

Handout Problems on Review of Mathematics of Finance

1. Mr. Right would like to buy a house at the end of ten years. How much money does he have to save now in order to buy the house if he just puts a lump sum into the bank now at 10% interest? How much is it if he puts a certain fixed amount at the beginning of every year, at 10% interest. The house will be worth \$260,000 at the end of year 10.

2. Mary is planning to retire in 25 years. Thus far, she has accumulated \$15,000 in a bank account, earning 5% interest. When she retires, she would like to withdraw \$24,000 from the account at the end of the following 15 years. After the last withdrawal, her bank account balance will be zero. How much must Mary deposit (25 deposits) for the next 25 years, first deposit start today to be able to do this? Assume the account will continue to earn 8%.

3. What is the 'EAR' for a quoted rate of 9% compounded quarterly? At this rate, how much will you have accumulated in 5 years with a principal of \$500? What if compounding is continuous?

4. Stephen and Company wants to borrow \$100,000 from the Royal Bank at an annual interest rate of 12%. The loan is to be repaid in 4 equal annual installments with the first payment made a year from now. If Stephen has a taxable rate of 40% and a cost of capital of 15%, what is the net cost of the loan to the company?

5. You want to have \$1,000,000 to use for retirement in 35 years. If you can earn 1% per month, how much do you need to deposit on a monthly basis if the first payment is made in one month? What if the first payment is made today?

6. You want to receive \$5,000 per month for the next 5 years. How much would you need to deposit today if you can earn 0.75% per month.
Suppose you have \$200,000 to deposit and can earn 0.75% per month:
 - a.) for how many months could you receive \$5,000 payment?
 - b.) how much could you receive every month for 5 years?

Handout Problems on Common Equity

- 1.) Frump Real Estate Inc expects to earn \$100 MM per year in perpetuity if it does not undertake any new projects. The firm has an opportunity to invest \$15 MM today and \$5MM in one year in real estate. The new investment will generate annual earnings of \$10 MM in perpetuity, beginning two years from today. The firm has 20 MM shares outstanding, and the required rate of return on the stock is 15%. Land investments are not depreciable. Ignore taxes.
 - a.) What is the price of a share if the firm does not undertake the new investment?
 - b.) What is the price of a share if the firm undertakes the new investment?

- 2.) A stock is selling at \$50 per share with an expected dividend of \$2. Short term prospects are excellent: a 20% annual growth rate is expected for the next 4 years. After that, the growth rate is expected to drop to a normal 6%. What is the expected long term rate of return from this stock.

- 3.) Consider a firm with existing assets that generate an EPS of \$5. If the firm does not invest except to maintain existing assets, EPS is expected to remain constant at \$5 per share. However; starting next year, the firm has the opportunity to invest \$3 per share a year in developing a newly discovered geothermal source for electricity production. These investments are expected to generate a permanent 20% return. However; the source will be fully develop by the 5th year. What will be the stock price and P/EPS ratio assuming investors require a 12% return?
Show that this ratio is 0.20 if the required rate of return is 20%.

- 4.) Kenneth Cole's (KCP) had sales of \$518 MM in 2010. Suppose you expect its sales to grow at 9% in 2011, but this rate will slow down by 1% per year to a long-run growth rate for the apparel industry of 4% by 2016. Based on KCP's past profitability and investment needs, you expect EBIT to be 9% of sales, increases in net working requirements to be 10% of any increase in sales, and capital expenditures to equal to depreciation expenses. If KCP has \$10 MM in cash, \$100 MM in debt at 6% interest rate and has 21 MM shares outstanding, a tax rate of 37% and a WACC of 11%, what is your estimate of the value of KCP's stock in early 2011?

Handout Problems on Capital Budgeting

1.) Clean Inc has several detergent brands on the market. A recent market study costing \$200,000 indicated that the company should launch a new type of detergent called "Bright Whites". The company has an empty building to house the new plant if the project proceeds, otherwise, the building can be rented out at \$150,000 per year, payable at the beginning of each year. Introducing "Bright Whites" will result in sales erosion of existing product lines estimated at \$90,000 per year. New machinery worth \$4 MM would be required for this facility and the applicable CCA rate is 20%.

