BU 393 Question Bank

Capital Budgeting Criteria

Question 1

In each of the following situations assume the cash flows given are after any tax implications and that a required rate of return of 16% is appropriate.

a) GroLogic Ltd. will receive $1,000,000 today from Vulture Capital and pay Vulture Capital $1,800,000 in three years. Evaluate the project using the NPV, IRR and profitability index criteria and reconcile the differences in the accept/reject decisions.

b) GroLogic Ltd. is considering the following two mutually exclusive Projects:

Project P: Costs $50,000 and returns $70,000 one year from now.

Project Q: Costs $75,000 and returns $100,000 one year from now.

Rank these projects using the NPV, IRR and profitability index criteria and reconcile the differences in the rankings.

Question 2

In each of the following situations assume a required rate of return of 10%.

a) Calculate the NPV, IRR and profitability index of the project in the table below, show the decision and reconcile the differences between the decision rules where necessary:

Project	Cash Flows		NPV	IRR	PI
	Year 0	Year 1			
X	$20,000	-$25,000			
Decision: Accept or Reject					

b) Projects Y & Z are mutually exclusive projects. In the table provided, calculate the NPV, IRR and profitability index of each project, show the decision and reconcile the differences between the decision rules where necessary:

Project	Cash Flows		NPV	IRR	PI
	Year 0	Year 1			
Y	-$10,000	$14,000			
Z	-$12,000	$16,500			
Decision: Y or Z?					

Question 3

Cement Inc. needs to allocate this year's capital expenditure budget to either construction of a new retail outlet or investment in product enhancement. The marketing department has prepared estimates of the predicted increase in sales resulting from each project.

The required investment for each project is known and the life of each project is 5 years. The capital expenditure for both projects will be depreciated using the straight line method, ignoring the ½ year rule. The salvage value for the machinery used in the construction of the new outlet is $200,000 at the

end of five years and the salvage value for the machinery used in the product enhancement is $50,000 at the end of five years.

The required rate of return for both projects is identical to the firm's cost of capital of 15%. The tax rate is 34%.

The cash flows for both projects are shown in the following table.

New Retail Outlet						
Year	0	1	2	3	4	5
Investment	$1,300					
Revenue		$2,000	$2,100	$2,205	$2,315.25	$2,431.01
Expenses		$1,100	$1,155	$1,212.75	$1,273.39	$1,337.06

Product Enhancement						
Year	0	1	2	3	4	5
Investment	$950					
Revenue		$1,500	$1,575	$1,653.75	$1,736.44	$1,823.26
Expenses		$800	$840	$882	$926.10	$972.41

(All figures in thousands)

a. According to the NPV rule which project should the firm choose?

b. According to the IRR rule which project should the firm choose?

c. According to the PI rule which project should the firm choose?

d. Are the selections based on different investment rules consistent? If the investment rules are not consistent, what causes the inconsistency? If the investment rules are not consistent, fix the ranking problem using the incremental IRR approach.

Capital Budgeting

Question 4

Gofast Corporation operates a computer on which it has a 4-year lease. Management is currently investigating the development of a new computer program to automate certain aspects of production scheduling in the plant. The before-tax costs of developing the program are estimated at $40,000. These costs would be capitalized, with capital cost allowance taken at a rate of 30 percent. A computer consultant would have to be hired at a fee of $6,000, with this amount being expensed in the current period. In addition, the corporation needs $10,000 immediately to meet working capital requirements related to the implementation of this computerization project. The total NWC will be recouped at the end of the project. The before-tax savings in production costs in the plant are expected to be $16,000 per year for 4 years if the new production scheduling system is implemented. At the end of 4 years, it is expected that the production process will have a value of $15,000. The company's cost of capital is 13 percent and the corporate tax rate is 45 percent.

a. Should the program be developed if the evaluation is based on the NPV method?

b. Calculate the IRR of the computerization project. Should the project be accepted or rejected based on this criterion?

Question 5

Spinright Information Inc. is investigating ways to reduce its operating costs to allow it to compete more effectively. Spinright's plant is currently operating at its capacity of 1,000,000 CD-ROM disks annually. In addition, the firm is also contracting out the manufacture of 500,000 CD-ROMs annually at a cost of $1.05 per disk. Currently, the cost of disks produced internally is $1.17, which includes $0.27 fixed overhead per disk, with the balance being direct labour and materials.

A representative from Nobler Technologies has demonstrated a manufacturing set-up that would have direct material and labour costs of $0.65, with the savings generated primarily through less waste and faster throughput, reducing the labour cost per disk. The set-up would have capacity of 1,500,000 disks per year, allowing Spinright to stop contracting out. The Nobler equipment would cost $750,000, plus there would be a maintenance contract of $100,000 per annum over its 4-year life. Nobler will repurchase the equipment after four years for $60,000. The equipment will be depreciated using the units of production method, the CCA rate for this type of asset is 20% and the firm's required rate of return is 15% after taxes of 40%

a. Should Spinright acquire the equipment?
b. How does your answer in (a) change if the entering federal government budget raises the tax rate to 45%, and reduces the CCA rate to 15%?

Question 6

To save on operating expenses, Wemakeit Company, a manufacturing firm is considering upgrading its facilities. Two different machines are available.

Machine 1: The first machine has a lifetime of 8 years. It can be purchased for $10,000 and sold after 8 years for $3500. Increased operating revenues are expected to be $2500 a year before tax.

Machine 2: The machinery for the second project has a lifetime of 4 years with no salvage value. At the current time the machine costs $5510. The machine is expected to produce before tax operating savings of $2200 a year over the lifetime of the project.

Wemakeit's tax rate is 42% and for both machines, CCA on a declining balance can be taken at a rate of 35%. The firm's cost of capital is 12%. Analysts have been unable to accurately predict the price of machine 2 in 4 years. In fact, market pressures are such that they are unsure as to whether the price will increase or decrease. What is the maximum price that this machine could be such that Wemakeit should choose machine 2?

Question 7

Norris Inc. manufactures electronic devices. After spending $20,000 on a feasibility study, Norris is considering entering the virtual pet market. The study suggested 1 of 2 possible projects

Project 1: The firm would have to buy new equipment that has a 5 year life and costs $40,000. Freight, an allowable installation expense, is $1000. The equipment will be added to the Norris' class 39 assets (CCA rate of 25%). Revenues for each of the five years are expected to be $33,000, and expenses are expected to be $9,000. At the end of the five years, the equipment can be sold for $10,000.

Project 2: The length of this project is 6 years. Because of the nature of this machinery, Norris would have to invest $5000 in NWC at the beginning of the project and because of changing technology, none of this would be recaptured at the end of the project. The machinery required, which is also a class 39 asset, would cost $45,000. This figure includes allowable installation costs. Revenues for the project are expected to be $36,500 a year over the life of the project. Ordinary expenses are anticipated at $10,000 a year for each year. In addition, the study suggests that the firm would incur an additional $2000 expense at the end of the third year to realign the delicate machinery. The machinery would be salvageable for $11,000 at the end of the 6 years.

The firm's tax rate is 46%, and the opportunity cost of capital for the project is 15%. Norris plans on repeating the project indefinitely in the future.

Which project should Norris undertake?

Cost of Capital

Question 8

As a consultant to MHD Technologies, you have been asked to estimate the firm's required rate of return. The following is extracted from the firm's balance sheet of May 31, 2013:

7.5% First Mortgage Bonds (matures May 31, 2023)…….……..	$30,000,000
Preferred Shares with $2.25 dividends (200,000 shares).....	5,000,000
Common Shares (2,000,000 shares issued and outstanding).....	4,000,000
Retained Earnings.....	15,000,000

There have be no changes to the firm's capitalization since these statements. None of these securities are publicly traded.

You have collected the following estimates and market data:

Dividends paid in current year.....	$0.97/share
MHD's beta.....	.0.75
Treasury Bill rate.....	7.00%
Expected return on the market.....	15.00%
Sustainable growth rate for MHD.....	3.00%
Required return on bonds similar to MHD's.....	9.80%
Required return on preferreds similar to MHD's.....	7.50%
MHD's effective tax rate.....	40.0%

Assume May 31, 2013 is the current date

a. Estimate the unit market value (price per share or bond) of MHD's debt, preferred shares and common shares. Round the bond price to the nearest dollar, and the share values to the nearest eighth of a dollar.

b. Using the market prices from a), estimate MHD's required rate of return.

Question 9

Honeycutt is calculating its opportunity cost of capital. The following has been determined:

Debt. $1,000 par value, 20-year, 9 percent coupon-rate bond can be sold at a discount of $50 per bond. Interest is paid annually, and the marginal corporate tax rate is 40 percent.

Preferred stock. $100 par value, 8.5 percent preferred stock can be sold at a discount of $9 per share.

Common equity. The present market price is $75 per share. The cash dividend next year is expected to be $5, and the growth rate is expected to be 7 percent for the foreseeable future.

Internally Generated Financing. All the common equity needs will be funded by internally generated funds.

Honeycutt's current market value capital structure is as follows:

Debt	30%
Preferred stock	20
Common Equity	50

a. What is Honeycutt's opportunity cost of capital?

b. Assume now Honeycutt decides to increase its financing substantially. Everything is the same as in a) except that internally generated financing is not available. However, the firm can issue new shares with underpricing costs equaling $12 per share.

Question 10

Gage Equipment has traditionally employed a firm-wide opportunity cost of capital for capital budgeting purposes. However, its two divisions-machinery and farm implements-have different degrees of risk. Data on the firm and the divisions are as follows:

	Gage Equipment	Machinery Division	Farm Implement Division
Beta	1.4	1.0	2.0
Percentage of debt	40%	50%	20%
Percentage of common equity	60	50	80

The following estimates have been made: r_i = 7%, the risk free rate is 10%, and the return on the market is 15%. The firm is considering the following capital expenditures:

Proposed Capital Projects		Initial Investment (in millions)	IRR
Machinery	M-1	$1	15%
	M-2	3	12
	M-3	2	9
Farm Implements	F-1	4	16
	F-2	6	20
	F-3	5	12

a. Based on a firm-wide opportunity cost of capital, which projects should Gage select? What is the size of the capital budget?

b. Based on the opportunity costs of capital for the two divisions, which projects should now be selected? What is the size of the resulting capital budget?

c. What happens if a firm uses a firm-wide opportunity cost for capital budgeting purposes when it should be using divisional opportunity costs?

Question 11

Gene's Supports has two divisions, wholesale and retail. Data are as follows:

marginal tax rate for Gene's	T = 0.40
after-tax cost of debt,	r_i= 9%
Debt-equity ratio for the wholesale division	0.65
Debt-equity ratio for the retail division	0.50

risk-free rate,	$R_F = 10\%$
expected return on the market	$r_M = 18\%$

Two-pure-play firms for each division and pertinent data for them are:

Pure-Play for Wholesale Division	Firm A	Firm B
market risk, β_j	1.20	1.40
marginal tax rate	0.30	.40
Debt/equity ratio	0.60	0.40

Pure-Play for Retail Division	Firm C	Firm D
market risk, β_j	1.50	1.40
marginal tax rate	0.35	.40
Debt/equity ratio	0.45	0.50

Determine the opportunity cost of capital for the wholesale division and for the retail division. (Use the average asset β of the pure play firms)

Question 12

Echo Industries' new CFO is undertaking a thorough review of how the firm makes its capital investments decisions. A major component of the review is how the firm determines its opportunity cost of capital.

Debt can be issued at par and will carry a 13.5 percent coupon interest rate, and preferred stock can also be issued at par and will carry a 13 percent dividend. Information on common stock is as follows:

	Year	Dividends per share
$P_0 = \$40$	-4	\$2.00
$\beta = 1.25$	-3	\$2.00
$R_f = 11\%$	-2	\$2.40
$r_m = 16\%$	-1	\$2.75
Expected risk premium of stocks over bonds= 5%	0	\$2.93

The market value capital structure for Echo Industries is 40 percent debt, 50 percent common equity, and 10 percent preferred stock. The firm's marginal tax rate is 35%.

a. Determine the cost of common equity.
b. What is Echo Industries' weighted average cost of capital?
c. Suppose Echo Industries' had to issue new securities to finance a project. What would be the impact of flotation costs on the firm's cost of capital?

