AFM 271

Midterm Examination #2

Friday July 09, 2010

Prof. J. Thompson

Name: _____

Student Number: _____ **Section Number:** 004

Duration: 2 hours

Instructions:

1. **Answer all questions in the space provided.**

2. **Show all of your calculations.**

3. **The examination has 9 pages (not including this cover page). Verify that your copy is complete.**

4. **Materials allowed: calculator.**

5. **Unless specifically instructed otherwise, provide final answers relating to percentage rates to four decimal places (e.g. 6.27% or .0627) and provide final answers involving dollar amounts to two decimal places (e.g. $98.27).**

6. **To have your exam considered for re-grading, the exam must be written in ink.**

7. **You may use your own formula sheet. Standard size paper, double sided, hand-written, no photocopies.**

Mark Distribution

1. _____/20   a. _____/5   b. _____/4   c. _____/7   d. _____/4

2. _____/7

3. _____/8

4. _____/8

5. _____/7

Total: _____/50

Question 1: 20 marks.

(a) (4 marks) An investment under consideration has a payback of six years and a cost of $49,000. The project is really (really!) risky so that the required rate of return is 100 percent, what is the worst-case NPV? What is the best case NPV? Explain. Assume that cash flows are conventional (i.e., this is a project in which an investment is made up-front and a positive payoff from that investment is realized later).

The worst case is that the $49,000 is paid back in full after 6 years and there are no further cash flows after that. The NPV is then $-49,000 + \frac{49,000}{2^6} = -48,234.38$. *(2 marks)*

The best case is infinite since there could be any positive payoff imaginable after the 6 year payback period. *(2 marks)*

(b) (5 marks) After getting into a motor cycle accident, Brian has been offered two settlement claims to chose from. The first would award him $27,000 today, while the second would pay him the nominal amount of $3500 every other year for 40 years (starting today). Let i (the nominal interest rate) be 10% and π (the expected inflation rate) be 4%. Solving this problem with your variables in real terms, find the present value of each option and determine (and state) which option Brian should take? (*note that you will only receive marks if you solve this problem in real terms*)

The nominal interest rate for a two year period is $1.1^2 - 1 = .21$. Therefore, the real interest rate every two years is $1 + r = \frac{1.21}{(1.04)^2} = 1.118713018$ (*1 mark*)

The real growth rate is given by $1 + g_{real} = \frac{1}{(1.04)^2} = 0.924556213$. (*1 mark*)

This is an annuity due, so we calculate: $PV = 3500 + \frac{3500}{1.04^2} \left[\frac{1 - (\frac{1+g_{real}}{1+r})^{19}}{r - g_{real}} \right]$ (*2 mark*)

Therefore the PV is: 19721.0851 (*0.5 marks*)

Since this is lower than the PV of the one time payment ($27,000), Brian should take the one time payment. (*0.5 marks*)

Note that this should be: $PV = 3500 + \frac{3500}{1.04^2} \left[\frac{1 - (\frac{1+g_{real}}{1+r})^{20}}{r - g_{real}} \right]$ given the number of payments. I accepted both due to the mix-up.

(c) (7 marks) Kennedy Inc. is evaluating the purchase of one of two machines. Each machine produces exactly the same output. Machine A costs $40,000 initially, and incurs maintenance costs of $10,000 per year for 5 years, at which time it must be replaced. Machine B costs $33,000 initially, and incurs maintenance costs of $12,000 per year for 4 years, at which time it must be replaced. Assume that the opportunity cost of capital is 9%. Assume that the machines will be replaced as needed forever, that all maintenance costs are paid at the end of each year, and that the firm does not pay any taxes.

(i) which of these two machines should be chosen?

$$\text{PV of costs for A:} = \$40{,}000 + \$10{,}000 A^5_{.09} = \$78{,}896.51.$$
$$\text{Equivalent annual cost for A:} = \$78{,}896.51/A^5_{.09} = \$20{,}283.70. \qquad \textit{(1.5 marks)}$$
$$\text{PV of costs for B:} = \$33{,}000 + \$12{,}000 A^4_{.09} = \$71{,}876.64.$$
$$\text{Equivalent annual cost for B:} = \$71{,}876.64/A^4_{.09} = \$22{,}186.07 \qquad \textit{(1.5 marks)}.$$

Since A has lower equivalent annual costs, it should be chosen. *(1 mark)*

(ii) Suppose that the new machine (either A or B depending on what you chose in (i)) will replace an existing machine C which was purchased 3 years ago for $29,000. This machine also produces exactly the same output as A or B. It will last for at most another 3 years, at which time it would have to be replaced. It can be salvaged today for $17,000, after 1 year for $8,000, after 2 years for $5,000, or after 3 years for $2,000. It will incur maintenance costs of $14,000 after 1 year, $18,000 after 2 years, and $22,000 after 3 years. When should machine C be replaced?

We have: The PV of costs of keeping C for 1 more year and then selling is:

$$\$17{,}000 + \frac{\$14{,}000 - \$8{,}000}{1.09} = \$22{,}504.59. \qquad \textit{(1.5 marks)}$$

The FV of this after 1 year is:

$$\$22{,}504.59 \times 1.09 = \$24{,}529.36. \qquad \textit{(1 mark)}$$

As this is higher than the equivalent annual cost of A, C should be replaced now. *(0.5 marks)*

(d) (4 marks) DMB Inc. is considering investing in a new project. The project will cost $358,750 today. It will generate annual after-tax net cash flows of $35,000 per year in perpetuity (the first of these will be received exactly one year from today). The opportunity cost of capital is 7%.

(i)What is the payback period for this project?