The following table summarizes estimates of sales and production costs for "Bright Whites" for the next 10 years:

Years	Sales	Variable Cost	Fixed Cost
1 st to 3 rd inclusive	\$ 1.5 MM	\$0.5 MM	\$0.30MM
4 th to 6 th inclusive	\$4.0MM	\$1.75MM	\$0.30MM
7 th to 10 th inclusive	\$3.50MM	\$1.50MM	\$0.30MM

Additional working capital of \$0.5MM will also be required at the start of this project. Salvage value on the machinery is expected to be \$0.9 MM. Clean Inc's tax rate is 40% and its minimum required return is 10%. Should Clean Inc introduce "Bright Whites"?

2.) A university student painter is considering the purchase of a new air compressor and paint gun to replace an old paint sprayer. (Both items belong to Class 9 and have a 25% CCA rate). These two items together cost \$8,000 and have a useful life of four years, at which time they can be sold for \$1,000. The old paint sprayer can be sold now for \$300 or could be scrapped for \$150 in 4 year. The entrepreneurial student believes that operating revenues will increase annually by \$8,000. Should the purchase be made? The tax rate is 22% and the required return is 17%.

3.) People's Gas, the local national gas distributor, has just signed a 10 year contract with a steel mill 3 km away for all the mill's natural gas requirements.

The 3 Km pipeline would normally be considered as Class 2 with a CCA rate of 6% and an investment of \$4.0 MM. Construction would start in a month's time and is expected to take 11 months to complete.

At the last round of negotiations with Revenue Canada, People's Gas has finally convinced the latter that the pipeline is also part of the manufacturing process and be reclassified as a class with 5% ITC, the balance can then be written off linearly over 4 years.

If People's Gas is content with an after-tax return of 12% regardless of the type of depreciation tax shield, how much money would the steel mill save annually? People's Gas has a marginal tax rate of 45%.

4.) Strong Metal Inc is in the mining business. It recently has discovered a copper mine in the northern part of Quebec and its ore content is expected to generate 10 years of net cash flow with the following schedule:

<u>Period (assumed incurred at year end)</u>	<u>Annual Net Cash Flow</u>
Year 1 to 5	\$20 MM
Year 6 to 10	\$10 MM

After 10 years of active excavation, the mine will be exhausted.

In order to open up this mine, \$90 MM of capital outlay is required immediately.

The Provincial Government has agreed to loan "Strong Metal" 70% of the required capital to finance this project at a preferential rate of 6% while the market would charge 9% as this project will be a real job creator and a boost to the local economy. This loan is to be repaid in 4 years with equal annual repayments to be paid at the end of each year. The balance of the financing will have to come from new equity with a 5% floatation cost.

Ignore depreciation expenses and the Company's cost of equity is 15%.

- a.) Calculate the NPV of this project.
- b.) Calculate the total NPV of the financing benefits.
- c.) From a.) and b.), calculate the APV of the project and comment on your results.

Handout Problems on EVA

1.) There are 2 ways to grade lumber products, visual and machine rated. For the sawmill owned by Eastern Timber Company, grading by machine will increase annual revenue by \$1.4MM. It will also incur additional operating cost by \$0.4MM.

In order to convert into machine-rated lumber grading, \$2.0MM worth of new equipment will have to be purchased. Installation will take 6 months to complete.

Additional working capital is expected to be 10% of annual sales and the project will have an economic life of 10 years.

Project financing is done with 40% debt at an interest rate of 10% and 60% equity at a cost of 14%. Tax rate for Eastern Timber is 40%.

Linear depreciation for book purposes is assumed to be 10 years commencing the year following equipment purchase and the CCA rate for such equipment is 30%.

- a.) Should this project be accepted under i) the NPV Rule? And ii) under the EVA Rule?
- b.) Show that, in 10 years time, the PV of EVA is approximately equal to the PV of NPV.

2.) What is the relationship between "Net Earnings" and NOPAT?
Why is NOPAT instead of Net Earnings used for the computation of EVA?