After further investigation it is determined that Echo Industries' three divisions – Industrial, Electrical and

Trucking - have vastly different risks. Hence, divisional opportunity costs of capital are required.

d. What occurs if a firm-wide opportunity cost is employed when risk differs significantly among divisions?

Three pure-play firms have been identified as follows:

	Pure Play Firms		
	Busy Beaver Industrial Ltd.	Benjamin Franklin Electrical Co.	Keep'em Moving Trucking Inc.
Firm β_{pp}	1.83	1.35	0.70
Firm's marginal Tax rate T_{pp}	0.40	0.30	0.40
Firm's debt equity ratio	0.30	0.90	1.00

For Echo Industries, the appropriate debt-equity ratios for its three divisions are: Industrial Division, 0.20; Electrical Division, 0.70; and Trucking Division, 1.10.

e. Ignoring the preferred shares, what are the appropriate weighted average costs of capital for the three divisions?

Long Term Financing

Question 13

Ten years ago, the Red Beer Company, Ltd. of Red Deer, Alberta issued at par $10 million in 30-year bonds at a coupon rate of 13%, in the process incurring flotation costs amounting to $200,000. Those bonds are now callable at a 15% call premium over par. Presently, Red Beer can issue at par 20-year bonds with a coupon rate of 11%. Both the outstanding bonds and the proposed new bonds entail annual rather than semiannual coupon payments. Issuance of the new bonds would require $300,000 in flotation costs. Due to a lack of financial synchronicity, the new bonds would have to be issued three weeks prior to the date of redemption of the outstanding bonds. Treasury bills issued by the Canadian Government are currently yielding 4%. Red Beer's tax rate is 35%.

Your advice has been solicited as regards calling the outstanding bonds and issuing the new bonds.

a. What do you advise Red Beer to do?

b. Suppose macroeconomic forecasts strongly suggest a steep drop in interest rates in the near future. Qualitatively assess how this additional information affects your advice to Red Beer. Note that quantitative analysis is not required for this part

Question 14

A firm distributes a $25 million bond issue with a 30 year maturity and a 15% annual coupon rate (i.e. coupons are issued once a year only). The existing indenture allows redemption at the following call premiums:

From 5 – 9 years after issue	10%	From 10 – 15 years after issue	6%	Greater than 15 years after issue	2%

10 years after the issue, the interests rate decline to 12%. What is the maximum amount of before tax issuing and underwriting expenses such that refinancing would be attractive? Assume that the firm's tax rate is 40%. The overlap period is 2 months, and the risk free rate is 6%.

Question 15 through Question 17 have been removed.

Question 15

Preston Partners currently has $150 million of 14% annual coupon bonds outstanding, with 25 years remaining to maturity. The bonds were issued 5 years ago with a flotation cost of $1.5 million. If called now, the bonds carry a call premium of 12%. Right now, $150 million of 25 year, 12.5% coupon bonds could be issued at par to refund these bonds. These bonds carry a call premium of 8%. Interest rates are not expected to decline further, flotation costs on the new bonds are $2.25 million, there is a one-month overlap, and Preston Partners' tax rate is 36%. The T-Bill rate is 9%. Should the firm refund the existing bonds?

Taxes and Capital Structure

Question 16

Georgetown Mining Inc. is currently an all equity company. It has 10 million shares outstanding with a book price of $35 per share. The shares are currently trading at $42.75. Georgetown Mining is considering bidding on a contract to supply uranium to the Department of National Defence. The cost of the project is $100 million, but Georgetown Mining is expected to receive $15 million in after tax cash flows a year in perpetuity.

The risk free rate is 4%, the market risk premium is 6.8%, and analysts have assigned Georgetown Mining a beta of 1.25. Georgetown Mining has a corporate tax rate of 40%

a. According to MM with taxes, if Georgetown Mining wants to maximize firm value, should they finance this project with debt or with equity? Why?

b. What is Georgetown Mining's cost of equity capital?

c. What is the market value Georgetown Mining Inc before it undertakes this project?

d. What is the NPV of the project?

e. What is the value of the firm if it finances the project with internally generated cash flow?

f. Georgetown Mining announces to the market that it has this contract with the Department of National Defence that will increase the value of the firm. According to the efficient market hypothesis, what should be the reaction of the market to this announcement? What is the price of each share?

g. Suppose that Georgetown Mining does not have access to enough funds to finance the project internally. Instead it issues $100 million in new equity. In an MM world with taxes, what will be the price at which Georgetown Mining can issue new shares? How many shares will Georgetown Mining have to issue to fund the project?

Suppose instead, Georgetown Mining finance the project with an 8% debt issue.

h. According to MM with taxes, what will be the value of the firm?

i. What will be the value of the firm's equity? What is the share price?

j. What will be the firm's WACC?

k. What will be the return required by equity holders?

Question 17

Endicott Industries is an all equity firm, with an expected EBIT of $100,000 and a tax rate of 40%. Investors currently require a rate of return of 12% on Endicott's stock.

a. What is the market value of Endicott Industries?

b. If there are 10,000 shares o/s, what is the price per share?

c. What is Endicott's WACC?

d. Endicott is considering repurchasing $50,000 of equity. The funds for the repurchase would be obtained by issuing long term debt with 8% coupons. What will be the value of the firm after the repurchase?

e. What accounts for the change in the value of the firm?

f. What is the value of the firm's equity after the repurchase?

g. What is the cost of equity of the levered firm?

h. What is the firm's WACC?

i. If EBIT is $100,000 do shareholders receive higher eps if the firm is recapitalized?

Question 18

Betty Ann Cosmetics is a new company that is launching a bath products line. This line will be the only revenue source for the firm. Betty Ann Cosmetics has access to 2 projects, Pretty-Safe and Pretty-Wild, whose cash flows are given below. The cost of both projects is $60,000 and look identical to any potential lenders. The firm would like to finance the projects with a combination of debt and equity. In particular, Betty Ann Cosmetics would like to raise $40,000 in debt to finance the project, and finance the remaining amount with equity.

Project Pretty-Safe

Economy State	Probability	Project Payoff
Bad State	0.5	$55,000
Good State	0.5	$75,000

Project Pretty-Wild

Economy State	Probability	Project Payoff
Bad State	0.5	$20,000
Good State	0.5	$100,000

Assume that the risk free rate is 0%. Therefore in a risk free world, a debt issue of with a face value of $40,000 would have a price of $40,000.

a. What is the NPV of Project Pretty-Safe?

b. What is the NPV of Project Pretty-Wild?

c. In a perfect world, what project should Betty Ann undertake?

d. Suppose lenders gave Betty Ann Cosmetics $40,000 for a debt issue with the face amount of $40,000 at time 0, and this amount was to be paid back when cash flows were realized. For each project, fill in the cash flows accruing to debt holders and equity holders.

Project Pretty-Safe

Economy State	Bad State	Good State
Project payoff	55,000	$75,000
Payment to debt holders		
Payment to equity holders		

Project Pretty-Wild

Economy State	Bad State	Good State
Project payoff	20,000	$100,000
Payment to debt holders		
Payment to equity holders		

e. In the presence of leverage, what project would equity holders prefer?

f. Given that debt holders cannot distinguish between the 2 projects, would debt holders be willing to accept a $40,000 payment at time zero for the debt issue with the face amount of $40,000? Why or why not? What is the maximum amount that the debt holders would be willing to lend?

g. How much then will equity holders have to contribute in order to undertake a project?

h. What project then will the equity holders of Betty Ann Cosmetics undertake? Why is this not optimal?

Question 19

Kitchener Waterloo Widgets, abbreviated KWW, is a levered firm with 100,000 shares and 1,000 bonds outstanding. The shares are currently trading at $50 per share whereas the bonds, which stipulate an annual coupon of 10%, are trading at their face value of $1,000 per bond. The company's tax rate is 45%.

KWW is considering a leveraged recapitalization, which would involve issuing $1,500,000 in junior debentures to an insurance firm at an interest rate of 12%. The proceeds of the junior debenture issue would be used to redeem and cancel common shares. KWW would repurchase the share at the current price of $50 per share.

An investment banker has advised the firm that its cost of equity would rise to 18% as a result of the leveraged recapitalization but that the market price of the currently outstanding bonds would not be affected.

Both the currently outstanding bonds and the proposed junior debentures will never mature (they are perpetuities).

a. Calculate the indifference or crossover EBIT (the value of EBIT at which the EPS assuming the current capital structure is maintained equals the EPS assuming the recapitalization plan is adopted).

b. Assume that the firm generates an annual EBIT (earnings before interest and taxes) of $1,500,000. Calculate the effect of the leveraged recapitalization on the following financial variables, showing their original and revised values.

Financial Variables	Original Values (before recapitalization)	Revised Values (after recapitalization)
EPS (earnings per share)		
Price	$50	
S (market value of equity)		
V (market value of the firm)		

Dividend Policy

Question 20

Small Corporation wishes to distribute $4,000 to shareholders, and is deciding between issuing an extra dividend or employing a share repurchase. Small's stock is currently selling for $35 per share and current earnings are 90 cents per share. The company has 150 shares outstanding. For parts (a) and (b), ignore taxes and other market imperfections.

a. Evaluate each of the two alternatives in terms of the effect on the price per share and shareholder's wealth.

b. What would be the effect on Small's EPS and PE ratio under each of the two alternatives?

c. In the real world, which of these alternatives would you recommend and why?

Question 21

Here are some key financial data for Marvin's Specific Computers Co. at the end of the day on December 31, 2005:

Earnings per share for 2005	$11
Number of shares outstanding	40 million
Target dividend payout ratio	50%
Planned dividend per share	$5.50
Stock price per share, year end 2005	$160
Discount rate	10%

Marvin plans on paying the entire dividend on January 1, 2006. Assume that the "perfect capital markets" assumptions of Miller and Modigliani hold.

a. What will be the stock price of Marvin after the planned dividend payout?

b. Suppose, at the end of day on December 31st, Marvin announces that he is canceling the dividend and instead using the proceeds to repurchase shares at the market price. How many shares will Marvin repurchase?

c. Complete the table below for the year end 2005 and for the 2 scenarios discussed in parts a) and b).

	Year end 2005, before repurchase or dividend	If Marvin pays dividend	If Marvin repurchases shares
Earnings per share			
Price earnings ratio			

d. What happens to the earnings per share and the price earnings ratio when Marvin pays a dividend? What happens to the earnings per share and the price earnings ratio when Marvin pays a repurchases shares?

Question 22

The price of Hillier Aeronautics Inc.'s share has grown recently and now the stock is trading at $20. The management feels that this price is too high and it is currently considering either a 4 for 3 stock split or a 33.33% stock dividend.[1]

Complete the equity section of Hillier's book value balance sheet and the share price information, by filling in the boxes, assuming that the firm records the book value of new shares at the current market price of $20.

	Current	4 for 3 stock split	33.33% stock dividend
Authorized number of shares	500,000	500,000	500,000
Number of Shares O/S	300,000		
Capital Stock	3,000,000		
Retained Earnings	2,500,000		
Shareholder's Equity	5,500,000		
Current share price	$20		

Leasing

Question 23

Marsh Brothers Distributors is considering a lease arrangement as a means of acquiring a new forklift. The forklift costs $150,000, is expected to be used for 3 years, and is a class 39 asset (CCA rate 25%). The forklift requires annual maintenance – most contractors purchase a 3 year maintenance contract with payments of $5000 a year, payable at the beginning of the year. This cost of the maintenance contract is not included in the lease price. Marsh Brothers estimates that the forklift's resale value in 3 years is $10,000. The firm's marginal tax rate is 30%, the firm's weighted average cost of capital is 14%, its cost of equity is 21.5% and the before-tax cost of debt is 11.43%.

a. If the lease payments are made in the beginning of the year, what is the maximum lease payment such that leasing in attractive?

b. If the maintenance costs were bundled in the lease payment, (i.e. the lease contract included the maintenance), what would be the maximum lease payment such that leasing would be attractive?

[1] Ignore, for the moment, that the TSX would consider such an announcement to be a stock split and not a dividend.

c. Suppose the lease payment is $55,000 and that the maintenance contract is not bundled with the lease. What is the maximum salvage value such that leasing is still attractive?

