Name:_____

Finance II (441) Professor Sapienza

Corporate Finance Midterm: Fall 2004

1) Time limit: you have 1 hour and 30 minutes to complete the exam.

2) The exam is closed book/closed note. Scratch paper and a formula sheet are provided and you may not use any outside materials except for a calculator or excel.

3) Point totals for each question are specified in parentheses. There are 120 total points.

4) Circle your numerical answers. This makes it easier for me to find them. If you get stuck on the math, tell me what the correct answer should be based on your intuition.

5) Unless the question specifies otherwise, there are no taxes or transaction costs.

6) **As always, I expect you to abide by the honor code**. I trust that no one will give or receive assistance which gives them an unfair advantage over other students.

7) Concise answers will be rewarded.

Good Luck!

Question	Points
1 (25)	
2 (40)	
3 (30)	
4 (25)	

Midterm Exam

1) Financial options

CHUGAI MINING CO., LTD. closing price on the Tokyo Stock Exchange was ¥50 on July 27th 2004. As of July 27th 2004 you invested by purchasing a one year call and by selling a one year put on CHUGAI MINING CO., LTD. The call option has a strike price of ¥60 and a price of ¥5.50. The put option has a strike price of ¥40 and a price of ¥2.50. Draw the gross payoff for this portfolio at expiration (one year from now). Label your diagram clearly. (10)

B) The expected return on CHUGAI MINING CO., LTD equity is 10% and the current yield on one year Japanese government bonds is 3% (you can assume that one year government bonds are risk-free). What can you say about the expected return on the portfolio that you built in A? Be as specific as possible. (10)

C) In an efficient market, securities are correctly priced. What beliefs must you have for the portfolio described in A) to be a good bet? Explain completely (5)

Problem 2

Rabbits Unlimited is a publicly listed firm that produces exclusive stuffed toy animals. Rabbits Unlimited share price is $30 and the company has 60,000 outstanding shares. The beta of equity is 1.3. In addition to equity the company has issued zero coupon bonds with one year maturity and with a total face value of 2.5M. Rabbits Unlimited has 3 million dollars invested in fabrics and stuffed animals' assets. The beta of these specific assets of Rabbits Unlimited (excluding cash) is 1.25. The company also has 1 million dollars in cash to finance future investments. The rate of return on one-year government bonds is 5.2% (you can assume that one year government bonds are risk free). Assume that the market risk premium is 8.5%.

A) What is the promised rate of return on Rabbits Unlimited debt? (10)

B) What kind of risk (i.e. systematic or idiosyncratic), **if any**, do the owners of Rabbits Unlimited's debt bear? Explain completely. (15)

C) Alice Porter, owner of Rabbits Unlimited, is thinking about investing in a new project. The idea is to produce clothing for its exclusive line of stuffed toy animals. Companies selling similar luxury goods have an average equity beta of 1.50, an average debt beta of .60, and an average debt/equity ratio of 0.20. The project is a one-year project and will be financed with an equal proportion of debt and equity. After the project is undertaken Rabbits Unlimited will hold additional clothing assets for 500,000 (in addition Rabbits Unlimited will still have 1M in cash and 3M in stuffed animal assets). Will the expected return on Rabbit's assets be higher or lower after the expansion? Assume that the debt beta of the company does not change. Explain completely. (15).