3.) ABC is contemplating investing \$5.0 MM to buy a piece of new equipment that will increase annual revenue by \$1.0MM and at the same time reduce operating cost by \$0.5MM .

The project is to be financed by 40% debt and 60% equity with the cost of debt at 8% and equity at 15%. The company's tax rate is at 40%.

Book depreciation is 10 year linear starting at the year of implementation and the CCA for that equipment is 30%.

The project also requires \$0.7 MM of additional working capital.

- a.) Compute the PV EVA or MVA of this project for 5 years.**
- b.) Compute the NPV of this project for 5 years.**
- c.) Compare the findings of a.) and b.).**

Handout Problems on Black Scholl Option Model on Capital Capital

1.) Consider an offshore oil property with an estimated oil reserve of 50MM barrels of oil; the cost of developing the reserve is expected to be \$600MM, and the development lag is 2 years.

Exxon has the rights to exploit this reserve for the next 20 years, and the marginal value (price per barrel – marginal cost per barrel) per barrel of oil is currently \$12. Once developed, the net production revenue each year will be 5% of the value of the reserve.

The risk free rate is 8% and the variance in oil prices is 0.03.

What is the value of this right?

2.) Assume that the Home Depot is considering opening a small store in France. The store will cost 100 MM French francs (FF) to build, and the PV of the expected cash flow from the store is 80MM FF. Thus, by itself, the store has a negative NPV of 20MM FF. Assume, however, that by opening this store, The Home Depot will require the option to expand its operations any time over the next 5 years.

The cost of expansion will be 200 MM FF, and it will be undertaken only if the PV of the expected cash flow from the expansion exceeds 200 MM FF. At the moment, this PV is believed to be only 150 MM FF.

The Home Depot still does not know much about the market for home-improvement products in France, and there is considerable uncertainty about this estimate. The variance in the estimate is 0.08.

Determine the value of this option.

3.) Assume that the Home Depot is considering a new store that requires a net initial investment of \$9.5MM and generate cash flows with a PV of \$8.563Mm. the NPV value of \$(937,287) would lead us to reject this project.

To illustrate the effect of the option to abandon, assume that the Home Depot has the option to close the store any time over the next 10 years and sell the land back to the original owner for \$5MM. In addition, assume that the standard deviation in the PV of the cash flow is 22%.

How much does Home Depot pay for this option?

Handout Problems on Project Risk Analysis

1.) Assume a project which requires \$30,000 as an initial outlay and its expected net cash receipt is \$36,000 for one year. Assume also that the certainty equivalent of this sum is \$33,000 and that the risk free rate is 7%.

- a.) Calculate the risk adjusted NPV of the project using the CEQ Method.
- b.) Find the RADR that will yield the same adjusted NPV.
- c.) What would be the appropriate discount rate under the same assumption that the risk of the project is larger and hence the CEQ of its expected receipt is only \$30,600.

2.) Stephen's Inc has \$4MM of debt and \$8MM of common equity in its financial structure which is assumed to be optimal. The current cost of debt before tax is 10% and the cost of equity is 18%. The corporate tax rate is 40%.

Stephen's is currently considering a project that has a risk 2 times that of the market. This project will require an initial outlay of \$1 MM and provides an expected net cash flow of \$400,000 each year for the next 4 years.

Given the expected return of the market is 12% and the risk free rate is 8%, what is the change in NPV of the project if the company uses the WACC as the discount rate rather than the RADR ?

3.) Stanley Steel is contemplating investing in a new steel mill costing \$50 MMM. Sales of steel are very dependent on the performance of the economy.

Stanley Steel has come up with 5 scenarios on the state of the economy and their probabilities of happening. The Company has also estimated the return on the project for each of these scenarios and the corresponding return on the market.

The result of these estimates are tabulated below:

<u>Performance of economy</u>	<u>Probability</u>	<u>Return on Project</u>	<u>Return on Market Portfolio</u>
Very high	0.05	0.50	0.20
High	0.15	0.40	0.18
Medium higher	0.30	0.20	0.15
Medium low	0.30	0.10	0.08
Low	0.20	- 0.20	0.05

Currently, treasury bills pay 5%.

