

Name: _____ M.I.T. ID# or S.S.#: _____

15.407 Midterm Exam

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Fall 2002

- The exam lasts 90 minutes.
- The exam consists of five questions. Please answer all of them.
- Credit for a question is exactly in proportion to the time allotted.

Question	Points/Minutes
1	/30
2	/15
3	/20
4	/10
5	/15
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Total	/90

- You are allowed one $8\frac{1}{2}'' \times 11''$ sheet of formulas and one calculator.
- You are to answer these questions without consulting anyone.
- Be neat and show your work. Answers without work receive no credit. Wrong answers with partially correct work may receive partial credit.
- Allocate your time optimally.

1. (30 minutes) True, false or uncertain? Briefly explain (or qualify) your answer.

(a) The rule to maximize the current market value of the firm assumes that shareholders all agree with the values of the firm's assets.

(b) When people discount a future cash flow to compute its present value, they use different discount rates depending on the rates they can borrow from banks.

(c) The price of a Treasury bond is determined by the yield to maturity on other Treasuries with similar maturities.

(d) Bonds with higher yield to maturity tend to give higher returns.

(e) In principle, the market price of a share of stock equals the discounted value of the stream of future earnings per share.

(f) Forward price is always higher than the spot price because it is the price you pay in the future for the same commodity or asset.

2. (15 minutes) You are planning to save to buy a Back Bay real estate in three years (year 3). Properties you are interested in are currently selling at \$1 million. The real estate prices in Back Bay are expected to stay the same in real terms for the next three years. You want to start saving immediately (year 0) and increase your nominal saving 10% per year until year 3. The nominal return on your savings is 4% and the expected inflation is 4%. What should be the amount of your first deposit? (For simplicity, assume no taxes and all cash flows occur at year end.)

(Additional space for question 2)

3. (20 minutes) Here are closing quotes for 4 Treasury securities in October, 2002.

Treasuries	Coupon	Maturity	Asked Price	Asked Yield
Note	6.5	Feb. 2010	119:08	3.50%
Note	5.0	Feb. 2011	109:20	3.65%
STRIPS	0	Feb. 2010	76:22	3.65%
STRIPS	0	Feb. 2011	73:08	3.77%

- (a) Suppose you buy the Feb. 2011 note and hold it to maturity. How much would you have to pay (approximately)? What cash flows would you receive, on what dates?
- (b) What are the spot interest rates for February 2010 and February 2011?
- (c) What is the forward rate of interest between February 2010 and February 2011?
- (d) Which of these securities has the shortest duration? Explain.
- (e) What is the convexity of the February 2010 STRIPS? Explain what convexity means.

(Additional space for question 3)

4. (10 minutes) Your rich aunt has died. Her will gives you ownership of 5,000 shares of Plum Creek Timber Company, currently trading at \$22 per share. But various legal complications will delay distribution of your aunt's shares to you until October 2003.

Plum Creek now pays an annual dividend of \$1.40 per share out of earnings of \$1.60 per share. Assume for simplicity that the next dividend will be paid in September 2003, just before you will receive the shares. (Therefore you will not receive the next dividend.) In the past Plum Creek's dividend has an average growth rate of 3% per year. This is a reasonable long-term trend, but security analysts are pessimistic for the immediate future. They forecast no growth in earnings and dividends for the next 3 years.

Plum Creek is a relatively safe security. Investors are content with an 8% expected rate of return.

- (a) Is Plum Creek a growth stock? Explain.
- (b) A bank offers to buy the shares from you for \$19.50 per share paid immediately. (The bank would pay \$19.50 per share now and receive the shares next October.) Is this a fair offer?

(Additional space for question 4)

5. (15 points) Oil is currently trading at \$27 per barrel. The futures price for December, which matures 60 days from today, is \$26.70. Treasury bills maturing on the same day yields an effective annual interest rate of 3%.

- (a) What is the net convenience yield of oil now?
- (b) You run an oil refinery and usually keep an oil reserve. The net convenience of oil is 12% per year for you. What would you do given the current market conditions?
- (c) You need 1 million barrels of oil in November. Historic data shows that changes in spot oil price, denoted by ΔS , and changes in futures price, denoted by ΔH , satisfy the following statistic relation:

$$\Delta S = 0.8\Delta H + e$$

where e is the noise term. If you want to use oil futures to hedge the risk in future oil prices, how many futures contract do you need to purchase? (Each contract has a size of 1000 barrels.)

(Additional space for question 5)