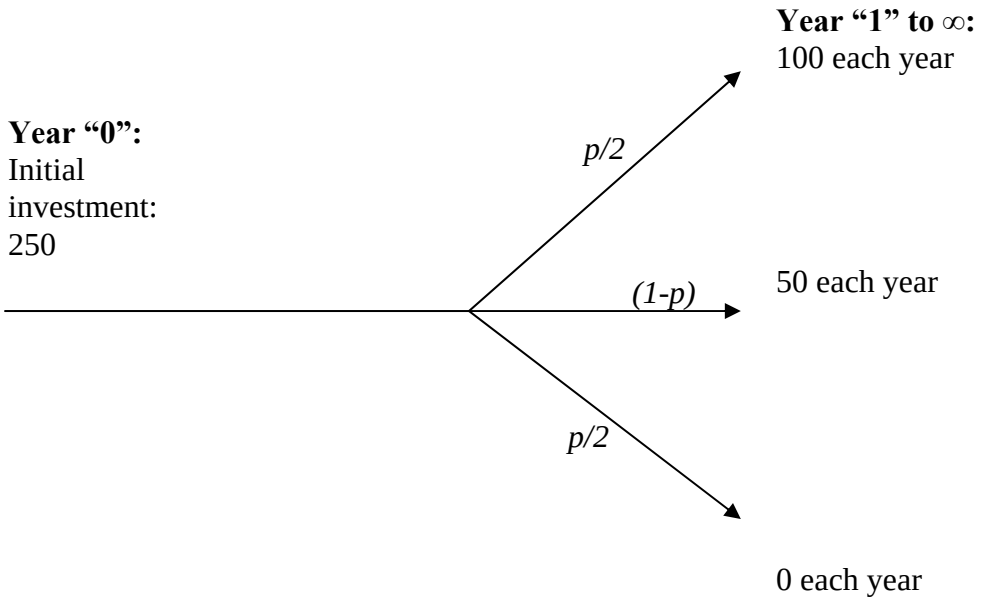
Problem 3

A) Last year Anderson Equity Mutual Fund had a return 2% above the S&P 500. Is this fact evidence that the efficient market hypothesis does not hold in the real world? Explain. (15)

B) In a world without taxes, shareholders prefer share repurchases to dividends as a means of distributing cash since the stock price will be higher following a share repurchases than following a dividend. True, False or Uncertain? Explain. (15)

Problem 4

Hatch Corporation is thinking of building a Survivor Camp far out in the corn fields outside of Chicago. Similar camps already exist around the US. The investment will cost $250M and cash flow will start arriving one year after the investment. Because of the violent and dangerous nature of such camps, the CEO of Hatch Corporation estimates that there is a probability *p* of the industry being subject to a lawsuit this year. The lawsuit is equally likely to be successful and to be dismissed. In case the lawsuit is successful, all such camps will be banned and cash flows will be 0 forever. If the lawsuit is dismissed, the extra attention created will increase demand and cash flows are expected to go up to $100M per year forever. If there is no lawsuit at all this year, the cash flows are expected to be $50M forever. The cash flows and timing if you invest in year 0 are given in the tree below.



where *p* indicates the probability of default. For the calculations below, use a 10% rate for discounting all cash flows.

A) Assuming that the CEO estimates that the probability of lawsuit is .1 and that she decides to invest today, what is the NPV of the project? (5)

B) Now assume that the CEO decides to wait until year 1 to make the investment (cash flows will not start arriving until in year 2). Assume that the CEO can make the investment decision after observing whether there was a lawsuit or not and the outcome of the lawsuit. What is the NPV (as of year 0) of this strategy? Is she better or worse off than in the case she decides to invest at 0? Explain the intuition. (8)

C) Now assume that after hiring a consultant the CEO decides to revise her estimated risk of the lawsuit to .3 instead of .1. Does this change your answer to question B)? Explain the intuition (and do the numbers, of course). (6)

D) Now assume that the investment is reversible, meaning that the company will be able to get its $250M investment back in any of the three scenarios by selling the land and the equipment if the company's executives choose so. Assume p=.3 as in C). How will this affect the timing of the investment? Explain the intuition. (6)

Facts and Formulas

Value of a perpetuity: $V_{cashflows} = \sum_{t=1}^{infinity} \frac{C}{(1+r)^t} = \frac{C}{r}$

Value of a growth perpetuity: $V_{cashflows} = \frac{C}{r - g}$

Value of a T year annuity: $V_{cashflows} = \sum_{t=1}^{T} \frac{C}{(1+r)^T} = \frac{C}{r} - \frac{C}{r(1+r)^T}$

Asset β: Since A=D+E $\beta_{Assets} = \beta_{Debt} \frac{Debt}{Debt + Equity} + \beta_{Equity} \frac{Equity}{Debt + Equity}$

If there are two types of assets: $\beta_{Assets} = \beta_{Asset1} \frac{Asset1}{TotalAssets} + \beta_{Asset2} \frac{Asset2}{TotalAssets}$

Equity β: $\beta_{Equity} = \beta_{Asset} + \frac{Debt}{Equity}(\beta_{Asset} - \beta_{Debt})$

