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**GOODMAN INSTITUTE OF INVESTMENT MANAGEMENT**  
**John Molson School of Business**  
**Concordia University**

Professor: Ian Rakita

GIIM 621, Winter 2013  
**Analysis of Fixed Income Securities**  
Class Test  
17 pages including cover

Name (please print): David Vachon

Student I.D. GR5062

Time available: 75 minutes

Instructions: **CLOSED BOOK EXAM. APPROVED CALCULATORS ALLOWED. ALL QUESTIONS SHOULD BE ANSWERED ON THE SEPARATE COMPUTER ANSWER SHEET PROVIDED.**

**EXAM BOOKLETS CAN BE KEPT. ANSWER SHEETS MUST BE RETURNED.**

**NOTE THAT WRITING PAST TIME CALLED WILL RESULT IN AN AUTOMATIC DEDUCTION OF 10% OFF THE VALUE OF THIS TEST. PLEASE TAKE THIS SERIOUSLY.**

Answer each question by darkening the circle corresponding to your choice on the separate answer sheet. Pencils should be used to allow for erasing. Scratch calculations should be done in an open space on the exam. Questions have either three alternatives or four alternatives. Be careful to darken the correct circle on the answer sheet.

1. The price of a bond is 98. If the price value of a basis point is 0.155, then the duration must be:

- A. 13.16.
- B. 15.82.
- C. 16.23.
- D. 18.52.

$$\frac{0.155}{98 \times 0.0001}$$

2. An interest rate is quoted as 6% per annum with semi-annual compounding. What is the equivalent rate with continuous compounding?

- A. 5.9118%
- B. 5.8269%
- C. 2.9559%

$$1.06 = e^r$$

3. A lender quotes the interest rate on loans as 5% per annum with continuous compounding and the interest is paid quarterly. The equivalent rate with quarterly compounding is:

- A. 1.2578%
- B. 2.0508%
- C. 5.0314%

$$e^{0.05} = (1+r)^4$$

4. Assume that a straight bond has a duration of 2.89 and a convexity of 15.99. If interest rates decline by 1 percent what is the convexity adjustment that must be made to the duration only estimated percentage price change? Choose the closest answer.

- A. 1.160%.
- B. -0.130%.
- C. 0.130%.
- D. 0.160%.

5. A nonparallel shift in the yield curve:

- A. refers to a shift in which the change in the yield for all maturities is the same. ~~X~~
- B. means that the yield for different maturities changes by the same number of basis points. ~~X~~
- C. could appear as a twist in the slope of the yield curve or a change in the curvature of the yield curve.

6. Amanda Arella, CFA, is the fixed income portfolio manager for SC Associates. She is drafting some training materials for junior associates and is trying to address the most commonly raised questions regarding the term structure of interest rates and the related theories. Which of the following is an accurate statement about the liquidity preference theory (LPT)?

- A. The LPT is a biased expectation of yields with progressively longer maturities. ✓
- B. The LPT suggests that forward rates are an unbiased estimate of the market's expectation of future interest rates. ~~X~~
- C. The LPT states that investors should be expected to hold longer-term maturity investments for supply and demand reasons alone. ~~X~~

7. Candidates for use in constructing the theoretical spot rate curve include all of the following EXCEPT:

- A. ~~on-the-run Treasury issues.~~ ✓
- B. ~~Treasury coupon strips.~~ ✓
- C. all Treasury coupon securities and bills. ✓
- D. on-the-run Treasury issues and all off-the-run Treasury issues. D

8. Choose the correct statement.

If an issuer's yield curve is used as a benchmark, then:

- A. the zero-volatility spread reflects compensation for option risk and liquidity risk. ✓
- B. the nominal spread reflects compensation for credit risk and liquidity risk. ~~X~~
- C. the OAS reflects compensation for option risk and liquidity risk. ~~X~~

Use the following information to answer the next 3 questions

Elias Sandoval, CFA, manages a relatively small portfolio for one of his clients. Sandoval feels that interest rates will change over the next year but is uncertain about the extent and direction. He is confident, however, that the yield curve will change in a nonparallel manner and that modified duration will not accurately measure her portfolio's yield-curve risk exposure. To help him evaluate the risk of his clients' portfolio, he has assembled the table of rate durations shown below.