Question 24

Peak Roofing Company has been in the construction business over the last four decades. It is considering the acquisition of a new construction crane that would cost $900,000. It is expected that the new crane will increase the speed at which roofs can be completed. In particular, it is expect that the crane will generate annual (before tax) savings of $300,000 for five years. The CCA rate for the machine is 40%. Salvage value is expected to be $60,000 at the end of the five years. Peak Roofing has a marginal tax rate of 20%, a before-tax cost of debt of 10% and a weighted average cost of capital (WACC) of 18%.

a. Should Peak Roofing Co. acquire the new construction crane?

b. As an alternative to purchasing the crane, Peak Roofing has the option of leasing it from the Caterpillar Leasing Inc. Lease payments are due at the beginning of each year over the five year leasing period. Calculate the maximum lease payment such that Peak Roofing would undertake this project.

c. Should Peak Roofing accept the leasing contract, if the annual lease payment is set at $207,000?

d. Caterpillar Leasing has a pretax cost of debt of 4%; its WACC is 12%, and tax rate is 45%. Caterpillar Leasing is able to acquire the crane at a whole sale price of only $800,000. Calculate the break-even lease payment for the lessor.

e. Given your results above, is a leasing contract feasible between Peak Roofing Co and Caterpillar Leasing Inc? If such a contract is feasible, indicate the range where the lease payment is likely to be set.

Mergers

Question 25

The management of Alpha, Inc. proposes to acquire Omega, Inc., believing that the acquisition will increase its annual after-tax cash flows by $350,000 indefinitely. The appropriate discount rate for incremental cash flows is 7 percent. Both Alpha and Omega are all-equity firms. Alpha has 200,000 shares outstanding, currently priced at $100 per share. Omega has 150,000 shares outstanding, priced at $80 per share.

a. If Alpha proposes to purchase Omega for $15 million cash, what is the NPV of this proposed takeover?

b. If Alpha proposes to purchase Omega by offering one new share of Alpha in exchange for each share of Omega, what is the NPV of this proposal?

c. Which of these two proposals is best for Alpha's shareholders, and why?

Comprehensive Questions

Question 26

Consider a company with the following balance sheet:

Assets (in millions)	Liabilities (in millions)
Total Assets = 200	Equity = 120
	Debt = 80

Assume that the after tax cost of debt is 5.7%. The risk free rate of interest is 5% and the expected return on the market as a whole is 15%. The beta of the equity of the company is 1.5.

The company has an environmentally hazardous project that costs $2 million in capital outlays now and lasts for 10 years. For each year of the project, the project generates net operating cash flows of $450,000, earned at the end of the year. Also, at the end of year 10 the company has to pay $1 million for some clean-up connected with this project. This amount can be expensed when it is incurred. The equipment connected with this project has a CCA rate of 30% and the salvage value of the equipment is $160,000 at the end of 10 years. The corporate tax rate is 43%.

a. Determine the company's required rate of return on equity.
b. Determine the company's cost of capital.
c. What is the NPV of the project? Should the company undertake the project? (
d. Suppose the company could lease rather than buy the equipment connected with this project. The lease payments are certain to be $200,000 per year. Is leasing preferable to purchasing?
e. If the company could lease the required equipment, should the company undertake the environmentally hazardous project or not?

Question 27

In 2006, to meet expanding demand for its product, Sparkling Water Inc. is looking at purchasing a new bottling machine for its Laurel Creek bottling centre. There are currently 2 standard machines that can be purchased. Regardless of what machine purchased, revenues associated with this bottling centre are expected to be $250,000 a year.

Machine 1

The industry standard machine costs $120,000 and has an anticipated life of 6 years. Installation costs on this machine are an additional $10,000 and are eligible for CCA deductions. At the end of the project, the machine can be salvaged for $45,000. Experience has shown however, that the cost of operating this machine increases over time. The firm estimates that operating costs will be $55,000 for the first 3 years after installation, and $65,000 for the last 3 years. In addition, this machine requires an increase in working capital items of $6000 at the time of installation. In the past, the firm has found that none of this can be recouped at the end of the project.

Machine 2

Because of anticipated change in CCA rates (see below), the firm is considering the purchase of a machine with an expected useful life of 2 years instead of the industry standard machine. The cost of this machine is $47,000 plus additional allowable installation costs of $4000. At the end of 2 years, the expected salvage on the machine is $5000. Anticipated operating costs on this machine are $60,000 a year. In addition, this machine requires an increase in working capital items of $4000 when it is installed. It is expected that half this amount can be recouped at the end of the two years.

Current CCA on this bottling machinery (CCA class 8) can be taken at a rate of 20%. However the government has announced that all CCA class 8 machinery purchased after December 31st 2007, will have a depreciation rate of 25%.

Sparkling Water has a corporate tax rate of 34%. It is financed 30% by debt and 70% by equity. The CFO estimates that the Sparkling Water Inc could finance the equity portion of this new project from internal equity. The risk free rate of interest is 5% and the market risk premium is 8%. According to analysts, Sparkling Water's beta is 1.27. New debt would need to be issued to finance this project. The CFO feels that the before tax cost of a new debt issue would be 7.01%.

Which machine should Sparkling Water purchase?

This question bank is work in progress. As such, there could be errors in the solutions. Please bring concerns to your instructor so that errors can be corrected.

Capital Budgeting Criteria Solutions

Solution to Question 1

a. GroLogic is receiving a loan. Therefore, the decision criterion for IRR is reversed.

$$NPV = 1{,}000{,}000 - \frac{1{,}800{,}000}{(1.16)^3} = -\$153{,}183.81 \quad \Rightarrow \quad \text{NPV} < 0, \text{ therefore reject project.}$$

$$\text{PI} = \frac{1{,}000{,}000}{\frac{1{,}800{,}000}{(1.16)^3}} = 0.867 \quad \Rightarrow \quad \text{PI} < 1, \text{ therefore reject project.}$$

$$0 = 1{,}000{,}000 - \frac{1{,}800{,}000}{(1+IRR)^3}$$

$$\text{IRR} = \left(\frac{1{,}800{,}000}{1{,}000{,}000}\right)^{1/3} - 1 = 21.6\% \quad \Rightarrow \quad \text{Cost of capital } 16\% < 21.6\%. \text{ Therefore reject project.}$$

b. Project Q has the higher NPV, while Project P has the higher PI and IRR. This is due to the scale of the cash flows.

For P:

$$NPV_p = -50{,}000 + \frac{70{,}000}{(1.16)} = \$10{,}345; \quad \text{PI}_p = \frac{\frac{70{,}000}{1.16}}{50{,}000} = 1.207; \quad 0 = -50{,}000 + \frac{70{,}000}{1+IRR_p} \rightarrow IRR_p = 40\%$$

For Q:

$$NPV_q = -75{,}000 + \frac{100{,}000}{(1.16)} = \$11{,}207; \quad \text{PI}_q = \frac{\frac{100{,}000}{1.16}}{75{,}000} = 1.149; \quad 0 = -75{,}000 + \frac{100{,}000}{1+IRR_q} \rightarrow IRR_q = 33\%$$

To correctly chose which project should be undertaken, use the incremental IRR approach.

Solution to Question 2

a. Filling in the table:

Project	Cash Flows		NPV	IRR	PI
	Year 0	Year 1			
X	$20,000	-$25,000	-2,727	25%	0.88
Decision: Accept or Reject			Reject	Reject	Reject

This is a loan. Thus, we want the IRR to be as low as possible. Since IRR>10%, we would reject this project.

b. With mutually exclusive projects, we cannot rely on IRR or PI to rank correctly, since they are biased toward smaller projects that are more profitable per dollar invested. The NPV indicates that the additional investment of $2,000 adds and extra $273 in value.

Project	Cash Flows		NPV	IRR	PI
	Year 0	Year 1			
Y	-$10,000	$14,000	2,727	40%	1.27
Z	-$12,000	$16,500	3,000	37.5%	1.25
Decision: Y or Z?			Z	Y	Y

Solution to Question 3

a. First, annual depreciation for new retail outlet=(C-S)/n=(1300-200)/5=220 thousand and the tax shields from depreciation=220*0.34=74.8 thousand

Annual depreciation for product enhancement=(C-S)/n=(950-50)/5 = 180 and the tax shields from depreciation = 61.20

New Retail Outlet						
Year	0	1	2	3	4	5
1)Investment	-1,300					
2)Revenue		$2,000.00	$2,100.00	$2,205.00	$2,315.25	$2,431.01
3)Expenses		$1,100.00	$1,155.00	$1,212.75	$1,273.39	$1,337.06
4)OCF=2)-3)		$ 900.00	$ 945.00	$ 992.25	$1,041.86	$1,093.95
5)After tax OCF=4)*(1-Tc)		$ 594.00	$ 623.70	$ 654.89	$ 687.63	$ 722.01
6)Tax Shields		$ 74.80	$ 74.80	$ 74.80	$ 74.80	$ 74.80
7)Salvage						$ 200.00
8)Net CF =1)+5)+6)+7)	$ (1,300.00)	$ 668.80	$ 698.50	$ 729.69	$ 762.43	$ 996.81
9)Discounted CF	$ (1,300.00)	$ 581.57	$ 528.17	$ 479.78	$ 435.92	$ 495.59

Product Enhancement						
Year	0	1	2	3	4	5
Investment	-$ 950.00					
Revenue		$1,500.00	$1,575.00	$1,653.75	$1,736.44	$1,823.26
Expenses		$ 800.00	$ 840.00	$ 882.00	$ 926.10	$ 972.41
4)OCF=2)-3)		$ 700.00	$ 735.00	$ 771.75	$ 810.34	$ 850.85
5)After tax OCF=4)*(1-Tc)		$ 462.00	$ 485.10	$ 509.36	$ 534.82	$ 561.56
6)Tax Shields		$ 61.20	$ 61.20	$ 61.20	$ 61.20	$ 61.20
7)Salvage						$ 50.00
8)Net CF	-$ 950.00	$ 523.20	$ 546.30	$ 570.56	$ 596.02	$ 672.76
9)Discounted CF	-$ 950.00	$ 454.96	$ 413.08	$ 375.15	$ 340.78	$ 334.48

NPV (retail outlet)=$1221.02

NPV (product enhancement) = $968.45

Therefore the firm should choose the retail outlet because it has the higher NPV.

b. IRR retail outlet=47.77% and RR product enhancement=51.15% Simply based on IRR, we would select the product enhancement project.

c. PI(retail outlet)=Total positive discounted cash flows/initial investment= $\frac{2521.02}{1300} = 1.94$

PI(enhancement) =Σ positive discounted cash flows/initial investment = $\frac{1918.45}{950} = 2.02$. PI gives us the selection of the enhancement project because it has a higher PI.

d. IRR and PI treat projects differently. IRR favours projects in which cash flows are earned sooner than later. PI tends to favour projects that are smaller.

To fix the project ranking problem, we can use incremental IRR rule.

Year	0	1	2	3	4	5
Net CF retail	-$ 1,300.00	$ 668.80	$ 698.50	$ 729.69	$ 762.43	$ 996.81
Net CF enhancement	-$ 950.00	$ 523.20	$ 546.30	$ 570.56	$ 596.02	$ 672.76
Incremental project	-$ 350.00	$ 145.60	$ 152.20	$ 159.13	$ 166.40	$ 324.05
Discounted CF	-$ 350.00	$ 126.61	$ 115.09	$ 104.63	$ 95.14	$ 161.11

Based on the above incremental CFs, we get incremental IRR=38.97%>15%. Therefore, we should undertake the bigger project: retail outlet. Now this selection is consistent with the selection from the NPV rule.

Capital Budgeting Solutions

Solution to Question 4

a. If you aren't told that the pool is closing, then you assume that it is not.