Expected rate of return on equity: $r_{equity} = r_{assets} + \frac{D}{E}(r_{asset} - r_{debt})$

Capital Asset Pricing Model: $E[r_{project}] = r_{risk\ free} + \beta_{project} E[r_{market\ return} - r_{risk\ free}]$

Equations and Facts, continued

Payoff to a call option:

$$\begin{aligned}\text{Payoff} &= \text{Max}\{0, \text{Price of Stock} - \text{Strike Price}\} \\ &= \text{Max}\{0, S_t - X\}\end{aligned}$$

Payoff to a put option:

$$\begin{aligned}\text{Payoff} &= \text{Max}\{0, \text{Strike Price} - \text{Price of Stock}\} \\ &= \text{Max}\{0, X - S_t\}\end{aligned}$$

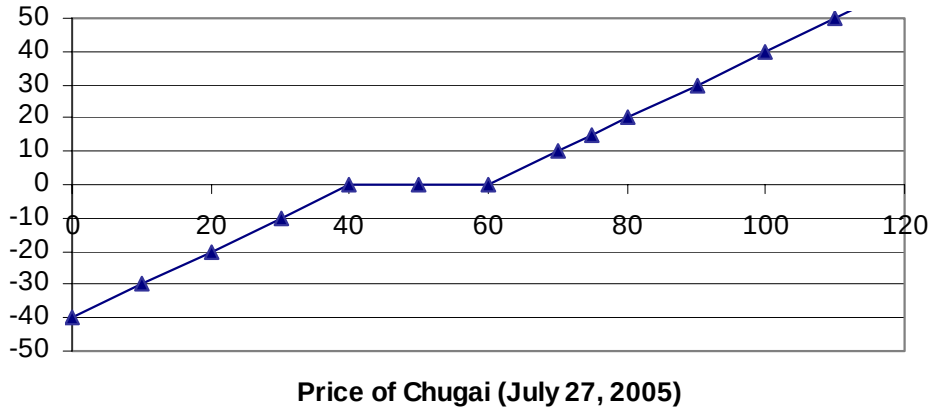
Scratch Sheet #1

Scratch Sheet #2

Suggested answers

Problem 1

A) The gross payoff to the call is positive only when the stock price is greater than 60. Above 60 every yen increase in the price raises the payoff to the portfolio by one yen. The gross payoff of the put is negative for stock prices below 40. Below 40 every yen decrease in the price of CHUGAI MINING CO., LTD. lowers the payoff to the portfolio by one yen.



B) The expected return on this portfolio should be higher than 10%. The expected return of any asset depends upon its beta. We know that Chugai's stock has a positive beta since its expected return (10%) is greater than the risk free rate (3%). Chugai's stock will tend to rise when the market goes up and fall when the market falls. To answer this question, you need to think what the beta of the portfolio is. The expected stock price is 55 (50*1.10). The portfolio has higher returns when Chugai is above 55 (the stock market rise). It has lower returns when Chugai is below 55 (the stock market falls). Therefore the portfolio has a positive beta as well. One can say more. Note that the portfolio's payoff is very similar to the payoff on Chugai's stock, except that the entire payoff is shifted downward. This shift reflects the fact that you are implicitly holding a leveraged position on the underlying asset. You are exposed to the risk of Chugai's stock but you have paid only 3.00=5.50-2.50 upfront. Compare this cost to the cost (50) of an unlevered position in Chugai.

C) This is a directional bet.; you must think that Chugai will be significantly higher than 55 in the future. More specifically, you must think that the probability that Chugai will be above 60 is higher than that that believed by the market

Problem 2

A) The market value of the debt must be equal to the market value of the assets (4 million) minus the market value of equity (60,000*30=1.8M). The market value of debt as today is equal to 2.2M. The promised return is therefore 2.5/2.2 – 1, or 13.6%

