Instructions. This exam is closed book and closed note. If you have a question, raise your hand. Scratch pages are not allowed. Write your answer in the space provided or in an equal space elsewhere. Spill-overs and illegible writing are penalized.

1. A. Define a call option. In a well-labelled diagram, show the pay-offs at expiration of a call option. Why does the value of a call rise when the risk of the underlying share increases?

B. A U.S. Treasury bond can be stripped to separate the coupon payments from the repayment of principal. Suppose the stripped coupons have a market value of $600 and the stripped principal has a market value of $410. The value of the bond should be $1010. Suppose for purposes of contradiction that the market mispriced the bond, giving it a value of $990. Construct a riskless arbitrage to take advantage of the mispricing.

2. A firm is considering an investment project that costs $1000 in time-zero money. Cash flows from the project are $100 during each of the first 15 years, paid at the end of each year, after which the cash flows grow at 5% per annum forever. The annual interest rate is 10 percent. Show that the project has a positive net present value, and explain your calculations clearly.
3. In the Miller “clienteles” model, the firm cannot ordinarily raise its value by changing leverage, and the leverage of the market as a whole is determined by market forces. Explain.

4. Active Radiation Inc. has designed a new drug to treat the common cold. If it markets the drug immediately there is a 50% chance of a successful marketing effort, in which case the present value of the payoff is $1 billion, and there is a 50% chance of a failure, in which the present value of the payoff is $100 million. Alternatively, the firm could delay the launch by one year and in that time, at a cost of $200 million in time-zero dollars, it could test market the drug and thereby improve the probability of a success to 80%. The rate of discount is ten percent. Show how the firm should view the problem of whether to go to market immediately or spend a year (and some money) in refining the marketing strategy? What is the correct decision?
5. A firm with no debt has a market value of $300,000. The firm issues debt with a market value of $150,000 and uses the proceeds to buy back $150,000 of its equity. The corporate tax rate is 34% and the firm has no possibility of financial distress. Explain why the value of the levered firm is $351,000, and explain why the value of the equity is $201,000.

Suppose that the required return on the equity of the levered firm is 16% and the rate on the firm’s debt is 7%. Show that the weighted average cost of capital for the levered firm is 11.13675%?

B. Consider a firm which, if it issued no debt, would have a required return to equity of 18%. However, the firm actually has a debt-equity ratio of 1/2. The interest rate on its debt is 9%, and the corporate tax rate is 34%. Show that the required return on the equity of the levered firm is 20.97%. Explain why it is higher than the 18%.

6. You are an investor and trying to collect information about the stock of firm A. The return on the stock of firm A is $R_A$, and the return on the market portfolio is $R_M$.

A. $\text{var}(R_A) = 0.81$, $\text{var}(R_M) = 0.25$, correlation coefficient $\rho_{M,A} = 0.9$. Show that the beta on the stock of firm A is 1.62.

B. The risk-free return is 3 percent, and the market risk premium is 7 percent. Draw the Security Market Line. Label the drawing carefully. Define the labels. What is the expected return on the market portfolio?

C. Show that the required return (which is the same as the expected return) on the stock A is 14.34.