maturity, a call price of 99, and a 2.50% coupon rate? Assume that the call option can be exercised at t=1 year from now.

	3.80%
3.18%	
	2.61%

(A) 98.65.
(B) 99.21.
(C) 98.25.

80. Using the following tree of semiannual interest rates what is the value of a putable semiannual bond that has one year remaining to maturity, a put price of 98 and a 4% coupon rate? The bond is putable today.

	7.59%

6.35%	
	5.33%

(A) 97.92.

(B) 98.00.

(C) 98.75.

81. Suppose that the value of an option-free bond is equal to 100.16, the value of the corresponding callable bond is equal to 99.42, and the value of the corresponding putable bond is 101.72. What is the value of the call option?

(A) 0.21.

(B) 0.64.

(C) 0.74.

82. Suppose the market price of a convertible security is $1,050 and the conversion ratio is 26.64. What is the market conversion price?

(A) $26.64.

(B) $39.41.

(C) $1,050.00.

83. Which bonds would have its maturity-matched rate as its most critical rate?

(A) High coupon callable bonds.

(B) Low coupon callable bonds.

(C) Low coupon putable bonds.

84. Using the report of the economist, which of the following order of effective durations (highest to lowest) of otherwise identical bonds is most accurate:

(A) callable, putable, straight.

(B) straight, callable, putable.

(C) straight, putable, callable.