B) In order to answer to this question you should compare the risk free rate, the promised rate of return, and the expected rate of return on debt. To calculate the required rate of return on debt calculate the beta of debt:

$$\beta_{\text{specific assets}} * \frac{\text{Specific Assets}}{\text{Total Assets}} + \beta_{\text{cash}} * \frac{\text{Cash}}{\text{Total Assets}} =$$
$$= \beta_{\text{debt}} * \frac{\text{Debt}}{\text{Total Assets}} + \beta_{\text{equity}} * \frac{\text{Equity}}{\text{Total Assets}}$$

$$1.25 * \frac{3}{4} + 0 * \frac{1}{4} =$$
$$= \beta_{\text{debt}} * \frac{2.2}{4} + 1.3 * \frac{1.8}{4}$$

The beta of debt is then 0.64 which implies that the required return on debt is 10.65%. The promised rate of return is higher than the risk free return. If one year T-bills are risk free (there is not real interest rate risk neither inflation risk in debt with one year maturity), the one year debt of Rabbit Unlimited has default risk (reflected in the beta). Also, notice that the promised rate of return is higher than the expected rate of return. This result implies that Rabbit Unlimited's risk of default has some idiosyncratic component and some systematic component.

C) To answer to this question, first you have to calculate the return on assets on the new project. To do so, first calculate the beta of assets for comparable firms. You should use the beta of debt, beta of equity, and debt over equity ratio of comparable companies.

$$\beta_{\text{Assets}} = \beta_{\text{debt}} * \frac{\text{Debt}}{\text{Total Assets}} + \beta_{\text{equity}} * \frac{\text{Equity}}{\text{Total Assets}} =$$
$$= 1.5 * 0.833333 + 0.6 * 0.166667 = 1.35$$

We know that the return on the stuffing animal assets was 1.25. Therefore, the expected return after the expansion will be higher than before, because the new project has a higher return on assets. The new return on assets will be a weighted average of the old return on assets and the return on assets on the new project.

Problem 3

A) Anderson Equity Mutual Fund beating the S&P 500 by 2 percent does not disprove the efficient market hypothesis. The efficient market hypothesis argues that it is impossible to consistently beat the market index on a risk adjusted basis using only public information. Thus AEMF could have beaten the market by taking on more risk (purchasing the S&P 500 with borrowed money -- see Orange County investment portfolio for instructions), by getting lucky, or by having and using inside information.

B) False. The stock price falls when a dividend is paid and in the absence of taxes the expected fall is equal to the dividend. However, shareholders will be indifferent between receiving a given amount of cash in the form of a dividend versus in the form of a stock repurchase. With a stock repurchase they will have fewer shares, but the stock price will be higher. With a dividend, the stock price will be lower, but they will have more shares (relative to a repurchase). The equity value (stock price times number of shares) will be the same across the two. If a numerical example helps, take the example of a firm with $1000 of cash and ten shares outstanding. The cum-dividend price is $100 per share. The firm wants to distribute $100 to its shareholders. If the firm pays a dividend of $10 per share, the ex-dividend stock price will be $90 and there will be 10 shares outstanding (ex-dividend). The total value of equity will be $900. If instead the firm repurchases one share with the $100, there will be only nine shares outstanding but the price per share will be higher at $100 per share. The total value of equity will still be $900, the same as above.

Problem 4

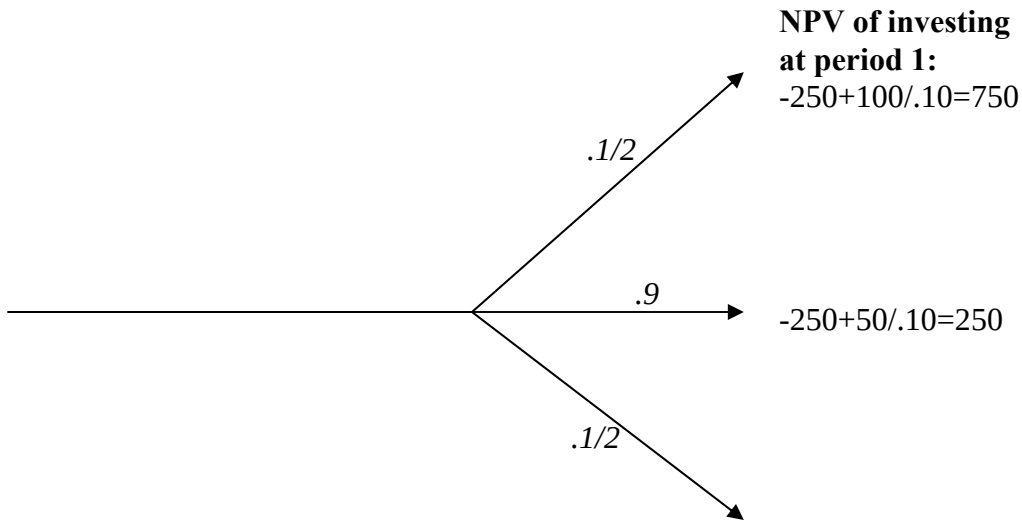
A) The expected cash flows each period is