| Issue  | Value (\$1,000's) | 3 mo | 2 yr | 5 yr | 10 yr | 15 yr | 20 yr | 25 yr | 30 yr |
|--------|-------------------|------|------|------|-------|-------|-------|-------|-------|
| Bond 1 | 100               | 0.03 | 0.15 | 0.49 | 1.35  | 1.51  | 1.59  | 1.47  | 4.62  |
| Bond 2 | 150               | 0.05 | 0.14 | 1.47 | 0.00  | 0.00  | 0.00  | 0.00  | 0.00  |
| Bond 3 | 200               | 0.03 | 0.16 | 0.51 | 1.60  | 1.68  | 1.64  | 2.34  | 2.93  |
| Bond 4 | 250               | 0.06 | 0.00 | 0.00 | 0.00  | 0.00  | 0.00  | 0.00  | 0.00  |
| Bond 5 | 300               | 0.00 | 0.92 | 0.00 | 0.00  | 1.73  | 0.00  | 0.00  | 0.00  |

10%  
15%  
20%  
25%  
30%

0.0315 0.0344 0.5115 0.455 0.999 0.487 0.615 1.042

9

What is the value of the portfolio if only 4 rates change while the others remain constant?

- The 2-year rate increases by 30 basis points
- The 5-year rate increases by 60 basis points
- The 10-year rate increases by 80 basis points.
- The 30-year rate decreases by 160 basis points.

0.01002  
1010.02

- A. 1,009,867.
- B. 1,010,638.**
- C. 990,133.

10

If the entire yield curve undergoes a parallel shift whereby the rate at all key maturities decreases by 20 basis points, what will the value of the portfolio be?

- A. \$1,019,462.
- B. \$1,008,716.**
- C. \$998,716.

11. What is the 5-year key rate duration for the portfolio?

- A. 0.3715.
- B. 0.6824.
- C. 0.9220.

12. Suppose the U.S. Treasury yield is 2.9% for a five-year maturity and is 3.3% for a seven-year maturity. Similarly, the corresponding German government bond yield is 3.2% for the five-year and 3.5% for the seven-year. Then a dollar denominated swap spread based on a five-year swap rate of 4% would be quoted as:

- A. 110 basis points.
- B. 80 basis points.
- C. 70 basis points.
- D. 50 basis points.

13. Which of the following statements about the properties of bonds without embedded options is **TRUE**?

- A. All else equal, duration is inversely related to length of maturity.
- B. All else equal, duration is positively related to the level of coupon payments.
- C. At relatively low yields, prices increase at an increasing rate as yields decline.
- D. For bonds that have coupons, duration can be higher than the bond's term to maturity.

14. There has been an increasing trend to measuring corporate credit spreads relative to which of the following security classes?
- A. Asset-backed securities.
  - B. Swaps.
  - C. Treasury bonds of similar maturity.
  - D. Treasury strips of similar maturity.

15. Fred Klinger and William Bates are fixed income analysts. Bates, voices his belief in Pure Expectations. He postulates that if future spot rates turn out to be equal to what they are predicted to be by current forward rates, then the return on bonds of any maturity will be equal over any short-term holding period.

Klinger, intrigued by Bates' blind faith in the assumptions that form the basis of Pure Expectations, decides to further question Bates. He lists the current one-year spot rate of 2.55% and estimates what one-year forward rates will be over the next three years. (Assume annual compounding for this question only).

$${}_1f_1 = 2.60\%; \quad {}_1f_2 = 2.30\%; \quad {}_1f_3 = 1.20\%; \quad {}_af_b = \text{the a-period rate in b periods}$$

Based on Klinger's estimates above, what would Bates derive to be the current three-year spot rate?

- A. 2.37%
- B. 2.48%
- C. 3.25%

16. Using the following interest rate tree of annual rates what is the value of an option free bond that has one year remaining to maturity and has a 4% semiannual coupon rate?



- A. 98.67.
- B. 99.06.
- C. 100.02.

17. Consider the following yield curve and choose the correct statement from the list of alternatives below.

| Term to maturity | Yield  |
|------------------|--------|
| 6 months         | 2.875% |
| 1 years          | 3.056% |
| 2 years          | 3.250% |
| 5 years          | 4.350% |
| 10 years         | 4.790% |
| 30 years         | 5.340% |

- A. The 6-month and 1-year rates are quoted as money market rates.
- B. The 2-year, 5-year, 10-year and 30-year rates are quoted as money market rates.
- C. Rates for all maturities are quoted as money market rates.
- D. Rates for all maturities are quoted as annual rates compounded semi-annually.

18. You are analyzing yield volatility and want to construct a 95% confidence interval for the range of possible values of interest rate changes over a selected period of time. You estimate the following:

|                                                |            |
|------------------------------------------------|------------|
| Current Treasury Yield                         | 3%         |
| Standard Deviation for Selected Period of Time | 6%         |
| Normal Curve Values Containing 95% of the Area | $\pm 1.96$ |

Based on this data, what is the range of values that will contain the true yield with 95% confidence?