Based on the above given information, should Stanley Steel accept the project?

4.) The scientists at Vegetron have come up with an electric mop, and the firm is ready to go ahead with pilot production and test marketing. The preliminary phase will take a year and cost \$130,000. Management feels that there is only 60% chance that pilot production and market test will be successful. If they are, then Vegetron will build a \$1.2 MM plant which would generate an expected net cash flow of \$300,000 for 7 years, followed by net perpetual cash flows of \$100,000. If they are not successful, the project will then be dropped.

Management has little experience with consumer products and considers this project of extremely high risk. Therefore; they discount the initial phase at 25%. If the test marketing is a success, the normal 15% discount would be used.

Should Vegetron go ahead with the entire project?

5.) Sony Electronics Inc has developed a new DVD player. If the DVD is successful, the PV of the payoff is \$20MM. If it fails, its PV payoff is \$5MM. If the newly invented DVD is launched right away, the probability of success is only 50%.

Alternatively, Sony can delay the launch by one year by spending \$2 MM to do a test market. Test marketing allows the firm to improve the product and increase the probability of success to 75%. The appropriate discount rate is 15%.

Should the firm conduct the test market? (Text book Chapter 9 problem 1)

Handout Problems on Leverage and Capital Structure

1. Black Sheep Enterprise has total operating costs of \$100,000 when it produces 450 units. When it operates at a level of 350 units, total operating costs decrease to \$96,000.

The selling price stays at \$75 per unit.

- a) What is the operating break-even in units and dollars?
- b) What is the degree of operating leverage (DOL) at 4500 units?

2. Blood and Sand Corporation has the following Income Statement as at December 31, 2003.

- Sales	\$200,000
- Variables costs	\$100,000
- Fixed costs	\$50,000
- Earnings before interest and tax	\$78,000
- Interest expense	\$12,000
- Taxes (0.4)	\$31,200
- Income after taxes	\$46,800

- a) What is Blood and Sand's break-even point in sale dollars?
- b) What would its total leverage be if it operates at sales level of \$300,000?

3. Collins Electronics Ltd is considering additional financing of \$20,000. They currently have \$100,000 of 6% bonds and 10,000 common shares outstanding. The firm can obtain the financing through a 6% bond issue or sale of 1,000 common shares. The expected EBIT is \$30,000 and a 40% tax rate:

- a) What would be the degree of financial leverage (DFL) under each financing plan?
- b) At what level of EBIT does the bond plan become superior to the common share plan?

4. Jason Inc. is considering the financing of a \$500,000 project with the following 2 plans:

Plan 1	Plan 2
\$500,000 debt at 8% interest	Issue common shares at \$20/share

As it stands, the company does not have any debt and there are 200,000 common shares outstanding trading at \$20/share. Tax rate is 40%.

- a) What is the B-E EBIT so that Jason would be indifferent in terms of EPS impact?
- b) What is EPS for part a)?
- c) If EBIT is expected to be \$420,000, what would be the corresponding EPS for each plan?
- d) Repeat c) for EBIT of \$260,000.

5. The Scott Corporation has an expected EBIT of \$100,000 and a corporate tax rate of 30%. Scott uses \$500,000 of 12% debt financing and the cost of equity to an unlevered firm in the same risk class with the identical EBIT is 16%.
- What is the value of the firm according to MM with corporate taxes?
 - Assume now that the value of Scott's equity is \$90,000. All else being equal, what is Scott's cost of equity?
6. Currently, ABC Inc. has a targeted D/E of 0.8. The cost of equity is 16% and the cost of debt is 8%. What will be the cost of equity if the target capital structure becomes 60% debt and 40% equity? (Ignore taxes.)
7. McGoy Pharmaceutical has a total market value of \$200 million, consisting of 2 million shares of common shares, selling for \$50/share and \$100 million of 10% perpetual bonds currently selling at par. McGoy pays out all earnings as dividends, and its marginal tax rate is 40%. The firm's earnings before interest and taxes (EBIT) are \$30 million. Management is considering increasing debt to \$140 million by calling in all old bonds and issuing new debt with a 12% coupon which can be sold at par. The additional funds will be used to repurchase stock at the new equilibrium price. If McGoy's financial leverage is increased as described, the required rate of return on common equity will increase to 15%.
- What is the company's current required rate of return on equity?
 - What would be the value of the firm if the proposed capital structure was made?

