

**SIMON FRASER UNIVERSITY**  
*Faculty of Business Administration*

**Midterm Examination**

BUS 417-D1  
Security Analysis

06-3

**Rules for Submission:** Answers to questions in Part I are to be typed, single spaced, of maximum length 1 page **each** for all questions, with 1" margins and type point not less than 12. (This assignment is typed in 12 point.) Violations will be subject to deductions. There are no page constraints in Part II. Assignments are due in class Nov. 6, 2006. Be sure to answer all parts of each question selected.

**PART I.**

**ESSAY QUESTIONS. 20 pts. each -- 10 pts each part for questions with a) and b) parts.**

1. Contrast the solution method used to solve for the value of a single life annuity used by de Witt and Halley. Be sure to explain the connection of each pricing method to pricing using discounted expected value. Stating any relevant assumptions used to obtain the solution, explain the procedure de Moivre used to derive his life annuity valuation formula. Is it possible for the value of a life annuity to be greater than the value of a term annuity with term to maturity equal to the expected duration of life?

2.a) "For a callable bond, it is inappropriate to use modified duration (and convexity) because the expected cash flow changes as the yield changes....A change in interest rates will affect the price volatility of the noncallable bond component depending on the duration of the noncallable bond. It will also affect the price of the embedded call option." Explain how the option adjusted duration measure for a callable bond is derived and how this measure and the option adjusted convexity measure can be used in the analysis of callable bonds. How would your answer change if the bond is a mortgage backed security?

b) An important drawback of "traditional yield spread analysis" is the "failure to take into account future interest rate volatility that would affect the expected cash flow" of a fixed income security. What is option adjusted spread analysis and how does this technique correct for this limitation of traditional yield spread analysis in the valuation of bonds with embedded option features? Once the option adjusted spread has been determined, how can the cost of option be calculated? What are some important pitfalls of option adjusted spread analysis?

3.a) "Whether the bond market moves up or down, high-convexity portfolios will always outperform low-convexity portfolios of equal duration and yield." Explain the argument supporting this statement. What factors would tend to undermine this position?

b) Explain this statement: "...the larger the convexity on a portfolio, the less the value of the portfolio rises over time if the interest rate remains unchanged." What are the implications of this result for the asset/liability managers seeking to control interest rate risk for a the fixed income portfolio of a life insurance company? Is it true that "the cost of a higher convexity is a lower yield"?

(Hint: In your answer be sure to address the tradeoff between time value and convexity.)

**PART II: REQUIRED NUMERICAL AND DEFINITIONS QUESTIONS**

**(10 points each question, where relevant please show formulas used and calculations)**

1. You are in the Vancouver market for a house. Your effective all-in market borrowing rate for a 5 year term house mortgage from a chartered bank is 5.65%. One of the houses you are considering purchasing has an assumable \$500,000, 6 year mortgage at 3.45%, with a 21 year amortization. The asking price on the house is \$800,000. What is the value of the concessionary financing for this house?
2. Assuming arithmetically declining survival rates and an interest rate of 4%, what is the Macaulay duration of a life annuity for a 24 year old person that cannot live beyond 95 years.
3. In no more than three sentences per part (plus equations), define the following:
  - i) classical immunization strategy;
  - ii) implied forward rate;
  - iii) unbiased expectations hypothesis of the term structure;
  - iv) self-calibrating interest rate process;
  - v) cumulative normal distribution function.
4. From the US Government bill, bond and note information provided in Table 1.9 of the text, calculate spot interest rates (implied zero coupon interest rates) for all semi-annual cash flow payment dates for the following five years. A complete answer will provide relevant calculations for the 10 spot interest rates required.