- A. 2.94%; 3.06%.
- B. 2.65%; 3.35%.
- C. 2.75%; 3.25%.

19. Which one of the following is a valid reason for the increased use of the swap curve relative to the government bond yield:

- A. there is little government regulation of the swap market. ✓
- B. technical factors in the swap market produce more reliable rate estimates. ✗
- C. similarities in sovereign credit risk make comparisons across countries of government yield curves easier. ✗
- D. there are fewer maturity points available to construct a swap curve than a government bond yield curve. ✗

20. According to the Preferred Habitat Theory:

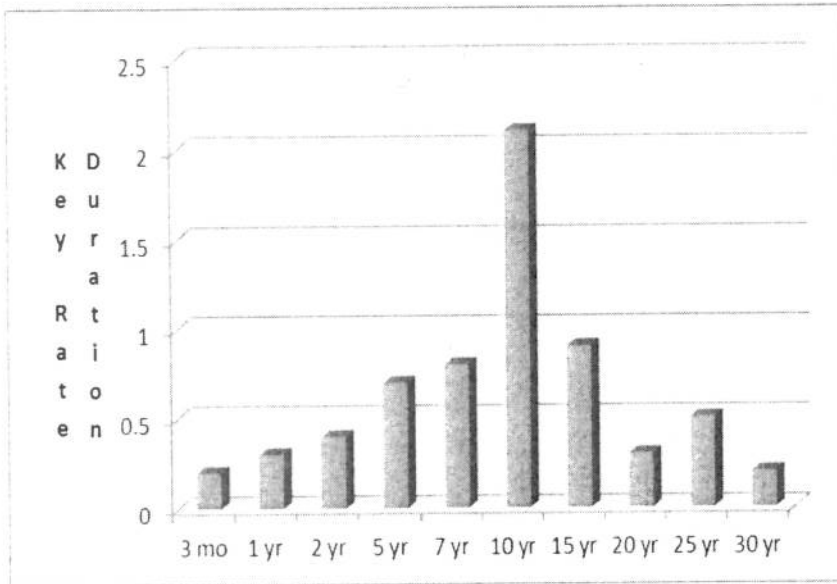
- A. the risk premium must rise uniformly with maturity. ✗
- B. the shape of the yield could be upward sloping, downward sloping or flat. ✓
- C. institutions have holding periods that are unrelated to the nature of their liabilities. ✗

21. Given the following five days of information about historical yields, what is the continuously compounded relative change in yield between day two and day three and between day three and day four?

| Day | $y_t$    |
|-----|----------|
| 1   | 3.5263   |
| 2   | 3.2232 - |
| 3   | 3.3897 - |
| 4   | 3.1697   |
| 5   | 3.4001   |

- |                                     | <u>Day 2 to Day 3</u> | <u>Day 3 to Day 4</u> |
|-------------------------------------|-----------------------|-----------------------|
| A.                                  | 5.0367% ✓             | 6.6301%               |
| B.                                  | -8.9875% ✗            | 1.6037%               |
| <input checked="" type="radio"/> C. | 5.0367% ✓             | -6.6301% ✓            |

22. Which type of bond portfolio has key rate durations consistent with the following chart?



- A. A bullet portfolio.
- B. A barbell portfolio.
- C. A ladder portfolio.

23. Which of the following scenarios will likely lead to a convertible bond outperforming the underlying stock?

- A. bond rating is downgraded.
- B. stock price rises.
- C. stock price falls.

24. The primary benefit of owning a convertible bond compared to owning the stock of the corporation is that:

- A. the convertible bond has lower downside risk ✓
- B. the conversion premium is tax deductible. ✗
- C. the stock has less upside potential ✗

25. A problem with implied volatility is that:

- A. it assumes that there are a variety of alternative option pricing models that could be used. ~~X~~
- B. interpreting the value becomes difficult because option pricing models often assume that volatility is constant over the life of the option.
- C. it assumes that option prices are variable. ~~X~~

26. A putable bond with a 4.0 percent annual coupon will mature in two years at par value. The current one-year spot rate is 5.0 percent. For the second year, the yield-volatility model forecasts that the one-year rate will be either 5.4 or 6.5 percent. The bond is putable in one year at 101. Using the binomial interest rate tree, what is the current value of this putable bond?

- A. 101.00.
- B. 101.35.
- C. 100.00.
- D. 99.81.