$T_C = .45$, k=13%, n =4, EE_0= -40,000, d = 30%, $C_0 = -6{,}000$,
$NWC_0 = -10{,}000$, $NWC_n = 10{,}000$, OCF = 16,000, S = 15,000

NPV = capital cost + pv operating cash flows + CCA tax shield
- CCA tax shield lost due to salvage+ pv salvage + pv NWC

$$EE_0 + PV_{OCF} + PV_{CCA\ TS\ forever} - PV_{CCA\ TS\ lost} + PV_{Salvage} + PV_{NWC}$$

$$= EE_0 + C_0(1-T_c) + OCF(1-T_C)\left[\frac{1-(1+k)^{-n}}{k}\right] + \left(\frac{C \cdot d \cdot T_C}{k+d}\right)\cdot\left[\frac{1+0.5k}{1+k}\right] - \left(\frac{S \cdot d \cdot T_C}{k+d}\right)\left[\frac{1}{(1+k)^n}\right]$$

$$+ \frac{S}{(1+k)^n} + NWC_0 + \frac{NWC_n}{(1+k)^n}$$

$$= -40{,}000 - 6000(1-.45) + 16{,}000(1-.45)\left[\frac{1-(1+.13)^{-4}}{.13}\right] + \left(\frac{-40000 \cdot 0.3 \cdot .45}{.13+0.3}\right)\cdot\left[\frac{1+0.5\times.13}{1+.13}\right]$$

$$-\left(\frac{15{,}000 \cdot 0.3 \cdot .45}{.13+0.3}\right)\left[\frac{1}{(1+.13)^4}\right] + \frac{15{,}000}{(1+.13)^4} - 10{,}000 + \frac{10{,}000}{(1+.13)^4}$$

$$= -40{,}000 - 3{,}300 + 26{,}175.35 + 11{,}835.77 - 2{,}888.30 + 9.199.78 - 3{,}866.82$$

$$= -2{,}844$$

Therefore do not undertake the project.

b. IRR can only be solved using solver. The answer is 10.8%. We know that the IRR will be less than 13%.

Solution to Question 5

a. Current production costs are 1 m x 1.17 + .5 m x 1.05 = $1.695 million.

Proposed production costs are 1.5 x (0.27+0.65) = $1.38 million.

Therefore proposed savings = 1.695 – 1.38 = $0.315 million

$T_C = .40$, k=15%, n =4, EE_0= -750 d = 20%, OCF = 315-100 = 215, S = 60

NPV = capital cost + pv operating cash flows + CCA tax shield
- CCA tax shield lost due to salvage+ pv salvage

$$EE_0 + PV_{OCF} + PV_{CCA\ TS\ forever} - PV_{CCA\ TS\ lost} + PV_{Salvage} + PV_{NWC}$$

$$= EE_0 + OCF(1-T_C)\left[\frac{1-(1+k)^{-n}}{k}\right] + \left(\frac{C \cdot d \cdot T_C}{k+d}\right)\cdot\left[\frac{1+0.5k}{1+k}\right] - \left(\frac{S \cdot d \cdot T_C}{k+d}\right)\left[\frac{1}{(1+k)^n}\right] + \frac{S}{(1+k)^n}$$

$$= -750 + 215(1-.40)\left[\frac{1-(1+.15)^{-4}}{.15}\right] + \left(\frac{750 \cdot 0.2 \cdot .40}{.15+0.2}\right)\cdot\left[\frac{1+0.5\times.15}{1+.15}\right]$$

$$-\left(\frac{60 \cdot 0.2 \cdot .40}{.15+0.2}\right)\left[\frac{1}{(1+.15)^4}\right] + \frac{60}{(1+.15)^4}$$

$$= -750 + 368.29 + 160.25 - 7.84 + 34.31$$

$$= -195$$

Therefore we should reject the project.

b. Change tax and CCA rates

$T_C = .40$, k=15%, n =4, EE_0= -750 d = 20%, OCF = 315-100 = 215, S = 60

NPV = capital cost + pv operating cash flows + CCA tax shield

- CCA tax shield lost due to salvage+ pv salvage

$$EE_0 + PV_{OCF} + PV_{CCA\ TS\ forever} - PV_{CCA\ TS\ lost} + PV_{Salvage} + PV_{NWC}$$

$$= EE_0 + OCF(1-T_C)\left[\frac{1-(1+k)^{-n}}{k}\right] + \left(\frac{C \cdot d \cdot T_C}{k+d}\right) \cdot \left[\frac{1+0.5k}{1+k}\right] - \left(\frac{S \cdot d \cdot T_C}{k+d}\right)\left[\frac{1}{(1+k)^n}\right] + \frac{S}{(1+k)^n}$$

$$= -750 + 215(1-.45)\left[\frac{1-(1+.15)^{-4}}{.15}\right] + \left(\frac{750 \cdot 0.15 \cdot .45}{.15+0.15}\right) \cdot \left[\frac{1+0.5 \times .15}{1+.15}\right]$$

$$- \left(\frac{60 \cdot 0.15 \cdot .45}{.15+0.15}\right)\left[\frac{1}{(1+.15)^4}\right] + \frac{60}{(1+.15)^4}$$

$$= -750 + 337.60 + 157.74 - 7.72 + 34.31$$

$$= -228$$

Our answer does not change, we should still reject the project

Solution to Question 6

This is a replacement chain problem. Calculate the NPV of the first machine, and then replicate the second project, letting EE_4 be the capital cost of the 2nd machine at time 4.

T = 42%, k = 12%, d = 35%

For project 1: n = 8, OCF = 2500, S = 3500, C_0=10,000, EE=-10,000

$$NPV = EE_0 + PV_{OCF} + PV_{CCA\ TS} + PV_{Salvage}$$

$$= EE_0 + OCF_j(1-T_c)\left[\frac{1-(1+k)^{-n}}{k}\right] + \left(\frac{C \cdot d \cdot T_C}{k+d}\right) \cdot \left[\frac{1+0.5k}{1+k}\right] - \left(\frac{S \cdot d \cdot T_C}{k+d}\right)\left[\frac{1}{(1+k)^n}\right] + \frac{S}{(1+k)^n}$$

$$= -10000 + 2500(1-.42)\left[\frac{1-(1+.12)^{-8}}{.12}\right] + 10000 * \frac{.35 * .42}{.35+.12} * \frac{.1+.06}{1+.12} - \frac{3500}{(1.12)^8} * \frac{.35 * .42}{.35+.12} + \frac{3500}{(1.12)^8}$$

$$= -10000 + 7203.78 + 2960.11 - 442.12 + 1413.59 = \$1134.65$$

Now for the 2nd machine, we have 2 NPV calculations, call them NPV_0 and NPV_4

For each replication: n = 4, OCF = 2200, S = 0, C_0=10,000, EE_0=-10,000, and C_4=-EE_4

$$NPV_0 = EE_0 + PV_{OCF} + PV_{CCA\ TS}$$

$$= EE_0 + \sum_{j=1}^{n} \frac{OCF_j(1-T_c)}{(1+k)^j} + \left(\frac{C \cdot d \cdot T_C}{k+d}\right) \cdot \left[\frac{1+0.5k}{1+k}\right]$$

$$= -5510 + 2200(1-.42)\left[\frac{1-(1+.12)^{-4}}{.12}\right] + 5510 * \frac{.35 * .42}{.35+.12} * \frac{.1+.06}{1+.12}$$

$$= -5510 + 3875.66 + 1631.02$$

$$= -\$3.32$$

and

$$NPV_4 = EE_4 + PV_{OCF} + PV_{CCA\,TS} = EE_4 + \sum_{j=1}^{n} \frac{OCF_j(1-T_c)}{(1+k)^j} + \left(\frac{C_4 \cdot d \cdot T_C}{k+d}\right) \cdot \left[\frac{1+0.5k}{1+k}\right]$$

$$= -EE_4 + 2200(1-.42)\left[\frac{1-(1+.12)^{-4}}{.12}\right] + EE_4 * \frac{.35*.42}{.35+.12} * \frac{1+.06}{1+.12}$$

$$= -EE_4 + 3875.66 + 0.296 \cdot EE_4 = 3875.66 - 0.70399 \cdot EE_4$$

The present value of the replicated project is

$$NPV = NPV_0 + \frac{NPV_4}{(1+k)^4} = -3.32 + \frac{3875.66 - 0.70399 \cdot EE_4}{(1.12)^4} = 2459.73 - 0.4474 \cdot EE_4$$

To find the maximum price for which project 2 would be undertaken, equate the two project NPVs:

$$NPV_{project\,1} = NPV_{project\,2} \Rightarrow 1134.65 = 2459.73 - 0.4474 \cdot EE_4 \Rightarrow EE_4 = 2961.75$$

Solution to Question 7

This is an equivalent annual annuity problem.

T = 46%, k = 15%, d = 25%

For project 1(all cash flows given in thousands): n = 5, OCF = 33-9=24, S = 10, EE=-(40+1), C_0=41

$$NPV = EE_0 + PV_{OCF} + PV_{CCA\,TS} + PV_{Salvage}$$

$$= EE_0 + OCF_j(1-T_c)\left[\frac{1-(1+k)^{-n}}{k}\right] + \left(\frac{C \cdot d \cdot T_C}{k+d}\right) \cdot \left[\frac{1+0.5k}{1+k}\right] - \left(\frac{S \cdot d \cdot T_C}{k+d}\right)\left[\frac{1}{(1+k)^n}\right] + \frac{S}{(1+k)^n}$$

$$= -41 + 24(1-.46)\left[\frac{1-(1+.15)^{-5}}{.15}\right] + 41 * \frac{.25*.46}{.25+.15} * \frac{.1+.075}{1+.15} - \frac{10}{(1.15)^5} * \frac{25*.46}{.25+.15} + \frac{10}{(1.15)^5}$$

$$= -41 + 43.44 + 11.019 - 1.429 + 4.972 = \$17.005$$

The equivalent annual annuity A_5 solves $17.005 = A_5\left[\frac{1-(1.15)^{-5}}{.15}\right] \Rightarrow A_5 = 5.073$

Now for the 2nd machine, we have a wrinkle in the OCF at time 3.

n = 6, NWC_0=5, EE=-45, C_0=45, S = 11, OCF=36.5-10=26.5, additional OCF_3=-2

and

$$NPV = EE_0 + PV_{OCF} + PV_{CCA\,TS} + PV_{Salvage} + PV_{\Delta\,NWC}$$

$$= EE_0 + OCF(1-T_c)\left[\frac{1-(1+k)^{-n}}{k}\right] + \frac{OCF_3(1-T_c)}{(1+k)^3} + \left(\frac{C \cdot d \cdot T_C}{k+d}\right) \cdot \left[\frac{1+0.5k}{1+k}\right]$$

$$- \left(\frac{S \cdot d \cdot T_C}{k+d}\right)\left[\frac{1}{(1+k)^n}\right] + \frac{S}{(1+k)^n} - NWC_0$$

$$= -45 + 26.5(1-.46)\left[\frac{1-(1+.15)^{-6}}{.15}\right] - \frac{2(1-.46)}{(1.15)^3} + 45 * \frac{.25*.46}{.25+.15} * \frac{.1+.075}{1+.15}$$

$$- \frac{11}{(1.15)^6} * \frac{25*.46}{.25+.15} + \frac{11}{(1.15)^6} - 5$$

$$= -45 + 54.156 - 0.7101 + 12.094 - 1.367 + 4.756 - 5 = 18.928$$

The equivalent annual annuity A_6 solves $18.928 = A_6\left[\frac{1-(1.15)^{-6}}{.15}\right] \Rightarrow A_6 = 5.001$.

Therefore the firm should undertake project 1 because it has the highest equivalent annual annuity.

Cost of Capital Solutions

Solution to Question 8

a. Recall that mortgage bonds are semi-annual. Bonds: C= ½ x7.25%, T = 40%, rb = ½ x 9.8%, F = 1000, n = 20 x 2.

$$P_B = C*\left[\frac{1-1/(1+r_b)^T}{r_b}\right]+\frac{F}{(1+r_b)^T}$$

$$= 37.50\times\left[\frac{1-(1+.049)^{40}}{.049}\right]+\frac{1000}{(1+.049)^{40}}$$

$$=(37.50)\times(17.39665)+(1000)\times(0.147564)$$

$$=652.374+147.564$$

$$=\$799.94$$

$$\approx \$800.00$$

- preferred shares $D_{ps} = 2.25$, $r_{ps} = .075$

$$P_P = \frac{D_{ps}}{r_{ps}} = \frac{\$2.25}{0.075} = \$30.00$$

- common shares $R_f = 7\%$, $r_m = 15\%$, $\beta = 0.75$, $g = 3\%$, $D_0 = 0.97$

$$r_s = R_f + \beta\left[r_m - R_f\right]$$

$$= 0.07 + 0.75(.15-.07)$$

$$=13\%$$

$$P_s = \frac{D_0(1+g)}{r_s - g}$$

$$= \frac{0.97(1.03)}{0.13-0.03}$$

$$= 9.991 \approx \$10.00$$

b. Estimate MHD's required rate of return.

