

Final Exam – Solutions
Finance 325
December 17, 2010

Name: _____

Exam Instructions:

- This exam should have 14 pages (including this one) and 11 questions. The point value is given for each problem. The entire exam is worth 100 points.
- There is a page at the back of the exam that has information that you will need to solve problems on the test. You may remove this page if it makes it easier for you to reference it during the test.
- You may use a calculator and the provided formula sheet on this exam.
- You must show your work in order to receive credit for your answers. Partial credit will be given for partially correct answers.
- If a question asks “Why/Explain”, you should give an explanation that would convince a skeptic.
- You may use the back of a page if you need additional space to write an answer.

Suggestions:

- Use your time wisely. Move on to another problem if you feel like you’re stuck.
- You may ask me questions if you are unclear about a problem. I may be able to clarify the problem for you.

GOOD LUCK!! Enjoy your winter break!

1. You are in a meeting in which one of your peers is presenting his analysis of two mutually-exclusive investments. There are no other possible investments at the present time. The information for the investments is below.

Investment	Today	Yr 1	Yr 2	Yr 3	IRR	NPV
A	-\$10 million	\$7 million	\$6 million	\$10 million	52%	\$4.792 million
B	-\$8 million	\$6 million	\$9 million	\$4 million	63%	\$4.790 million

He goes on to argue that, since the discount rate for these investments is 24%, the firm should take Investment B because it has the highest rate of return.

You raise your hand and tell him that, since these two projects are mutually-exclusive, IRR should not be used to determine the investment. You argue that NPV should be used instead. His response is as follows: “The NPV of A is slightly higher than B. But this doesn’t take into consideration the fact that A costs \$2 million more than B. We can invest \$8 million in B at a higher rate of return and invest the remaining \$2 million at our opportunity cost of 24%. The combination of these two investments should surely exceed the NPV of A by itself.”

Evaluate his argument. If he is correct, explain why. If not, explain why not. (8 pts)

His argument is incorrect. By investing in projects that earn a rate of return equal to the cost of capital, one guarantees an NPV of zero. Think of the IRR rule when making investments... if the IRR equals the discount rate for the investment, then we are indifferent to making the investment.

So, by investing the remaining \$2 million at the discount rate, the NPV of investing in B doesn’t change. Thus, A is still the best investment to make.

(The typo in the exam stated 23% instead of 24% as the opportunity cost. Using the same logic from above, an investment with a return of 23% if the discount rate is 24% would be a negative NPV investment and would actually lower the overall NPV of the investment).

2. Compare and contrast 401-k plans and traditional IRAs. Be specific. (10 pts)

Similarities between 401-k plans and traditional IRAs include:

- **Both are investment vehicles that encourage saving for retirement**
- **Both allow for investment in stocks, bonds, mutual funds, etc.**
- **Both allow for investment of pre-tax dollars (i.e. investors avoid taxes today on what they save)**
- **Both investments grow tax-free.**
- **Both investments are taxed once money is removed from accounts during retirement**
- **Investors of both would incur penalties if they try to withdraw these funds prior to retirement age (except for a very few circumstances)**

Differences include:

- **401-k plans are through one's employer, while IRAs can be set up by individuals**
- **Participation in 401-k is limited to those with that particular benefit from their employer, while anyone can open an IRA**
- **Employers often match 401-k contributions, while IRA contributions are not matched by anyone**
- **The annual maximum contribution is different for each**

3. Given that the prices of gold have skyrocketed in the last year due to the recession, you are thinking about buying stock in a privately-held firm that mines for gold. This firm expects to pay a \$2 dividend today, and this dividend is expected to grow by 2% into perpetuity. This firm is financed with 60% equity and 40% debt. While not publicly traded, it is extremely similar to the publicly-traded firm ORO. What is the price per share of this privately-held mining stock? (10 pts)

First, we need to compute the cost of equity for this mining firm. We can use the capital structure and equity beta information for ORO to determine the systematic risk of the mining firm's assets, then use the capital structure to find the systematic risk of its equity. Once we have the equity beta, we use the CAPM to find the expected return of the equity.

$$\beta_a = \beta_{e,ORO} \left(\frac{E}{D + E} \right) = 1.42 \left(\frac{50}{60 + 50} \right) = 0.6454$$

$$\beta_{e,private\ firm} = \beta_a + \beta_a \left(\frac{D}{E} \right) = 0.6454 \left(\frac{0.40}{0.60} \right) = 1.0756$$

$$E[R_e] = r_f + \beta_e(r_m - r_f) = 0.03 + 1.0756(0.12 - 0.03) = 0.1268$$

Now that we have a discount rate for the equity CFs, we need to value the dividends. The stream of dividends is:

<u>Today</u>	<u>1 year</u>	<u>2 years</u>	<u>3 years</u>	<u>...</u>
\$2.00	\$2.00(1.02)	\$2.00(1.02) ²	\$2.00(1.02) ³	...

