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

15.407 Final Exam

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Fall 2002

- The exam lasts 180 minutes.
- The exam consists of 10 questions. Please answer all of them.
- Credit for each question is exactly proportional to the time allotted.

1	/40
2	/20
3	/10
4	/15
5	/25
6	/ 7
7	/ 8
8	/25
9	/10
10	/20
Total	/180

- You are allowed two $8\frac{1}{2}$"$\times$11" sheets of formulas and one calculator.
- Please answer these questions without consulting anyone.
- Use the space provided. If more space is needed, use the other side.
- 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. (40 minutes) True, false or "it depends". Briefly explain your answer in each case.

   (a) Maximizing firm's market value is equivalent to choosing projects with highest expected returns.

   (b) If bond X has a higher yield to maturity than bond Y, X is usually the better investment.

(c) Growth stocks usually have fast growing dividends.

(d) Futures prices for natural gas are always higher for long-term contracts than for short-term contracts. This pattern of prices is caused by the time value of money.

(e) If a three-month call option trades at the money (stock price equals exercise price), then a put with the same exercise price and maturity must be worth less than the call.

(f) Diversification reduces risk only when asset returns are uncorrelated.

(g) Assets with more volatile returns (higher standard deviation or variance) should earn higher returns on average because they are riskier.

(h) In valuing risky projects, the correct discount rate is the expected rate of return required by investors on the firm's common stock.

2. (20 minutes) The Wall Street Journal gives the following prices for the STRIPS:

Maturity (years)	1	2	3
Price (% of par value)	97.56	95.18	92.86

Suppose that you are required to pay out $10 million every year for the next three years.

(a) Calculate the present value of this liability.

(b) Calculate the duration of the liability.

(c) Suppose that you want to set aside $20 million to pay part of the liability and this amount will be invested in STRIPS. In order to eliminate interest rate risk, what portfolio of STRIPS should you pick (no short position in the STRIPS is allowed)?

(d) Suppose you invest the portfolio from part (c). What happens to the value of your $10 million net liability if interest rates increase by 0.10% (10 basis points)?

3. (10 minutes) Beta Inc. faces an opportunity to expand its current business. The expansion can earn a return on equity of 12%. Beta Inc. is 100% equity financed. Its shares are traded on NASDAQ. Regression analysis shows that it has a market beta of 0.8. Assume that CAPM holds. Is Beta a growth stocks.

   (a) Should Beta Inc. expand?

   (b) Suppose Beta Inc. does expand. Is it correct to say that Beta Inc. is a growth stock? Briefly explain.

   Use reasonable estimates for the market premium and risk-free rate and briefly explain your choices of the estimates.

4. (15 minutes) The spot price for smoked salmon is \$5,000 per ton and its 3-month futures price is \$4,800. The monthly interest rate is .0025 (.25%) per month .

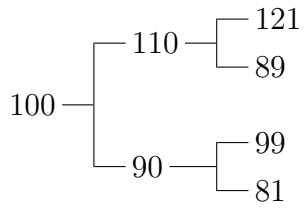
   (a) What is the average monthly net convenience yield on smoked salmon for the next 3 months?

   (b) If you are a manager of Bread&Circus and need 10 tons of smoked salmon in 3 months. How can you avoid the risk in the price of smoked salmon over the next 3 months using futures?

   (c) Suppose that your net convenience yield for smoked salmon is 2% per month. How does this change your hedging strategy?

5. (25 minutes)

The price of stock X for the next 6 months can be described by the following binomial tree: an increase or a decrease of 10% over each 3-month period with equal probabilities



The 3-month interest is 0.25% (not annualized). Consider a European-style put option on stock X with a maturity of 6 months with a strike price of \$100.

(a) Plot the payoff of the put at maturity as a function of the share price then.

(b) Compute the initial value (current price) of the put.

(c) If you buy one put option, compute your net gains/losses at maturity for different values of the stock price.

(d) What is the value of the put if it is American-style instead of European?

(*Additional space for question 5*)

6. (7 minutes) The government has just increased its forecast for aggregate consumption growth over the next year. How do you expect the 1-year real interest rate to change? Briefly explain.

7. (8 minutes) James Bond (not the 007), a successful bond trader explains his secrets in forecasting changes in interest rates: "An upward-slopping yield curve implies that the interest rate on average will go up. What advice do you have for Mr. Bond?

8. (20 minutes)

Your company offers three funds to its employees for their pensions: a money-market fund, an S&P 500 index fund and a new-economy equity fund. You need to form a portfolio from these funds for your own pension investments.

The money-market fund is invested in 3-month Treasury bills, now with a risk-free return of 2% per annum. The index fund gives a premium of 8% and a standard deviation of 20% per annum. The new-economy fund's return can be described by the following equation:

$$r_t - r_F = \alpha + \beta(r_{Mt} - r_F) + e_t$$

where r_t and r_{Mt} are the fund and market returns, r_F is the risk-free return, α is a constant, and e_t is the part of the fund's returns not explained by the market. The performance of the fund over the past gives

- $\alpha = 0.0$
- $\beta = 1.0$
- $R^2 = 0.50$ (proportion of the variance of the fund's return explained by the market return).

(a) Compute the expected return of the new-economy fund using CAPM.

(b) If CAPM holds, what is the optimal portfolio to achieve an expected return of 8% per annum.

(c) If instead, the estimate of α is 0.020 (2% per annum) with a standard error of 0.002. Briefly describe what your optimal portfolio (with expected return of 8%) may be and explain why.

(d) Compute the optimal portfolio, again with an expected return of 8%.

(*Additional space for question 8*)

9. (10 minutes)

Suppose that asset returns can be described by a two-factor APT model:

Factors	Factor risk premium (%)
Market	6.5
Interest rate	-1.0

The risk-free rate is 2%. As a money manager, you are managing two portfolios, A and B. They have the following factor risks:

Stock	Market (b_1)	Interest rate (b_2)
A	1.2	0.0
B	0.8	-0.5

(a) Calculate the expected return on the two stocks using APT.

(b) A potential client is willing to invest \$100 million with you if you can offer a portfolio such that (1) it has a beta of 1 with respect to the market and (2) beats the market portfolio on average. Can you offer such a portfolio? If yes, how and if no, why?

10. (20 minutes)

You have developed a technology to use gold to produce high capacity fiber optic switches. The technology has already cost $5 million to develop. You need $50 million of initial capital investment to start production. Switch sales are forecasted at $25 million per year for the next 5 years and zero afterwards. The main cost of production is gold. Each year, you need 20,000 ounces of gold. Gold is currently selling for $300 per ounce. Your supplier thinks that the gold price will appreciate at 5% per year for the next 5 years. The cost of capital is 10% for the fiber-optics business. The tax rate is 35%. The capital investment can be depreciated straight-line over the next 5 years.

(a) Calculate the after-tax cash flows of the project.

(b) Should you take the project?

(*Additional space for question 10*)