	Market Value	weight	cost
Debt	$B = P_B \times$ # bonds o/s $=800\times\frac{30{,}000{,}000}{1000} = 24{,}000{,}000$	$w_{debt} = B/V = 24/50$ $= 0.48$	$r_i = r_b(1-T)$ $= 0.98(1-0.4) = 5.88\%$
Preferred Shares	$PS = P_{ps} \times$ # preferred shares o/s $=30\times 200{,}000 = 6{,}000{,}000$	$w_{ps} = PS/V = 6/50$ $= 0.12$	r_{ps}.= 075

Common Shares	$S = P_s \times \#$ common shares o/s $= 10 \times 2{,}000{,}000 = 20{,}000{,}000$	$w_{equity} = S/V = 20/50 = 0.40$	r_s.=.13
Total	**50,000,000**	**1.00**	

$$WACC = r_i w_{debt} + r_{ps} w_{ps} + r_s w_{equity}$$
$$= 0.0588 \cdot 0.48 + .075 \cdot 0.12 + 0.13 \cdot 0.40$$
$$= 8.92\%$$

Solution to Question 9

a. The weights for capital structure are given as w_{debt} = 30%, w_{ps}= 20% w_{equity} = 50%

For cost of securities:

Debt: F = 1000, c = 9%, Coupon = \$90,T = 40%, underpricing costs = \$50, P_B = F – costs = 950, n = 20

$$P_B = C * \left[\frac{1 - 1/(1+r_b)^T}{r_b} \right] + \frac{F}{(1+r_b)^T}$$

$$950 = 90 \times \left[\frac{1 - (1+r_b)^{20}}{r_b} \right] + \frac{1000}{(1+r_b)^{20}}$$

Solution can be found either by using the YTM approximation, or solver in Excel. Using solver, r_b=9.57%

Therefore $r_i = r_b(1\text{-}T)$ = 5.742%

Preferred Shares: D_{ps} = 100 x 0.85 = \$8.50, P_{ps} =100, underpricing costs = \$9,

NP_{ps} = P – costs = 100 – 9 = \$91

$$r_{PS} = \frac{D_{ps}}{NP_{PS}} = \frac{\$8.50}{91} = 9.34\%$$

Equity $P_s = 75,\ g = 7\%, D_1 = \$5$

$$r_s = \frac{D_1}{P_s} + g = \frac{5}{75} + .07 = 13.67\%$$

WACC Calculation

$$WACC = r_i w_{debt} + r_{ps} w_{ps} + r_s w_{equity}$$
$$= 0.0574 \cdot 0.30 + .0934 \cdot 0.20 + 0.1367 \cdot 0.50$$
$$= 10.43\%$$

b. The only thing that changes in part b), is that we need to issue new equity in order to finance projects. The weights remain unchanged, as do the costs of debt and preferred shares.

Therefore w_{debt} = 30%, w_{ps}= 20% w_{equity} = 50% , r_i = 5.742%, r_{ps}=9.34%.

Equity underpricing costs = \$12, $P_s = 75,\ g = 7\%, D_1 = \$5, NP = P_s$ – costs = 75 – 12 = \$63

$$r_s = \frac{D_1}{P_s} + g = \frac{5}{63} + .07 = 14.94\%$$

WACC Calculation

$$WACC = r_i w_{debt} + r_{ps} w_{ps} + r_s w_{equity}$$
$$= 0.0574 \cdot 0.30 + .0934 \cdot 0.20 + 0.1494 \cdot 0.50$$
$$= 11.06\%$$

Solution to Question 10

a. Calculate the firm wide cost of capital

Weights: B/V = 40, S/V = 60%

Debt: r_i = 7%,

Equity: $R_f = 10\%, r_m = 15\%, \beta = 1.4$

$$r_s = R_f + \beta\left[r_m - R_f\right] = 0.10 + 1.4\left(.15 - .10\right) = 17.025\%$$

WACC Calculation

$$WACC = r_i w_{debt} + r_s w_{equity}$$
$$= 0.07 \cdot 0.4 + .17025 \cdot 0.60$$
$$= 13\%$$

The firm would accept projects M-1 (15% IRR), F-1 (16% IRR), and F-2 (20% IRR). The total capital budget is $1 million + $4 million + $6 million= $11 million.

b. Calculate the cost of capital for each division separately and select projects.

Machinery Division

Weights: B/V = 50%, S/V = 60%

Debt: r_i = 7%,

Equity: $R_f = 10\%, r_m = 15\%, \beta = 1$

$$r_s = R_f + \beta\left[r_m - R_f\right] = 0.10 + 1.4\left(.15 - .10\right) = 15\%$$

WACC Calculation

$$WACC = r_i w_{debt} + r_s w_{equity}$$
$$= 0.07 \cdot 0.5 + .15 \cdot 0.5$$
$$= 11\%$$

The division would accept projects M-1 (15% IRR) and M-2 (12% IRR). The capital budget for the machinery division is $1 million + $3 million = $4 million.

Farm Implements Division

Weights: B/V = 20% and S/V = 80%

Debt: r_i = 7%,

Equity: $R_f = 10\%, r_m = 15\%, \beta = 2.0$

$$r_s = R_f + \beta\left[r_m - R_f\right] = 0.10 + 2\left(.15 - .10\right) = 20\%$$

WACC Calculation

$$WACC = r_i w_{debt} + r_s w_{equity}$$
$$= 0.07 \cdot 0.2 + .20 \cdot 0.8$$
$$= 17.4\%$$

The division would accept project F-2 (20% IRR). The total capital budget is $6 million for the division.

The capital budget for the firm is $4 million + $6 million = $10 million.

c. The use of a firm-wide opportunity cost of capital, instead of divisional opportunity costs, tends to overallocate resources to risky divisions and underallocate them to safe divisions. The firm has increased its risk exposure without a sufficient increase in returns to compensate for the increased risk. In this case using a firm-wide opportunity cost of capital, the firm would reject M-2, which should be accepted. In addition, using a firm-wide opportunity cost of capital it would accept F-1, which should be rejected.

Solution to Question 11

a. The asset βs for the four pure play firm's are calculated in the table below

Firm	$\beta_{pp\ firm}$	T_{pp}	B/S_{pp}	$\beta_{pp\ firm}$
A	1.2	0.30	0.60	$\beta_{asset} = \frac{\beta_{pp\ firm}}{1+(1-T_{pp})\frac{B}{S_{pp}}} = \frac{1.2}{1+(1-.3)\times 0.6} = 0.845$
B	1.4	0.40	0.40	$\beta_{asset} = \frac{\beta_{pp\ firm}}{1+(1-T_{pp})\frac{B}{S_{pp}}} = \frac{1.4}{1+(1-.4)\times 0.4} = 1.129$
C	1.5	0.35	0.45	$\beta_{asset} = \frac{\beta_{pp\ firm}}{1+(1-T_{pp})\frac{B}{S_{pp}}} = \frac{1.5}{1+(1-.35)\times 0.45} = 1.161$
D	1.4	0.40	0.50	$\beta_{asset} = \frac{\beta_{pp\ firm}}{1+(1-T_{pp})\frac{B}{S_{pp}}} = \frac{1.4}{1+(1-.4)\times 0.5} = 1.077$

The asset βs for the two divisions are:

Wholesale division: β asset = ½ (0.845 + 1.129) = 0.987 and Retail division: β asset = ½(1.161 + 1.077 = 1.119

Division	β_{asset}	T_{div}	B/S_{div}	B_{div}
Wholesale	0.984	0.40	0.65	$\beta_{div} = \beta_{asset}\left\{1+(1-T_{div})\frac{B_{div}}{S_{div}}\right\} = 0.984\{1+(1-.4)\times 0.65\} = 1.372$
Retail	1.119	0.40	0.50	$\beta_{div} = \beta_{asset}\left\{1+(1-T_{div})\frac{B_{div}}{S_{div}}\right\} = 1.119\{1+(1-.4)\times 0.50\} = 1.4547$

To calculate two divisional opportunity costs of capital we have T = .5, r_i=9%:, R_f = 10%, r_m=18%

Division	β_{div}	B/S_{div}	B/V_{div}	S/V_{div}	r_s	$WACC_{div}$
Wholesale	1.372	0.65	$\frac{0.65}{0.65+1}$	$\frac{1}{0.65+1}$	$r_s = R_f + \beta_{div}[r_m - R_f]$ $= 0.10 + 1.372(.18 - .10)$ $= 20.976\%$	$WACC = r_i w_{debt} + r_s w_{equity}$ $= 0.09 \cdot \frac{.65}{1.65} + .20976 \cdot \frac{1}{1.65}$ $= 16.25\%$

Retail	1.4547	0.50	$\frac{0.5}{0.5+1}$	$\frac{1}{0.5+1}$	$r_s = R_f + \beta_{div}\left[r_m - R_f\right]$ $= 0.10 + 1.4547(.18 - .10)$ $= 21.638\%$	$WACC = r_i w_{debt} + r_s w_{equity}$ $= 0.09 \cdot \frac{.5}{1.5} + .21638 \cdot \frac{1}{1.5}$ $= 17.43\%$

Solution to Question 12

a. The cost of equity: Using the CAPM, we have Rf = 11%, β = 1.25, rm =16%.

Therefore $r_s = R_f + \beta (r_m - R_f) = 0.11 + 1.25(0.16\text{-}0.11) = .1725$

$\left(\frac{2.93}{2.00}\right)^{\frac{1}{4}} - 1 = 10\%$ (or students may use average of 1 year growth rates:

$average\left[\left(\frac{2.00}{2.00}\right) - 1, \left(\frac{2.40}{2.00}\right) - 1, \left(\frac{2.75}{2.40}\right) - 1, \left(\frac{2.93}{2.75}\right) - 1\right] = 10.28\%$). Both are acceptable

$Div_0 = 2.93$, $P_0 = 40$

$r_s = \frac{Div_1}{P_0} + g = \frac{2.93(1.1)}{40} + .1 = 18.06\%$ or $r_s = \frac{Div_1}{P_0} + g = \frac{2.93(1.1028)}{40} + .1028 = 18.36\%$

The firm's cost of equity is ½(.1725 + .1806) = 17.66% or ½(.1725 + .1836) = 17.81%

b. Capital structure weights: W_{equity}=0.5 and W_{debt}=0.4 and W_{ps}=0.1

$r_{ps} = 0.13$, $r_b = .135$, $r_i = r_b(1\text{-}T_c) = .135(1\text{-}.35) = 8.775\%$

$WACC = r_i w_{debt} + r_{ps} w_{ps} + r_s w_{equity}$
$= .08775 \cdot .40 + .13 \cdot .1 + .1766 \cdot .5$ or
$= 13.64\%$

$WACC = r_i w_{debt} + r_{ps} w_{ps} + r_s w_{equity}$
$= .08775 \cdot .40 + .13 \cdot .1 + .1781 \cdot .5$
$= 13.72\%$

c. Flotation costs, whether for debt, equity or preferred shares, will impact the NPV of a project as this is a T=0 expense that must be included. However we do not include flotation costs as part of the WACC.

d. If project risk < WACC, then the firm risks rejecting profitable projects. If project risk > WACC, then the firm risks accepting unprofitable projects, and potentially bypasses too many safe projects.

e. Information is given in the table below.