27. Using the bootstrapping approach and given the following data for three securities, what is the annualized one-year spot rate based on the 1.5 year security?

| Term to maturity | CPN                                 | YTM<br>(Annual rate, S.A. CPN) | Price   | Discount Factor | Spot Rate<br>(Annual rate, comp. S.A.) |
|------------------|-------------------------------------|--------------------------------|---------|-----------------|----------------------------------------|
| 0.5 Yr           | 0                                   | 3%                             | 98.522  | 0.98522         | 3.000%                                 |
| 1 Yr             | 4%                                  | 3.50%                          | 100.487 | 0.96585         | 3.505%                                 |
| 1.5 Yr           | <input checked="" type="radio"/> 6% | 5.00%                          | 101.428 | ?               | ?                                      |

- A. 5.366%.
- B. 5.115%.
- C. 5.051%.

Handwritten calculations for bootstrapping:

- 0.954219
- 0.9079

28. The following are the yields on various bonds. The relevant benchmark is that of Treasury securities.

|                       |       |
|-----------------------|-------|
| Treasury Bond Yield   | 4.00% |
| Bond Sector Yield     | 4.50% |
| Comparable Bond Yield | 5.00% |
| ABC Bond Yield        | 5.50% |

Is the ABC bond undervalued or overvalued and why? Using relative value analysis, the ABC bond is:

- A. overvalued because its yield is greater than that of Treasuries.
- B. undervalued because its spread is greater than that of comparable bonds.
- C. overvalued because its spread is lower than that of comparable bonds.

- ★ 29. You observe a 1-year (zero-coupon) Treasury trading at a YTM of 3 percent (price of 97.0874 percent of par). You also observe a 2-year T-note with a 5 percent coupon trading at a price of 100.4732. Assuming ANNUAL coupon payments in both cases, what is the 2-year spot rate using the bootstrapping method?

5% 0.91065

- A. 3.7651%
- B. 3.8835%
- C. 4.7688%
- D. 4.7688%

30. Which of the following is *closest* to the annualized yield volatility (250 trading days per year) if the daily yield volatility is 0.733%?

- A. 7.12%.
- B. 9.74%.
- C. 11.59%.
- D. 13.47%.

31. Which of the following is a key consideration when daily yield volatility is annualized?

- A. The shape of the yield curve. ~~X~~
- B. The appropriate time horizon. ~~X~~
- C. The appropriate day multiple to use for a year.

32. For a given three-day period, the interest rates are 3.0%, 3.1% and 3.0%. What is the yield volatility over this period?

0.001

- A. 0.0328.
- B. 0.0368.
- C. 0.0464.

33. Suppose that the sample mean of 30 daily yield changes is 0.12%, and the sum of the squared deviations from the mean is 4.5722. Which of the following is *closest* to the daily yield volatility?

- A. 0.6859%.
- B. 0.5430%.
- C. 0.4471%.
- D. 0.3971%.

34. Consider an annual pay two-bond, portfolio as follows:

- i. A two-year 4% coupon bond priced at par
- ii. A three-year 5% coupon bond priced at 101.5

The yield to maturity of the bond portfolio is closest to:

- A. 5.0947%.
- B. 4.5947%.
- C. 4.2718%.

35. On a given day, a bond with a put provision rose in value by 2%. What can be said with respect to the level and volatility of interest rates?

- A. The level of interest rates may have remained constant, but the volatility of interest rates rose. ✓
- B. The level of interest rates must have fallen. ✗
- C. The level of interest rates may have remained constant, but the volatility of interest rates fell. ✗

36. The problem with using treasury coupon strips to derive the theoretical spot rate curve is that:

- A. they may be biased due to an unfavourable tax treatment. ✗
- B. observed yields may not reflect a liquidity premium. ✓
- C. they are not as accurate as the rate at which fixed cash flows can be exchanged for floating cash flows.

37. Tom is a portfolio manager. He is considering the purchase of corporate bonds. The following two bonds are from the same issuer:

|                             |                               |
|-----------------------------|-------------------------------|
| Bond A                      | Bond B                        |
| Non-Callable                | Callable                      |
| Price: \$104.24             | Price: \$102.68               |
| Time to maturity: 5.0 years | Time to maturity: 5.0 years   |
| Coupon: 5.00%, SA           | Coupon: 5.00%, SA             |
| Yield to Maturity: 4.054%   | Yield to Maturity: 4.023%     |
|                             | Time to first call: 0.0 years |

What is a reasonable estimate for the value of the embedded call option of Bond B?

- A. \$1.79.
- B. \$1.00.
- C. \$1.56.

