ECONOMICS 136

FINAL EXAM

THIS EXAM HAS THREE SECTIONS:

I.	**True/False**	**21 points**
II.	**Problems**	**64 points**
III.	**Essay**	**15 points**

INSTRUCTIONS:

You have 3 hours to answer all questions. Number your blue books, and be sure to put your name and your GSI's name on all of them.

You are allowed to use three two-sided sheets of notes and a calculator.

GOOD LUCK!

PART I (21 points, 3 each)

Are the following statements true of false? Explain in no more than two sentences. You will be graded both on your answer and the explanation.

1) When the riskfree rate increases, the optimal portfolio share of risky assets for a mean-variance investor is unaffected.

2) Marking to market implies that any increase in the futures price is immediately credited to the party holding the short position.

3) ABC and XYZ have the same price today. ABC pays no dividends, while XYZ pays quarterly dividends. Then the forward price for delivery in one year of ABC must be lower than that of XYZ.

4) PQR pays no dividends. An American put on PQR with strike \$10 is trading at \$2.27, while another American put on PQR with the same expiration date and strike \$11 is trading at \$2.14. There is an arbitrage opportunity.

5) The return of an equal weighted portfolio of two investments always has lower variance than the variance of the return of either investment.

6) For an investor holding a bond portfolio, an increase in yields is typically bad news.

7) Consider a European call and a European put for the same non-dividend-paying stock, same expiration T, and same strike $X = F_0^T$ which is the forward price of the underlying for delivery date T. Under no arbitrage the two options have the same price today.

PART II

Note: Use natural units; e.g., a standard deviation of 20% means $\sigma = 0.2$ and σ^2=0.04.

1. Time-varying betas (28 points, 4 each)

Consider an economy over three periods, $t = 0$, $t = 1$ and $t = 2$. At $t = 0$, the market stock index is trading at a value of \$100. At $t = 1$, the market either rises by 20 with probability 3/4 or falls by 20 with probability 1/4. Following either outcome at $t = 1$, the market either increases by 20 with probability 3/4 or falls by 20 with probability 1/4. Thus the highest possible market value at $t = 2$ is 140, and the lowest is 60. The market pays no dividends, and a riskfree bond earns a safe net return $R_f = 0$ each period.

Consider a European put on the market with strike price $X = \$100$ expiring at $t = 2$.

(a) Draw the event tree of this economy. For all nodes at $t = 2$, compute the probability of reaching that node and the payoff of the put option in that node.

(b) Consider the node at $t = 1$ when the market has gone down. Call this "**node X.**" Construct a portfolio of the market and the riskfree bond at node X that replicates the subsequent payoffs of the put at $t = 2$. Under no arbitrage, what should be the put price at node X? What is the put price at the other node at $t = 1$?

(c) Now construct a portfolio of the market and the bond at $t = 0$ that replicates the put prices at $t = 1$. Under no arbitrage, what is the put price at $t = 0$?

(d) We will now verify CAPM for the period following node X. First compute the realized net return of the market R_m between $t = 1$ and $t = 2$ for both possible outcomes after node X. Also compute the realized net return of the put R_p between $t = 1$ and $t = 2$ for the two outcomes after X. What are the expected returns ER_m and ER_p at node X?

(e) We will now compute the beta of the put β_p at node X using the regression $R_p - R_f = \alpha_p + \beta_p \cdot (R_m - R_f) + \varepsilon_p$. In (d) we computed two realizations of R_p and R_m corresponding to the two possible outcomes after node X. The regression equation must hold for both of these realizations. It turns out that ε_p will be zero here, so we have two equations for two unknowns, α_p and β_p. Solve these equations. What is the beta of the put? (Intuitively: by what factor do you have to multiply R_m to get R_p?) Using this beta, does CAPM correctly predict the expected return of the put at node X?

(f) Now compute the beta of the put between $t = 0$ and $t = 1$ using a similar procedure. Is this beta the same as in (e)? What are the expected returns of the market and the put between $t = 0$ and $t = 1$? Does the CAPM prediction hold for the put for this period?