$$100 * \frac{p}{2} + 50 * (1 - p) + 0 * \frac{p}{2} = p(\frac{100}{2} - 50) + 50 = 50$$

so NPV (as of time 0 of investing at 0) is calculated as:

$$NPV_0^0 = -250 + \frac{50}{.10} = 250$$

B) Obviously, Hatch will not invest if the lawsuit is successful (Hatch loses). In the other two scenarios, the NPV's as of year 1 from investing are:

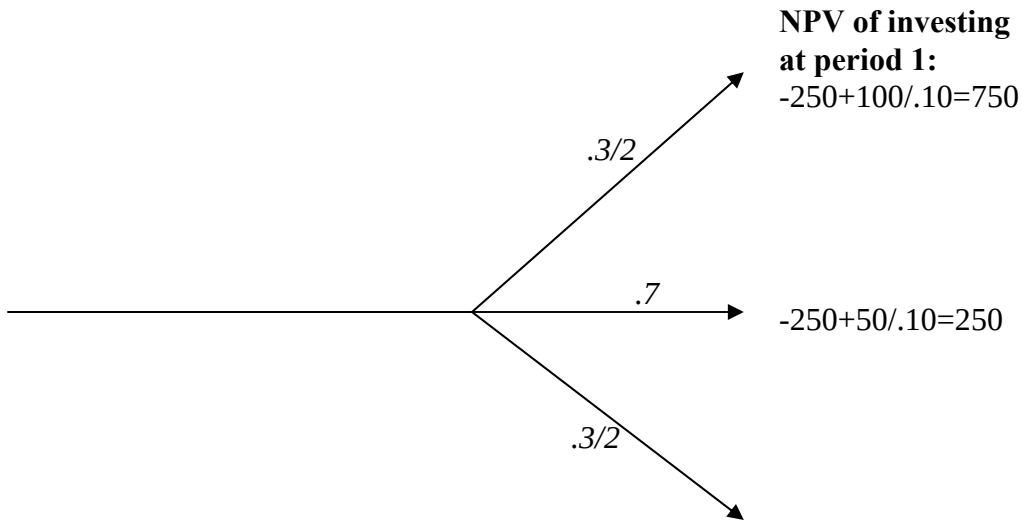


So, the NPV of investing at time 1, calculated as of time 0 is

$$NPV_0^1 = \frac{\frac{.1}{2} * 750 + .9 * 250}{(1 + .10)} = 238.6$$

The NPV Hatch would get in case we decide to wait one year prior to investing is lower than the NPV Hatch would get if they invest right away. The reason is that Hatch loose out on early cash flows by waiting to invest, and the time value of information is not sufficient to make up for that loss.

iii) If p = .3, the tree will look as



$$NPV_0^1 = \frac{\frac{.3}{2} * 750 + .7 * 250}{(1 + .10)} = 261.4$$

This is more than Hatch would get if they start the project immediately, so Hatch should wait to invest. The reason is that the time value of information has now gone up since cash flows are more volatile; this increases the value of the option to wait (just like the value of all call options increase in the volatility of the underlying asset).

D) If the investment is reversible, Hatch would get $250M back in the bad scenario. The NPV if we invest in year 0 is therefore:

$$NPV_0^0 = \frac{.3}{2}[-250 + \frac{100}{.10}] + .7[-250 + \frac{50}{.10}] + \frac{.3}{2}[-250 + \frac{250}{(1 + .1)}] = 284.1$$

This is bigger than if Hatch waits. The value of waiting comes from the possibility of avoiding the investment in the low cash flow scenario, but if we can reverse the investment the value of this option is dramatically reduced.