38. In class we defined the par bond rate (also known as the par yield) as the coupon rate that would price a bond at par given the spot rate curve. We showed that:

$$coupon = \frac{100 - 100d_n}{\sum_{i=1}^n d_i}$$

The  $d$  values are discount rates for different maturities. Assume we are operating in continuous time. As such each discount factor is of the form:  $d = e^{-rT}$  where  $r$  is the continuously compounded annualized spot rate and  $T$  is the maturity of each spot rate. Suppose annualized spot rates are given in the following table as:

| Period of time        | Annualized spot rate |
|-----------------------|----------------------|
| 6 months = 0.5 years  | 3.0%                 |
| 12 months = 1.0 year  | 3.5%                 |
| 18 months = 1.5 years | 4.0%                 |
| 24 months = 2.0 years | 5.0%                 |

Based on this information, what is the two-year par yield?

- A. 3.007%.
- B. 3.594%.
- C. 5.012%.

*Handwritten calculation:*  
 $e^{-0.03(0.5)} + e^{-0.035(1)} + 2e^{-0.04(1.5)} + e^{-0.05(2)}$

*Handwritten result:* 3.7973

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

min

- A. Max(par value, discounted value).
- B. Min (call value, discounted value).
- C. Min (par value, discounted value).
- D. Max (call price, discounted value).

~~X~~ 40. In using a weighted average technique to forecast yield volatility the usual approach is to:

- A. multiply squared deviations by an average weight over a period of time in the past.
- B. use higher weights for more recent yield change observations with the sum of the weights equaling  $T$ .
- C. use higher weights for more recent yield observations with the sum of the weights equaling  $T-1$ .
- D. use lower weights for more recent yield observations with the sum of the weights equaling  $T-1$ .

41. The main difference between modified duration and effective duration is that:

- A. modified duration does not allow for the fact that the cash flows for a bond with an embedded option may change due to the exercise of the option.
- B. effective duration does not take into account how changes in interest rates in the future may change the cash flows due to the exercise of the option.
- C. modified duration is able to more easily capture the impact that an embedded option will have on the cash flows of a bond.

42. You determine that the PVBP (DV01) of a corporate bond is 11.1234 while the PVBP for a Treasury is 8.1525. If you manage a portfolio of \$20 million worth of the corporate bond, how could you go about hedging this position using the Treasury? Choose the best response.

1.3644

- A. Sell \$20 million worth of the Treasury.
- B. Buy \$20 million worth of the Treasury.
- C. Sell about \$27.288 million of the Treasury.
- D. Buy about \$27.288 million of the Treasury.

43. Choose the correct statement.

If Treasury market rates are used as a benchmark, then:

- A. the zero-volatility spread reflects compensation for credit risk and liquidity risk. ✓
- B. the nominal spread reflects compensation for credit risk and liquidity risk.
- C. the OAS reflects compensation for credit risk and liquidity risk.

W 44. *wrong* Billy Elliot, CFA, is analyzing the price volatility of Bond Y. Y's effective duration is 9.5, and its effective convexity is 95.7. What is the estimated price change for Bond Y if interest rates fall/rise by 125 basis points?

- |                                     | <u>Fall</u> | <u>Rise</u> |
|-------------------------------------|-------------|-------------|
| A.                                  | +14.68%     | -10.82%     |
| <input checked="" type="radio"/> B. | +13.37% ✓   | -10.82%     |
| C.                                  | +14.68%     | -10.38%     |

45. Consider the following two statements:

- I. The Black-Scholes model can be used to determine the option value of a *callable* bond.
- II. The Black-Scholes model can be used to determine the option value of a *convertible* bond.

In evaluating these two statements, determine the most accurate choice from among the following alternatives.

- |                                     | <u>Statement I</u> | <u>Statement II</u> |
|-------------------------------------|--------------------|---------------------|
| <input checked="" type="radio"/> A. | False              | False               |
| B.                                  | False              | True                |
| C.                                  | True               | False               |
| D.                                  | True               | True                |

**Let's see how risk-averse (or risk-loving) some of you are.**

**EMBEDDED OPTION (Beware: This option, if exercised, CAN have a negative impact)**

Indicate your preference from the choices below by darkening question 46 on the answer sheet with the letters A. (for choice 1 – the 25% alternative); B. (for choice 2 – the status quo) or C. (for choice 3 – the 35% alternative). If left blank or if more than one letter is darkened, the 30% choice (B) will apply.

I want this test to count for: A. 25% of my final grade. In this case the final exam will be worth 45% not 40%.

B. 30% of my final grade. The status quo.

C. 35% of my final grade. In this case the final exam will be worth 35% not 40%.

**PLEASE TAKE THIS SERIOUSLY AS IT MAY AFFECT YOUR FINAL GRADE IN THIS COURSE**