The PV of this growing perpetuity of dividends is:

$$PV = \frac{2(1.02)}{0.1268 - 0.02} + 2 = \$21.10$$

The stock price should be \$21.10 per share.

4. You would like to form a portfolio by combining the stock from the privately-held mining firm (from problem #3) with Verizon stock. You estimate that the standard deviation of returns for the mining firm will be 35%, and the correlation between Verizon and the mining firm will be 0.37. What will be the expected return, standard deviation of returns, and the 95% confidence interval of returns for the portfolio if you invest 40% in Verizon and 60% in the mining firm? (12 pts)

For the Verizon stock:

$$E[R] = \frac{0.16 + 0.25 + 0.27 + (-0.18) + (-0.10)}{5} = 0.08$$

$$\sigma^2 = \frac{(0.16 - 0.08)^2 + (0.25 - 0.08)^2 + (0.27 - 0.08)^2 + (-0.18 - 0.08)^2 + (-0.10 - 0.08)^2}{5 - 1} = 0.04285$$

$$\sigma = \sqrt{\sigma^2} = \sqrt{0.04285} = 0.2070$$

For the mining stock: $E[R] = 0.1268$ (from previous problem), $\sigma = 0.35$ (from this problem)

For portfolio:

$$E[R_p] = (0.40)(0.08) + (0.60)(0.1268) = 0.1081$$

$$\sigma_p^2 = (0.40)^2(0.2070)^2 + (0.60)^2(0.35)^2 + 2(0.40)(0.60)(0.2070)(0.35)(0.37) = 0.063823$$

$$\sigma_p = \sqrt{\sigma_p^2} = \sqrt{0.063823} = 0.2526$$

$$95\% \text{ CI} = E[R] \pm 2\sigma = 0.1081 \pm 2(0.2526) = [-0.3971, 0.6133]$$

5. You recently watched the movie “I love you Phillip Morris” and think that, instead of Verizon in the portfolio (from problem #4), you would rather use Phillip Morris stock instead. You have no idea what the correlation between Phillip Morris and the mining firm should be, but you know for certain that Phillip Morris has a much higher standard deviation than Verizon. If you switch your investment from Verizon to Phillip Morris, can you determine how the portfolio’s risk will change? If yes, explain how it will change. If not, explain why not. (8 pts)

You cannot determine from the information given how the portfolio risk will change. Look at the formula for portfolio risk. When we change from Verizon to Phillip Morris, two components of the equation change... the σ of Verizon to the σ of Phillip Morris, and the correlation between the mining firm and Verizon to the correlation between the mining firm and Phillip Morris. Since we don’t know how the correlation is changing, we cannot be certain as to the change in the risk of the portfolio. While the increase in the risk of Phillip Morris would cause the risk of the portfolio to increase if everything else stayed the same, a decrease in the correlation could more than offset the increase in risk and cause the portfolio risk to be less than before.

6. Define the three types of market efficiency. Also describe a trading strategy that yields abnormal returns for each type of market efficiency. (10 pts)

There are three forms of market efficiency. Weak form efficiency is when all information about past stock prices is reflected in the current stock price. To earn abnormal returns in weak form efficient markets, one just needs to trade on other public information or private information, as this information would not be incorporated into the stock price.

Semi-strong form efficiency is when all public information is reflected in the current stock price. This includes past stock prices and any publicly available information (such as financial statements, analyst reports, etc). To earn abnormal returns in semi-strong form efficient markets, one needs to trade private information, as this information would not be incorporated into the stock price.

Strong form efficiency is when all information (both public and private) is reflected in the current stock price. To earn abnormal returns in strong form efficient markets... well, one cannot consistently earn abnormal returns in this case without luck, as there is no information that you can obtain that hasn't already be incorporated into the stock price.