Handout Problems on Dividend Policy

- 1.) Rooster Rocks Corporation (RRC) currently has 100,000 shares outstanding that sell for \$70 per share. Assuming no market imperfections or tax implications exist, what will the share price be after:**
 - a.) RRC has a five-for-three stock split?**
 - b.) RRC has a 15% stock dividend?**
 - c.) RRC has a four-for-seven reverse stock split?**

- 2.) Red Zeppelin Corp follows a strict residual dividend policy. Its Debt/equity ratio is 3.**
 - a.) If earnings for the year are \$140,000, what is the maximum of capital spending possible with no new equity?**
 - b.) If planned investment outlays for the coming year is \$770,000, will Red Zeppelin pay a dividend? If so, how much?**
 - c.) Does Red Zeppelin maintain a constant dividend payout? Why and why not?**

Handout Problems on Mergers & Acquisitions

- 1.) The Mirabel Corporation is planning a merger with the Dorval Corporation. Figures for April 1, 2009 for each company are given below:

	Mirabel	Dorval
Total Earnings	\$50,000	\$20,000
Number of shares	5,000	5,000
Market price of stock	\$60	\$10
EPS	\$10	\$4

- a.) The Mirabel Corp plans to acquire Dorval through an exchange of stock. The basis of exchange will be the EPS for the last fiscal year. In order to ensure the success of the offering, Mirabel will pay a 20% premium for the Dorval shares. How many new shares of Mirabel stock will have to be issued if all the Dorval stocks are turned in?
- b.) What will be the expected price of Mirabel stock in exactly 5 years' time, given that the merger takes place as described in a.) ? The annual growth rate in earning per share for the corporation after the merger is expected to be 7% and Mirabel's EPS is expected to remain unchanged from its level before the merger.
- 2.) Holt Ltd, intends to acquire the common shares of Prentice Inc through a share exchange, and plans to offer shares valued at \$40 per share to the owners of Prentice. Data for the two firms are given below:

	Holt	Prentice
Total earnings (2009)	\$64,000,000	\$12,000,000
Price per share	\$72	\$34,50
P/E ratio	13.5	11.5

- a.) Why is Holt's P/E ratio higher than that of prentice? Provide 2 possible explanations.
- b.) Calculate the exchange ratio for the deal.
- c.) What are the new EPS of the combined company in the absence of any synergistic effects?
- d.) If the P/E ratio of the combined entity were a weighed average of the P/E ratios of the 2 separate companies (weighed by total earnings), what would the effect of the acquisition on the wealth of an investor who owned 100 Prentice shares in December 2009?

3.) Consider the following information for 2 all-equity firms, A and B:

	<u>Firm A</u>	<u>Firm B</u>
Shares outstanding	100	50
Price per share	\$50	\$30

Firm A estimates that the value of the synergistic benefit from acquiring Firm B is \$200. Firm B has indicated it would accept a cash purchase offer of \$35 per share. Should Firm A proceed?

4.) Consider the following pre-merger information about a bidding firm (Firm B) and a target Firm (Firm T). Assume that both firms have no debt outstanding:

	<u>Firm B</u>	<u>Firm T</u>
Shares outstanding	1,000	600
Price per share	\$34	\$24

Firm B has estimated that the value of the synergistic benefits from the acquiring Firm T is \$3,000.

- If Firm T is willing to be acquired for \$27 per share in cash, what is the NPV of the merger?
- What will the price per share of the merger firm be, assuming the conditions in (a)?
- In part a.), what is the merger premium?
- Suppose Firm T is agreeable to a merger by an exchange of stock. If B offers three of its shares for every five of T's shares, what will the price per share of the merged firm be?
- What will be the benefits accrued to the original Firm B's shareholders based on this stock to stock swap deal? What about to the original Firm T's shareholders?