	Industrial	Electrcal	Trucking
Pure play firm variables	$B/S_{pp} = 0.3;\ T_{pp} = 0.4;$ $\beta_{pp} = 1.83$	$B/S_{pp} = 0.9;\ T_{pp} = 0.3;$ $\beta_{pp} = 1.35$	$B/S_{pp} = 1;\ T_{pp} = 0.4;$ $\beta_{pp} = 0.7$
Unlever β_{pp}	$\beta_{project} = \beta_{pp}\dfrac{1}{1+(1-T_{pp})B_{pp}/S_{pp}}$ $\beta_{project} = \dfrac{1.83}{1+(1-.4)(0.3)} = 1.551$	$\beta_{project} = \beta_{pp}\dfrac{1}{1+(1-T_{pp})B_{pp}/S_{pp}}$ $\beta_{project} = \dfrac{1.35}{1+(1-.3)(0.9)} = 0.828$	$\beta_{project} = \beta_{pp}\dfrac{1}{1+(1-T_{pp})B_{pp}/S_{pp}}$ $\beta_{project} = \dfrac{0.7}{1+(1-.4)(1)} = 0.4375$
Division variables	$B/S_{div} = 0.2;\ T_c = 0.35;$	$B/S_{div} = 0.7;\ T_c = 0.35;$	$B/S_{div} = 1.1;\ T_c = 0.35;$
Relever project β	$\beta_{div} = \beta_{project}\left[1+(1-T_C)\left(B/S_{div}\right)\right]$ $\beta_{div} = 1.551\left[1+(1-.35)(0.2)\right]$ $= 1.753$	$\beta_{div} = \beta_{project}\left[1+(1-T_C)\left(B/S_{div}\right)\right]$ $\beta_{div} = 0.828\left[1+(1-.35)(0.7)\right]$ $= 1.2047$	$\beta_{div} = \beta_{project}\left[1+(1-T_C)\left(B/S_{div}\right)\right]$ $\beta_{div} = 0.4375\left[1+(1-.35)(1.1)\right]$ $= 0.7503$
CAPM variables	R_f = 11%, β_{div} = 1.753, r_m =16%.	R_f = 11%, β_{div} = 1.2047, r_m =16%.	R_f = 11%, β_{div} = 0.7503, r_m =16%.
Division cost of equity	$r_{div} = R_F + \beta_{div}(r_m - R_F)$ $= 11\% + 1.753 * (16\% - 11\%)$ $= 19.765\%$	$r_{div} = R_F + \beta_{div}(r_m - R_F)$ $= 11\% + 1.2047 * (16\% - 11\%)$ $= 17.024\%$	$r_{div} = R_F + \beta_{div}(r_m - R_F)$ $= 11\% + 0.7503 * (16\% - 11\%)$ $= 14.752\%$
WACC variables	$B/V_{div} = \dfrac{0.2}{.2+1};\ r_i = 0.08775;$	$B/V_{div} = \dfrac{0.7}{.7+1};\ r_i = 0.08775;$	$B/V_{div} = \dfrac{1.1}{1.1+1};\ r_i = 0.08775;$
Divisional WACC	$WACC = B/V_{div}\ r_i + S/V_{div}\ r_{div}$ $= \dfrac{0.2}{1.2}\times 0.08775 + \dfrac{1}{1.2}\times 0.19765$ $= 17.93\%$	$WACC = B/V_{div}\ r_i + S/V_{div}\ r_{div}$ $= \dfrac{0.7}{1.7}\times 0.08775 + \dfrac{1}{1.7}\times 0.17024$ $= 13.63\%$	$WACC = B/V_{div}\ r_i + S/V_{div}\ r_{div}$ $= \dfrac{1.1}{2.1}\times 0.08775 + \dfrac{1}{2.1}\times 0.14752$ $= 11.62\%$

Long Term Financing Solutions

Solution to Question 13

Note: Dollar amounts are in millions.

a. C_{new} = 11%, c_{old} = 13%, F = 10 million, n = 20, p = 15%, T = 0.35; $\ell = \dfrac{3}{52}$, R_f=4%, k_i= C_{new}(1-T) =7.15%, E = 0.3. The after tax costs of the new issue are:

$$\text{Cost of refinancing} = pF + (1-T_C)c_{old}F\,\ell + E - \frac{E}{5}(T_C)\left[\frac{1-(1+k_i)^{-5}}{k_i}\right]$$

$$= 0.15\times 10 + (1-.35)\times .13\times 10\times\frac{3}{52} + 0.3 - \frac{0.3}{5}(0.35)\left[\frac{1-(1.0715)^{-5}}{0.0715}\right]$$

$$= 1.5 + 0.04875 + .3 - 0.085759$$

$$= 1.762991$$

The incremental cash savings from refinancing are

$$\text{Benefits of Refinancing} = (F-E)\ell R_f(1-T_C) + F(c_{old}-c_{new})(1-T_C)\left[\frac{1-(1+k_i)^{-n}}{k_i}\right]$$

$$= (10-.3)\times\frac{3}{52}\times 0.04\times(1-0.35) + 10(.13-.11)\times(1-0.35)\times\left[\frac{1-(1.0715)^{-20}}{0.0715}\right]$$

$$= 0.01455 + 1.36131$$

$$= 1.37586$$

The NPV of reissuing are

NPV=Benefits of Refinancing - Costs of Refinancing = 1.37586-1.762991=-0.387131.

Therefore do not refinance

b. A positive NPV can be generated by postponing the refunding for a short time – until the interest rates drop. This argues for re-evaluating this decision then.

Solution to Question 14

Let the before tax issuing and underwriting expenses be E.

C_{new} = 12%, c_{old} = 15%, F = 25 million, n = 20, p = 6%, T = 0.4 $\ell = \frac{2}{12}$, R_f=6%, k_i= C_{new}(1-T) =7.2%. Therefore the after tax costs of the new issue are:

$$\text{Cost of refinancing} = pF + (1-T_C)c_{old}F\,\ell + E - \frac{E}{5}(T_C)\left[\frac{1-(1+k_i)^{-5}}{k_i}\right]$$

$$= 0.06\times 25 + (1-.4)\times .15\times 25\times\frac{2}{12} + E - \frac{E}{5}(0.4)\left[\frac{1-(1.072)^{-5}}{0.072}\right]$$

$$= 1.5 + 0.375 + E - 0.326266E$$

$$= 0.6737332E + 1.875$$

The incremental cash savings from refinancing are

$$\text{Benefits of Refinancing} = (F-E)\ell R_f(1-T_C) + F(c_{old}-c_{new})(1-T_C)\left[\frac{1-(1+k_i)^{-n}}{k_i}\right]$$

$$= (25\text{-E})\times\frac{2}{12}\times 0.06\times(1-0.4) + 25(.15-.12)\times(1-0.4)\times\left[\frac{1-(1.072)^{-20}}{0.072}\right]$$

$$= 0.006(25\text{-E}) + 4.69409$$

$$= 4.84409 - 0.006E$$

To find the maximum that the firm would spend on expenses, equate the costs and the savings

Costs of Refinancing = Benefits of Refinancing

$$0.6737332E + 1.875 = 4.84409 - 0.006E$$

$$0.6797332E = 2.96909$$

$$E = 4.368 \text{ million}$$

Solution to Question 15

After tax cost of new debt = 0.125(1-0.36)=0.08 or 8%.

Cost of Refunding

Call Premium	($150 million)(0.12) = $18 million
Interest Paid during overlap	($150 million)(0.14/12)(1-0.36) = $1.12 million
Flotation costs less PVTS)	$2.25 million – (2.25/5)(0.36)$\left(\frac{1-(1.08)^{-5}}{.08}\right)$=$1.60318 million

Total Costs of Refunding) = $18 + $1.12 + $1.60318 = $20.72318 million

Benefits of Refunding

Interest Savings on new issue	(0.14 – 0.125)($150million)(1- 0.36)$\left(\frac{1-(1.08)^{-25}}{.08}\right)$ = $15.371678million
interest earned on new issue during overlap period	($150million - $2.25 million)(0.09/12)(1 – 0.36) = $0.7092 million

Total Benefit of Refunding = $15.371678 + $0.7092 = $16.0809

NPV of Bond Refunding = Benefits – Costs

$16.0809-$20.72318 < 0. The costs are greater than the benefits of refunding – Preston Partners SHOULD NOT refund the existing bond.

Taxes and Capital Structure

Solution to Question 16

a. If Georgetown Mining wishes to maximize the overall value of the firm, it should use debt to finance the $100 million purchase. Since interest payments are tax deductible, debt in the firm's capital structure will decrease the firm's taxable income, creating a tax shield that will increase the overall value of the firm.

b. Using the CAPM, we have R_f = 4%, β = 1.25, $r_m - R_f$ =6.8%.

Therefore $r_0 = R_f + \beta (r_m - R_f) = 0.04 + 1.25\ (0.068) = .125$

c. V_U = share price x # shares o/s = 42.75 x 10 million = 427.5 million

d. The NPV of the project is:

$$\text{value of project} = \text{initial outlay} + \text{after tax project cash flows.}$$

$$= -100 + \frac{\text{after tax project cash flows}}{r_0}$$

$$= -100 + \frac{15}{.125}$$

$$= 20 \text{ million}$$

e. According to MM and the efficient markets hypothesis, If it finances using internally generated cash flow, V_U = value before project + NPV of project = 427.5 + 20 =447.5 million. Recall that the NPV is the increase the in the value of the firm that accrues to equity holders.

f. Efficient markets state that as soon as the firm announces the project, investors will revalue the firm to account for the $20 million increase in market value.

$$\text{Thus the share price becomes share price} = \frac{V_u}{\#\text{shares o/s}} = \frac{447.5 \text{ million}}{10 \text{ million}} = \$44.75$$

g. Once new shares are issued and the project is undertaken the value of the firm will be

V_U = value before project + NPV of project + amount of new equity raised

= 427.5 + 20 +100=547.5 million.

Existing equity holders know that there will be an incremental benefit accruing to all equity holders if the project is undertaken (the NPV of $20 million). They would not be willing to sell new equity at the pre-project price of $42.75 – this would be a transfer of wealth from existing to new shareholders.

In the absence of any market frictions, new shares must be issued at $44.75.

The firm needs $100 million, so number of new shares issued is

$$\#\text{shares issued} = \frac{\text{initial outlay}}{\text{share price}} = \frac{100 \text{ million}}{44.75} = 2{,}234{,}637$$

How do we know that this make sense? The share price after the equity offering is

$$\text{share price} = \frac{V_u}{\#\text{shares o/s}} = \frac{547.5 \text{ million}}{10 + 2.234637 \text{ million}} = \$44.75 \ .$$

Because the shares were correctly priced, there is not loss in share value by issuing new equity.

Suppose instead, Georgetown Mining finance the project with an 8% debt issue.

h. According to MM, we have T_c = 0.4, and B = 100

$$V_U = \text{inital firm value} + \frac{\text{project after tax cash flows}}{r_0} = 427.5 + \frac{15}{.125} = 547.5$$

Therefore V_L = 547.5 + .4 x 100 = 587.5 million

i. $S_L = V_L - B = 587.5 - 100 = 487.5$.