7. Delta Airlines is looking to raise some capital to invest in a space tourism venture. They want to raise \$1 billion, and they will borrow this capital by issuing bonds. They consider this increase in their debt level to be permanent and feel that it will not impact their cost of financial distress. The investment bank charges a transaction fee of 3% of the amount of capital raised. They will use these funds to invest in space travel-related projects (thus, none of this capital will be distributed directly to shareholders). What will be the new value of the whole firm and the firm's equity after this transaction? (8 pts)

The formula for determining the new value of the firm is:

$$V_{new} = V_{old} + \Delta PV_{tax\ shields} - \Delta PV_{financial\ distress} - trans.\ costs + \Delta Equity + \Delta Debt$$

For the change in the tax shields, we use the perpetuity formula since the debt will be permanent, and the tax savings as the CF:

$$\Delta PV_{tax\ shields} = \frac{\Delta D \times r_d \times t}{r_d} = \Delta D \times t = 1 * 0.35 = 0.35B$$

Plugging everything in:

$$V_{new} = 24 + 0.35 - 0 - 0.03 + 0 + 1 = 25.32B$$

Debt is \$15B, so equity must be \$10.32B.

8. The risk of space tourism is very different from Delta's existing business; thus, Delta expects that the discount rate for their new venture will be different than that of its airline business. After the change in its capital structure, Delta's new equity beta became 1.02. Also, assume that Delta's new investment in space tourism represents 4% of its total investments. Using the fact that the asset beta of a firm is a weighted average of the asset betas of each of its investments (see below), calculate the discount rate that Delta should use for its new space tourism venture. (10 pts)

$$\beta_{a,Delta} = w_{space\ tourism}\beta_{a,space\ tourism} + w_{rest\ of\ Delta}\beta_{a,rest\ of\ Delta}$$

The asset beta of the "rest of Delta" is just the asset beta from before the change in capital structure:

$$\beta_a = \beta_e \left(\frac{E}{D+E} \right) = 0.75 \left(\frac{10}{14+10} \right) = 0.3125$$

The asset beta of Delta with the space tourism business is:

$$\beta_a = \beta_e \left(\frac{E}{D+E} \right) = 1.02 \left(\frac{10.32}{15+10.32} \right) = 0.4157$$

Now just plug into the formula above using 4% for space tourism weight and 96% for rest of Delta, and solve for the asset beta of the space tourism business:

$$0.4157 = (0.04)(\beta_{a,space\ tourism}) + (0.96)(0.3125)$$

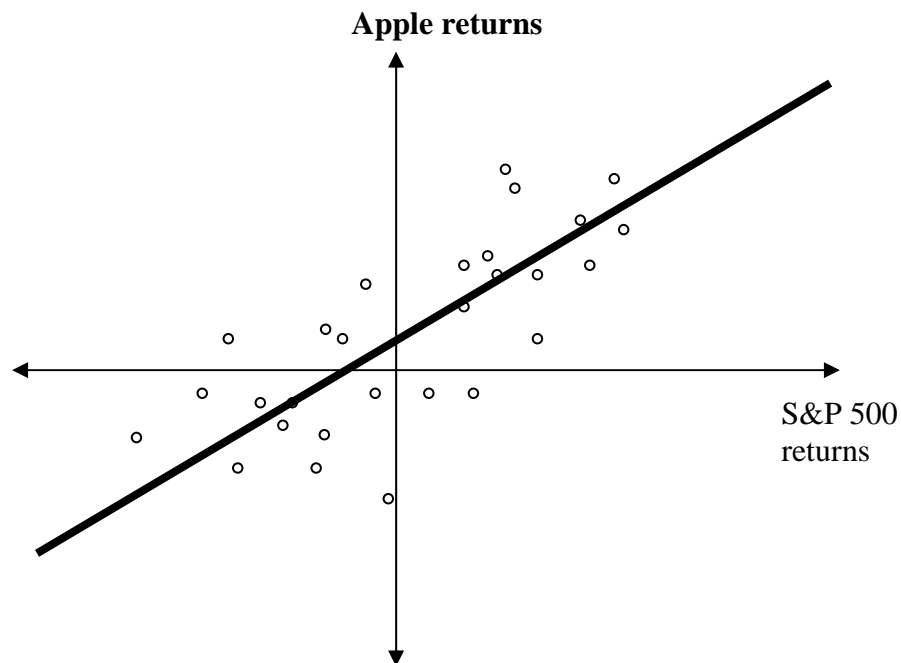
$$\beta_{a,space\ tourism} = 2.893$$

Now, just use the CAPM to solve for the expected return:

$$E[R_a] = r_f + \beta_a(r_m - r_f) = 0.03 + 2.893(0.12 - 0.03) = 0.2904$$

9. Define beta (in finance), and describe how beta is measured directly. Be specific. (8 pts)

Beta is the measure of systematic risk of an investment. Systematic risk is the risk that we cannot diversify away. In order to directly measure beta, we need historical returns for the investment we are trying to measure (let's choose Apple) and the S&P 500. We match periodic returns (daily, weekly, monthly, etc) of our investment to the corresponding periodic return of the S&P 500 (for example, last month's Apple stock return is matched with last month's return of the S&P 500). You can plot these on a graph (see below). Then we perform regression analysis to determine the best-fit line. The slope of this line is the beta. Beta tells us how sensitive the returns of the investment (Apple in this case) are to the market.