(g) Now consider the put return between $t = 0$ and $t = 2$. It can be shown that the beta of the put over this horizon is -2.5. Use this to check whether CAPM holds for the put between $t = 0$ and $t = 2$. What is the alpha of the put for this investment horizon? If the alpha is non-zero, do you think that EMH fails, or that CAPM is not the right asset pricing model between $t = 0$ and $t = 2$? What may be a problem with CAPM here?

2. The cross-section of returns (20 points, 4 each)

Consider an economy where the riskfree rate is $R_f = 3\%$, and the return of the market portfolio has expected value $ER_m = 7\%$ and standard deviation 20%.

(a) The covariance between the return of ABC stock and the return of the market is 0.06. What ABC's beta? Under CAPM, what should be ABC's expected return?

(b) Suppose that ABC pays dividend $D_1 = \$5$ next year, and dividends are expected to grow at a rate of 5% per year. Using your answer from (a), compute the current stock price P_0 of ABC. What is the dividend-price ratio D_1/P_0?

(c) The return of stock XYZ has a covariance of 0.12 with the market return. XYZ also pays dividends $D_1 = 5$ next year, and the expected dividend growth rate is also 5% per year. What is the beta of XYZ? Under CAPM, what is it's expected return? What is the current price P_0 of XYZ? What is the dividend-price ratio D_1/P_0?

(d) In the data, do stocks with high dividend-price ratios earn higher expected returns? What is the name of this fact? Are ABC and XYZ consistent with these data? What explains the difference in expected returns between ABC and XYZ in this problem?

(e) In the data, do stocks with high dividend-price ratios have higher CAPM betas? Does this help explain their average returns? Are ABC and XYZ consistent with these data? Empirically, do stocks with high dividend-price ratios have higher betas with respect to some other asset pricing factor? Which factor? Explain.

3. Welfare effects of risk (16 points, 4 each)

Consider an economy where CAPM holds, the riskfree rate is $R_f = 2\%$, and the return of the market portfolio has expectation $ER_m = 10\%$ and standard deviation 40%.

(a) Draw the capital market line. What is the optimal portfolio of a mean-variance investor with risk aversion $A = 2$? What is the mean and standard deviation of this portfolio? Show this portfolio in the figure. What is the value of this investor's mean-variance utility function if he invests in this optimal portfolio (i.e., what is $ER_p - (A/2)\,Var\,(R_p)$)?

(b) What is the optimal portfolio of an investor with risk aversion $A = 4$? What is its mean and standard deviation? Show this portfolio in the figure too. What is the value of this investor's mean-variance utility function when investing optimally?

(c) Now suppose that due to a reduction in uncertainty, the standard deviation of the market return falls to 20%, while other parameters are unchanged. Draw the new capital market line. What are the new optimal portfolios of the two investors? What are these portfolios' means and standard deviations? Show them in the figure. Which investor's portfolio share of risky assets changes by more relative to earlier? Why?

(d) What are the values of the two investors' utility functions now, given their new optimal investments? Which investor's utility increases by more relative to before? Why? Comment on this statement: "Reductions in risk are most beneficial to conservative investors who are highly sensitive to fluctuations in their wealth."

PART III – ESSAY (15 points)

Write a *short* essay on the topic below. The essay will be graded on the quality of your arguments and not length.

Mortgage backed securities and bank runs

(a) (4 points) Suppose that a mortgage pool is exposed to default risk. Explain tranching and how it helps manage this risk using an example with two states of the world, where the pool has a low value in the bad state.

(b) (4 points) What is prepayment risk? When is a mortgage pool likely to be prepaid? Why is prepayment bad for investors? How can tranching help with prepayment risk?

(c) (4 points) Suppose that an investment bank financed by short-term debt invests in illiquid CMOs. Develop an example to demonstrate how two possible outcomes can arise, one with a bank run, the other without.

(d) (3 points) Explain how a wealthy investor can step in and prevent the bank-run outcome.