When we issue debt, we don't impact the number of shares o/s so

$$\text{share price} = \frac{S_L}{\#\text{shares o/s}} = \frac{487.5 \text{ million}}{10 \text{ million}} = \$48.75$$

j. The firm's WACC is $WACC = r_0\left(1 - T_c \frac{B}{V_L}\right) = .125\left(1 - .4 \times \frac{100}{587.5}\right) = 11.65\%$

k. Equity holders will demand $r_s = r_0 + \frac{B}{S_L}(1 - T_c)(r_0 - r_B) = .125 + \frac{100}{487.5}(1 - .4)(.125 - .08) = 13.05\%$

Solution to Question 17

a. Market value $V_U = \frac{EBIT(1 - T_C)}{r_s} = \frac{100{,}000(1 - .4)}{.12} = 500{,}000$

b. The price per share is 500,000/10,000 = $50

c. The WACC is simply the return required by equity holders of 12%

d. T he market value of the firm is $V_L = V_U + T_c \times B = 500{,}000 + 0.4 \times 50{,}000 = 520{,}000$

e. The present value of tax shield arising from the tax deductibility of debt

f. If B = 50,000, then S = V_L - B = 520,000 – 50,000 = 470,000.

g. $r_s = r_0 + \frac{B}{S} \times (1 - T_c) \times (r_0 - r_B) = .12 + \frac{50}{470} \times (1 - .4) \times (.12 - .08) = 12.26\%$

h. Either

$$r_{WACC} = \frac{B}{S_L + B} r_b (1 - T_c) + \frac{S_L}{S_L + B} r_s = \frac{50}{470 + 50} \times 0.08(1 - .4) + \frac{470}{470 + 50} .1226 = 11.54\%$$

or

$$r_{WACC} = r_0 \left[1 - T_c \times \frac{B}{S_L + B} \right] = .12 \left[1 - 0.4 \times \frac{50}{470 + 50} \right] = 11.54\%$$

i. Before recapitalization

$$\text{eps} = \frac{\text{net income}}{\#\text{ shares o/s}} = \frac{100{,}000(1 - .4)}{10{,}000} = \$6.$$

After recapitalization, # shares o/s = 10,000 – 50,000/52 = 10,000-961.54 = 9038.46

$$\text{eps} = \frac{\text{net income}}{\#\text{ shares o/s}} = \frac{(\text{EBIT- interest})(1 - T_c)}{9038.46} = \frac{(100{,}000 - 4000)(1 - .4)}{9038.46} = \$6.37$$

Shareholders earn a higher eps after the firm is leveraged

Solution to Question 18

a. NPV = -60 + ½ (55 + 75) = 5

b. W NPV = -60 + ½ (20 + 100) = 0

c. Undertake project a) because it has the higher NPV.

d. Payouts are:

Project Pretty-Safe

Economy State	Bad State	Good State
Project payoff	55,000	$75,000
Payment to debt holders	40,000	40,000
Payment to equity holders	15,000	35,000

Project Pretty-Wild

Economy State	Bad State	Good State
Project payoff	20,000	$100,000
Payment to debt holders	20,000	40,000
Payment to equity holders	0	60,000

e. The expected payoff to equity holders from project Pretty Safe is ½ (15,000 + 35,000) = 25,000
The expected payoff to equity holders from project Pretty Wild is ½ (0 +60,000) = 30,000

Therefore equity holders would prefer project pretty wild because it gives them the higher NPV.

f. The debt holders will not lend $40,000 because they know that if they do, the firm will undertake project Pretty Wild because it gives the highest NPV to the equity holders. The most that debt holders would be willing to pay is ½ (20,000 + 40,000) = $30,000.

g. Equity holders would have to contribute 60,000 – 30,000 = 30,000)

h. Equity holders will only be willing to undertake the risky project, which will have a 0 NPV for them. They will not undertake the good project because to them the NPV is -30 + 25 = -5, which is negative. This is not optimal because the safe project increases the value of the firm more than the risky project, yet equity holders are forced to undertake the risky project.

Solution to Question 19

Note that this problem is not a set in a MM world. There are market frictions, asymmetric information and bankruptcy costs here. The MM equations do not hold.

a. Eps / ebit relationship for current capital structure

S = 100,000 shares at $50 = $5,000,000

B = 1,000 bonds at $1,000 = $1,000,000 with 10% coupon

Eps = (EBIT – 100,000)(1-.45) / 100,000

Eps/ ebit relationship for proposed capital structure

Repurchase 1,500,000 / 50 = 30,000 shares

After issuing $1,500,000 in 12% coupon bonds

Total interest = $100,000 + $180,000 = $280,000

Eps = (EBIT – 280,000)(1-.45) / 70,000

Equate the 2 eps equations and solve:

Crossover EBIT = $700,042

b. Table values are:

Financial Variables	Original Values (before recapitalization)		Revised Values (after recapitalization)
EPS (earnings per share)	$7.70		$9.59
Price	$50		$53.28
S (market value of equity)	$5,000,000		$3,729,600
V (market value of the firm)	$6,000,000		$6,229,444

a.) EPS (earnings per share).

Before: $7.70 = (1,500,000 – 100,000)(1-.45) / 100,000

After: $9.59 = ((1,500,000-280,000)(1-.45) / 70,000

b.) P (price per share).

After: $53.28 = 9.59 / .18

c.) S (market value of equity).

Before: $5,000,000 = $50 (100,000)

After: $3,729,600 = $53.28 (70,000)

d.) V (market value of the firm).

Before: $6,000,000 = 5,000,000 + 1,000,000

After: $6,229,600 = 3,729,600 + 2,500,000

Dividend Policy

Solution to Question 20

a. Cash dividend: DPS = $4,000 / 150 = $26.67.

P_x = $35 – 26.67 = $8.33 per share

Per-share wealth of shareholder = share price + dividend received

= 8.33 + 26.67 = $35

Repurchase: $4,000 / $35 = 114.29. Therefore 114 shares will be repurchased.

If you submit your shares for repurchasing, you receive $35

If you keep your shares, they're still worth $35

b. Cash dividend: EPS = $0.90

P/E = 8.33 / 0.90 = 9.26

Repurchase: EPS = $0.90 (150) / (150 – 114) = $3.75

P/E = 35 / 3.75= 9.33

c. The preferred alternative is probably the share repurchase, as it gives shareholders the choice of selling some of their shares for cash now or remaining fully invested. Given the tax implications of issuing dividends, there is a real cost to investors if they wish to reinvest dividends.

Solution to Question 21

a. Because there are no market imperfections, the share price falls by the entire amount of the dividend. The stock price after the dividend payout=160-5.50=154.50

b. $5.50*40million/$160=1,375,000 shares will be repurchased.

c. The table is:

	Year end 2005, before repurchase or dividend	If Marvin pays dividend	If Marvin repurchases shares
Earnings per share	EPS=$11	EPS=$11	EPS=($11*40,000,000)/(40,000,000-1,375,000)=$11.39
Price earnings ratio	P/E=160/11=14.55	P/E=154.50/11=14.05	P/E=160/11.39=14.05

d. 1) Dividend payout:

EPS is unchanged, while P/E declines because price drops after dividend payouts.

2) Share repurchase:

EPS is higher than the case of dividend payout because number of shares outstanding declines and the total earnings are unchanged after repurchases.

P/E is the same as the case of dividend payout.

Solution to Question 22

	Current	4 for 3 stock split	33.33% stock dividend
Authorized number of shares	500,000	500,000	500,000
Number of Shares O/S	300,000	400,000	400,000
Capital Stock	3,000,000	3,000,000	5,000,000
Retained Earnings	2,500,000	2,500,000	500,000
Shareholder's Equity	5,500,000	5,500,000	5,500,000
Current share price	$20	$15	$15

Leasing

Solution to Question 23

a. The maintenance is not an incremental cash flow – the firm would incur this cost if it leased or if it purchased the forklift. Therefore ignore this amount.

CLA_0 =150, S = 10, n = 3, T_c =.3, r_b = .1143, k = .14, d = .25 We wish to solve for L that sets NAL = 0

$r_i = r_b(1-T_c) = 8\%$

$$NAL = CLA_0 - L(1+r_i)(1-T_c)\left[\frac{1-(1+r_i)^{-n}}{r_i}\right] - CLA_0\frac{dT_c}{d+r_i}\left[\frac{1+.5r_i}{1+r_i}\right] - \left[\frac{S}{(1+k)^n} - \frac{S}{(1+k)^n}\times\frac{dT_c}{d+r_i}\right]$$

$$0 = 150 - L(1.08)(1-.3)\left[\frac{1-(1.08)^{-3}}{.08}\right] - 150\frac{.25\times.3}{.25+.08}\left[\frac{1+.04}{1+.08}\right]$$

$$-\left[\frac{10}{(1+.14)^3} - \frac{10}{(1+.14)^3}\times\frac{.25\times.3}{.25+.08}\right]$$

$$0 = 150 - 1.94829L - 32.8283 - (6.7497 - 1.5340)$$

$$0 = 111.956 - 1.97829L$$

$$L = 57.4639$$

If Marsh Distributors can negotiate a lease of less than $57,464 per year, it should lease the equipment; otherwise it should purchase.

b. If the firm leased the asset, it would not have to make the maintenance payments because it is bundled in the leasing contract (but must make the maintenance payments separately if buying the asset). Let L be the maximum lease that it would pay.

The net annual cost to the firm from the lease is (L – 5)

CLA_0 =150, S = 10, n = 3, T_c =.3, r_b = .1143, k = .14, d = .25

We wish to solve for L that sets NAL =0

$r_i = r_b(1-T_c) = 8\%$

$$NAL = CLA_0 - (L-5)(1+r_i)(1-T_c)\left[\frac{1-(1+r_i)^{-n}}{r_i}\right] - CLA_0\frac{dT_c}{d+r_i}\left[\frac{1+.5r_i}{1+r_i}\right] - \left[\frac{S}{(1+k)^n} - \frac{S}{(1+k)^n}\times\frac{dT_c}{d+r_i}\right]$$

$$0 = 150 - (L-5)(1.08)(1-.3)\left[\frac{1-(1.08)^{-3}}{.08}\right] - 150\frac{.25\times.3}{.25+.08}\left[\frac{1+.04}{1+.08}\right]$$

$$-\left[\frac{10}{(1+.14)^3} - \frac{10}{(1+.14)^3}\times\frac{.25\times.3}{.25+.08}\right]$$

$$0 = 150 - 1.94829L + 9.7414 - 32.8282 - (6.7497 - 1.5340)$$

$$0 = 121.69745 - 1.97829L$$

$$L = 62.4639$$

If Marsh Distributors can negotiate a lease of less than $62,464 per year, it should lease the equipment; otherwise it should purchase.

c. A sensitivity question, similar to above. Set L = 55,000 and solve for S that puts the NAL to zero.

$$NAL = CLA_0 - L(1+r_i)(1-T_c)\left[\frac{1-(1+r_i)^{-n}}{r_i}\right] - CLA_0\frac{dT_c}{d+r_i}\left[\frac{1+.5r_i}{1+r_i}\right] - \left[\frac{S}{(1+k)^n} - \frac{S}{(1+k)^n}\times\frac{dT_c}{d+r_i}\right]$$

$$0 = 150 - 55{,}000(1.08)(1-.3)\left[\frac{1-(1.08)^{-3}}{.08}\right] - 150\frac{.25\times.3}{.25+.08}\left[\frac{1+.04}{1+.08}\right]$$

T

$$-\left[\frac{S}{(1+.14)^3} - \frac{S}{(1+.14)^3}\times\frac{.25\times.3}{.25+.08}\right]$$

$$0 = 150 - 107.15569 - 32.8283 - (0.6750S - 0.1534S)$$

$$0 = 10.016 - 0.52157S$$

$$S = 19.204$$

If the salvage value were greater than $19,204, Marsh Brothers would be better off purchasing the forklift.

Solution to Question 24

a. EE_0 =-900, OCF = 300, C = 900, S = 60, n = 5, T_c =.2, d = .4, k = 0.18

$$NPV = EE_0 + PV_{OCF} + PV_{CCA\ TS\ forever} - PV_{CCA\ TS\ lost} + PV_{Salvage}$$

$$= EE_0 + OCF_j(1-T_c)\frac{1-(1+k)^n}{k} + \left(\frac{C\cdot d\cdot T_C}{k+d}\right)\cdot\left[\frac{1+0.5k}{1+k}\right] - \left(\frac{S\cdot d\cdot T_C}{k+d}\right)\left[\frac{1}{(1+k)^n}\right] + \frac{S}{(1+k)^n}$$

$$= -900 + 300(1-.2)\frac{1-(1+.18)^{-5}}{.18} + 900*\frac{.4*.2}{.4+.18}*\frac{.1+.09}{1+.18} - \frac{60}{(1.18)^5}*\frac{.4*.2}{.4+.18} + \frac{60}{(1.18)^5}$$

$$= -900 + 750.521 + 114.67 - 3.617 + 26.227$$

$$= -12.2$$

Therefore do not purchase crane as it has a negative NPV

b. CLA_0 =900, S = 60, n = 5, T_c =.2, r_b = 0.1, k =0.18, d = 0.4.

We wish to solve for L that sets NAL = 12.2.