10. Great Wolf Lodge is looking at two different models for its next theme attraction: indoor roller coasters. The incremental cash flows of the two models are listed below (in \$ thousands).

	<u>Today</u>	<u>Year: 1</u>	<u>2</u>	<u>3</u>	<u>4</u>	<u>5</u>	<u>6</u>	<u>7</u>
Dragonroll	-200	-4	-4	-4	-4	-4	-4	-4
Wizardrun	-100	-2	-2	-2	-2			

Great Wolf Lodge plans to continue with the model it chooses for the foreseeable future (i.e. it will reinvest in the chosen model when the previous model needs to be replaced.)

Great Wolf Lodge is financed with \$50 million in risky debt (currently with a YTM of 6.5%) and \$100 million in equity (with a beta of 1.10). This roller coaster investment can be considered a scale-expansion of the existing business. Which roller coaster should they choose? (10 pts)

First, we need a discount rate... since this is a scale expansion, we can use the WACC, but first we'll solve for the cost of equity:

$$E[R_e] = r_f + \beta_e(r_m - r_f) = 0.03 + 1.1(0.12 - 0.03) = 0.129$$

$$WACC = \left(\frac{50}{50 + 100}\right)(0.064)(1 - 0.35) + \left(\frac{100}{50 + 100}\right)(0.129) = 0.100$$

Since these are investments with different lives that will be repeated, we need to use either EAA or take each investment to the common ending period. Here is the solution for EAA:

$$\text{For Dragonroll: } PV = -200 - 4\left(\frac{1}{0.10} - \frac{1}{0.10(1.10)^7}\right) = -219.47$$

$$-219.47 = EAA_{Dragonroll} \left(\frac{1}{0.10} - \frac{1}{0.10(1.10)^7}\right)$$

$$EAA_{Dragonroll} = -45.08$$

For Wizardrun:

$$PV = -100 - 2 \left(\frac{1}{0.10} - \frac{1}{0.10(1.10)^4} \right) = -106.34$$

$$-106.34 = EAA_{\text{Wizardrun}} \left(\frac{1}{0.10} - \frac{1}{0.10(1.10)^4} \right)$$

$$EAA_{\text{Dragonroll}} = -33.55$$

Wizardrun has a lower EAA cost, so we would choose that one.

11. It is December 2010. You are trying to price a corporate bond that matures in December 2012, has a par value of \$1,000 and a coupon rate of 6% with semi-annual payments (with the first occurring 6 months from now.) Given the following yield curve and T-strip information, what is the price of this bond? Assume all interest rates are quoted as APRs, compounded semi-annually. (8 pts)

Cash flows from the bond are:

December 2010	June 2011	December 2011	June 2012	December 2012
	30	30	30	1030

	APR	T-strip
June 2011	5.1%	
Sept 2011	5.3%	
Dec 2011		94:21
Mar 2012		93:04
June 2012		91:22
Sept 2012	6.2%	
Dec 2012	6.4%	

$$PV = \frac{30}{\left(1 + \frac{0.051}{2}\right)^{2 \times 0.5}} + 30 \left(\frac{94 \frac{21}{32}}{100}\right) + 30 \left(\frac{91 \frac{22}{32}}{100}\right) + \frac{1030}{\left(1 + \frac{0.064}{2}\right)^{2 \times 2}} = 993.23$$

EXTRA CREDIT (1 pt each): Define the following acronyms. Must be exact to receive credit.

WACC: Weighted Average Cost of Capital

CAPM: Capital Asset Pricing Model

IRR: Internal Rate of Return

EAA: Equivalent Annual Annuity

Company	Business	Equity Beta	Debt	Equity
ORO	Gold mining	1.42	\$60 M	\$50 M
Delta Airlines	Travel	0.75	\$14 B	\$10 B

Return on the market: 12%

Risk-free rate: 3%

Corporate tax rate: 35%

Assume the beta of debt is zero unless otherwise indicated.

Assume that changes of capital structure have no effect on investment policy.

Historical annual returns of Verizon stock over the past 5 years:

5 years ago	4 years ago	3 years ago	2 years ago	Last year
16%	25%	27%	-18%	-10%