$r_i = r_b(1-T_c)$ = 8%

$$NAL = CLA_0 - L(1+r_i)(1-T_c)\left[\frac{1-(1+r_i)^{-n}}{r_i}\right] - CLA_0\frac{dT_c}{d+r_i}\left[\frac{1+.5r_i}{1+r_i}\right] - \left[\frac{S}{(1+k)^n} - \frac{S}{(1+k)^n}\times\frac{dT_c}{d+r_i}\right]$$

$$12.2 = 900 - L(1.08)(1-.2)\left[\frac{1-(1.08)^{-5}}{.08}\right] - 900\frac{.4\times.2}{.4+.08}\left[\frac{1+.04}{1+.08}\right]$$

$$-\left[\frac{60}{(1+.18)^5} - \frac{60}{(1+.18)^5}\times\frac{.4\times.2}{.4+.08}\right]$$

$$12.2 = 900 - 3.4497L - 144.44 - (26.2266 - 4.3711)$$

$$12.2 = 733.7045 - 3.4497L$$

$$L = 209.15$$

The maximum lease payment is $209.1499 thousand

c. Yes, because this is less than the maximum lease calculated in part b.

d. CLA_0 =800, S = 60, n = 5, T_c =.45, r_b = .04, k = .12, d = .4

We wish to solve for L that sets NPV = 0.

$r_i = r_b(1-T_c)$= 2.2%

$$NAL = -CLA_0 + L(1+r_i)(1-T_c)\left[\frac{1-(1+r_i)^{-n}}{r_i}\right] + CLA_0\frac{dT_c}{d+r_i}\left[\frac{1+.5r_i}{1+r_i}\right] + \left[\frac{S}{(1+k)^n} - \frac{S}{(1+k)^n}\times\frac{dT_c}{d+r_i}\right]$$

$$0 = -800 + L(1.022)(1-.45)\left[\frac{1-(1.022)^{-5}}{.022}\right] + 800\frac{.4\times.45}{.4+.022}\left[\frac{1+.011}{1+.022}\right]$$

$$+\left[\frac{60}{(1+.12)^5} - \frac{60}{(1+.12)^5}\times\frac{.4\times.45}{.4+.022}\right]$$

$$0 = -800 + 2.634L + 337.559 + (34.056 - 14.52182)$$

$$0 = -442.907 + 2.634L$$

$$L = 168.15$$

The minimum lease payment that they are willing to accept is $168.15 thousand

e. Yes a contract is feasible: The minimum lease payment that Caterpillar is willing to accept is $168.15 thousand. The maximum lease payment that Peak is willing to pay is $209.15 thousand. Any lease payment between $168.15 and $209.15 thousand is feasible.

Mergers

Solution to Question 25

a. Total benefits = Incremental benefits + Value (Omega

= $350,000 / .07 + (150,000) ($80)
= $5M + $12M = $17 M

b. Value of combined firms = V (Alpha) + Total Benefits (from part a)

= (200,000) ($100) + $17M
= $20 M + 17 M = $37 M

New number of Alpha shares = 200,000 + 160,000 = 360,000
Total benefits = $17 M from part a)
Total cost = (150,000 / 750,000) ($37) = $ 15,857,143
NPV (Alpha) = 17M – 15,857,143 = $1,142,857

c. Alpha shareholders prefer the $15 M cash offer because it has the highest NPV.

Comprehensive Questions

Solution to Question 26

a. Using CAPM, we get

$R_s=R_f+\beta(R_m-R_f)=5\%+1.5*(15\%-5\%)=20\%$

b. Capital structure weights: $W_{equity}=120/200=0.6$ and $W_{debt}=80/200=0.4$

$WACC= W_{equity} *R_s+ W_{debt} *R_i=0.6*20\%+0.4*5.7\%=14.28\%$

c. EE_0=-2 million, C=2 million, OCF = 0.45 million, additional OCF_{10}=-1 million S=0.16 million, n=10, d=0.3, T_c=0.43, K=14.28%

$$NPV = EE_0 + PV_{OCF} + PV_{CCA\,TS} + PV_{Salvage}$$

$$= EE_0 + \sum_{j=1}^{n} \frac{OCF_j(1\text{-}T_c)}{(1+k)^j} + \left(\frac{C\times d\times T_c}{k+d}\right)\left[\frac{1+0.5k}{1+k}\right] - \left(\frac{S\times d\times T_c}{k+d}\right)\left[\frac{1}{(1+k)^n}\right] + \frac{S}{(1+k)^n}$$

$$= -2 + 0.45(1-0.43)\times\frac{1-1.1428^{-10}}{0.1428} - 1\times(1-0.43)\times\frac{1}{1.1428^{10}}$$

$$+\left(\frac{2\times0.3\times0.43}{0.1428+0.3}\right)\left[\frac{1+0.5\times0.1428}{1.1428}\right] - \left(\frac{0.16\times0.3\times0.43}{0.1428+0.3}\right)\left[\frac{1}{1.1428^{10}}\right] + \frac{0.16}{1.1428^{10}}$$

$$= -2 + 1.1734 + 0.5463 - 0.0123 + 0.0421$$

$$= -0.25049$$

NPV is equal to -$250,490. Therefore, the project should not be undertaken.

d. We need to calculate the net benefit of leasing. CLA_0=2 million, S=0.16 million, L=0.2 million, n=10, d=0.3, T_c=0.43, r_i=5.7%, K=14.28%

$$NAL = CLA_0 - L(1+r_i)(1-T_c)\left[\frac{1-(1+r_i)^{-n}}{r_i}\right] - CLA_0\left(\frac{T_c\times d}{d+r_i}\right)\left[\frac{1+0.5r_i}{1+r_i}\right] - \left(\frac{S}{(1+k)^n} - \frac{S}{(1+k)^n}\left(\frac{T_c\times d}{d+r_i}\right)\right)$$

$$= 2 - 0.2\times(1+0.057)(1-0.43)\left[\frac{1-1.057^{-10}}{0.057}\right] - 2\left(\frac{0.43\times0.3}{0.3+0.057}\right)\left[\frac{1+0.5\times0.057}{1+0.057}\right]$$

$$-\left(\frac{0.16}{1.1428^{10}} - \frac{0.16}{1.1428^{10}}\left(\frac{0.43\times0.3}{0.3+0.057}\right)\right)$$

$$= 2 - 0.89962 - 0.7032 - (0.0421 - 0.0152)$$

$$= 0.370282$$

The net advantage of leasing is $370,282, which is positive. Therefore, the company should lease.

e. NPV(if leasing)= -$250,490+$370,282=$119,792.

Therefore, the company should lease the equipment and undertake the project.

Solution to Question 27

First we need to calculate the WACC for the firm:

The cost of equity: Using the CAPM, we have R_f = 5%, β = 1.27, $r_m - R_f$ =8%.

Therefore $r_0 = R_f + \beta\,(r_m - R_f) = 0.05 + 1.27(0.08) = .1516$

Capital structure weights: $W_{equity}=0.7$ and $W_{debt}=0.3$

$WACC= W_{equity} *R_s+ W_{debt} *R_b(1\text{-}T_c)=0.7*15.16\%+0.3*7.01\%(1\text{-}.34)=12\%$

Because the depreciation rates change for machine 2 , we need to do replacement chain method.

For machine 1: EE_0 = -(120,000+10,000), C = 130,000, n = 6, S = 45,000, $OCF_{1\text{-}3}$= -55,000, $OCF_{4\text{-}6}$= -65,000, NWC_0 = -6000, T_c = .34. d = .2

$$NPV_1 = EE_0 + PV_{OCF} + PV_{CCA\,TS} + PV_{Salvage}$$

$$= EE_0 + \sum_{j=1}^{n} \frac{OCF_j(1\text{-}T_c)}{(1+k)^j} + \left(\frac{C \times d \times T_c}{k+d}\right)\left[\frac{1+0.5k}{1+k}\right] - \left(\frac{S \times d \times T_c}{k+d}\right)\left[\frac{1}{(1+k)^n}\right] + \frac{S}{(1+k)^n} + NWC_0$$

$$= -130{,}000 - \frac{55{,}000\,(1\text{-}.34)}{(1.12)} - \frac{55{,}000\,(1\text{-}.34)}{(1.12)^2} - \frac{55{,}000\,(1\text{-}.34)}{(1.12)^3} - \frac{65{,}000\,(1\text{-}.34)}{(1.12)^4} - \frac{65{,}000\,(1\text{-}.34)}{(1.12)^5}$$

$$- \frac{65{,}000\,(1\text{-}.34)}{(1.12)^6} + \left(\frac{130{,}000 \times 0.2 \times 0.34}{0.12+0.2}\right)\left[\frac{1.06}{1.12}\right] - \left(\frac{45{,}000 \times 0.2 \times 0.34}{0.12+0.2}\right)\left[\frac{1}{1.12^6}\right] + \frac{45{,}000}{1.12^6} - 6000$$

$$= -130{,}000 - 160{,}527 + 26{,}145 - 4845 + 22{,}798 - 6000$$

$$= -252{,}428.52$$

For machine 2, we need to look at the first replication separately from the 2nd and 3rd replications because of the change in d.

Replication 1: EE_0 = -(47,000+4000), C = 51,000, n = 2, S = 5000, $OCF_{1\text{-}3}$= -60,000, NWC_0 = -4000, NWC_n = 2000, T_c = .34. d = .2

$$NPV = EE_0 + PV_{OCF} + PV_{CCA\,TS} + PV_{Salvage}$$

$$= EE_0 + \sum_{j=1}^{n} \frac{OCF_j(1\text{-}T_c)}{(1+k)^j} + \left(\frac{C \times d \times T_c}{k+d}\right)\left[\frac{1+0.5k}{1+k}\right] - \left(\frac{S \times d \times T_c}{k+d}\right)\left[\frac{1}{(1+k)^n}\right] + \frac{S}{(1+k)^n} + NWC_0 + \frac{NWC_n}{(1+k)^n}$$

$$= -51{,}000 - \frac{60{,}000\,(1\text{-}.34)}{(1.12)} - \frac{60{,}000\,(1\text{-}.34)}{(1.12)^2} + \left(\frac{51{,}000 \times 0.2 \times 0.34}{0.12+0.2}\right)\left[\frac{1.06}{1.12}\right]$$

$$- \left(\frac{5{,}000 \times 0.2 \times 0.34}{0.12+0.2}\right)\left[\frac{1}{1.12^2}\right] + \frac{5{,}000}{1.12^2} - 4000 + \frac{2000}{1.12^2}$$

$$= -51{,}000 - 66{,}926 + 10{,}257 - 847 + 3986 - 2406$$

$$= -106{,}936$$

Replications 2 and 31: EE_0 = -(47,000+4000), C = 51,000, n = 2, S = 5000, $OCF_{1\text{-}3}$= -65,000, NWC_0 = -4000, NWC_n = 2000, T_c = .34. d = .25

$$NPV = EE_0 + PV_{OCF} + PV_{CCA\,TS} + PV_{Salvage}$$

$$= EE_0 + \sum_{j=1}^{n} \frac{OCF_j(1\text{-}T_c)}{(1+k)^j} + \left(\frac{C \times d \times T_c}{k+d}\right)\left[\frac{1+0.5k}{1+k}\right] - \left(\frac{S \times d \times T_c}{k+d}\right)\left[\frac{1}{(1+k)^n}\right] + \frac{S}{(1+k)^n} + NWC_0 + \frac{NWC_n}{(1+k)^n}$$

$$= -51{,}000 - \frac{60{,}000\,(1\text{-}.34)}{(1.12)} - \frac{60{,}000\,(1\text{-}.34)}{(1.12)^2} + \left(\frac{51{,}000 \times 0.25 \times 0.34}{0.12+0.25}\right)\left[\frac{1.06}{1.12}\right]$$

$$- \left(\frac{5{,}000 \times 0.25 \times 0.34}{0.12+0.25}\right)\left[\frac{1}{1.12^2}\right] + \frac{5{,}000}{1.12^2} - 4000 + \frac{2000}{1.12^2}$$

$$= -51{,}000 - 66{,}926 + 11{,}089 - 916 + 3986 - 2406$$

$$= -106{,}173$$

The present value of the 3 replications of machine 2 is

$$NPV_2 = -106{,}936 - \frac{106{,}173}{(1.12)^2} - \frac{106{,}173}{(1.12)^4}$$

$$= -259{,}051$$

Therefore the firm should choose machine 1 as it has the lower cost.