$\frac{358,750}{35,000} = 10.25$ years.   *(1 mark)*

(ii)What is the discounted payback period for this project?

$$358,750 = 35000 \times A^T_{.07}$$
$$T = 18.68 \ years. \qquad \textit{(2 marks)}$$

(iii)Is it possible that the payback period rule rejects a project while the discounted payback rule accepts it? Explain.

Yes, although the discounted payback period will always be higher, if the threshold is lower for the discounted payback rule, then it can accept it while the payback rule rejects it.   *(1 mark)*

Question 2: 7 marks.

After examining patterns from recent years, management found the following regression-estimated relationships between some company balance sheets and income statement accounts and sales:

$$CA = 0.7\ million + 0.20S$$
$$FA = 1.0\ million + 0.45S$$
$$CL = 0.1\ million + 0.25S$$
$$NP = 0.0\ million + 0.04S$$

where, CA is Current assets, FA is Fixed assets, CL is Current liabilities, NP is Net profit after taxes, and S is Sales.
The company's sales for last year were $10 million. The year-end balance sheet is reproduced below.

Current assets	$ 3,500,000	Current liabilities	$ 1,600,000
Fixed assets:	7,000,000	Bonds	2,500,000
		Common Stock	2,600,000
		Retained earnings	3,800,000
Total	10,500,000	Total	10,500,000

Management projects that sales will grow to $21 million next year. The firm pays out 40 percent of net profits after taxes in dividends. Given that the firm intends to keep its debt-to-asset ratio (namely, the ratio of it current liabilities plus bonds over total assets) constant, construct a pro-forma balance sheet for this firm and insert the values below. NOTE: Show all your work on the next page

Current assets	_____	Current liabilities	_____
Fixed assets:	_____	Bonds	_____
		Common Stock	_____
		Retained earnings	_____
Total	_____	Total	_____

Variables related to sales:

$$\text{current assets} = \$700{,}000 + .2(\$21{,}000{,}000) = \$4{,}900{,}000 \quad \textit{(0.5 marks)}$$
$$\text{fixed assets} = \$1{,}000{,}000 + .45(\$21{,}000{,}000) = \$10{,}450{,}000 \quad \textit{(0.5 marks)}$$
$$\text{current liabilities} = \$100{,}000 + .25(\$21{,}000{,}000) = \$5{,}350{,}000 \quad \textit{(0.5 marks)}$$
$$\text{net profit after taxes} = .04(\$21{,}000{,}000) = \$840{,}000 \quad \textit{(0.5 marks)}$$

Forecasted amount of retained earnings: the change in retained earnings is $\$840{,}000 \times .60 = \$504{,}000$, so retained earnings are forecasted to be \$3.8 million plus \$504,000, or \$4,304,000. *(1 mark)*

Forecasted amount of bonds:

$$\text{debt-to-asset ratio} = \frac{\$1{,}600{,}000 + \$2{,}500{,}000}{\$10{,}500{,}000} = .3905$$
$$\text{bonds} = (\$4{,}900{,}000 + \$10{,}450{,}000)(.3905) - \$5{,}350{,}000 = \$643{,}810 \quad \textit{(1.5 marks)}$$

Forecasted amount of stock:

$$\text{stock} = \$4{,}900{,}000 + \$10{,}450{,}000 - \$5{,}350{,}000 - \$643{,}810 - \$4{,}304{,}000$$
$$= \$5{,}052{,}190 \quad \textit{(1.5 marks)}$$

Therefore the pro forma balance sheet is

Balance Sheet			
Current assets	$4,900,000	Current liabilities	$5,350,000
Fixed assets	$10,450,000	Bonds	$643,810
Total	$15,350,000	Common stock	$5,052,190
		Retained earnings	$4,304,000
		Total	$15,350,000

Mr. Chuckles Children's Restaurant Inc. has just reported EPS of $3.50 and is just about to pay a dividend of $2.10 per share. The firm has growth prospects over the next ten years (namely, the number of times it can grow its dividend is 10), but it will not have any growth opportunities thereafter. It will maintain its current payout ratio until the end of year 10, at which point it will switch to a payout ratio of 100%. In other words, the first time in which the payout ratio is different is year 11. Assume that the firm pays dividends annually and that the opportunity cost of capital is 10%. Also assume that the firm will earn a rate of return of 15% on its retained earnings over the next 10 years.

(a) (4 marks) What is the current price per share of Mr. Chuckles Children's Restaurant Inc.'s stock?

$$g = [1 - \$2.10/\$3.50] \times 15\% = 6\% \qquad \textit{(1 mark)}$$

$$P_0 = \$2.10 + \$2.10(1.06)\left[\frac{(1 - (1.06/1.10)^{10})}{.10 - .06}\right] + \frac{\$3.50(1.06^{11})/.10}{1.10^{10}} \qquad \textit{(2 mark)}$$

$$= \$2.10 + \$xxx + \$yyy$$

$$= \$zzz \qquad \textit{(1 mark)}$$

(b) (2 marks) What is the net present value (per share) of the firm's growth opportunity?

$$\text{NPVGO} = \$zzz - \$3.50 - \$3.50/.10 = \$??? \qquad \textit{(1.5 marks)}$$

(c) (2 marks) Suppose instead that the firm does have some growth possibilities after year 10. In particular, suppose that it will maintain its payout ratio from years 1-10 forever (i.e., it no longer switches to a 100% payout ratio), but that the growth rate will become 4% after the end of year 10. What would the firm's stock price be today? Explain your answer.

The return on retained earnings would be $.04/.40 = 10\%$. Since this equals the opportunity cost of capital, the net present value of the firm's growth opportunities beyond year 10 would be zero. The stock price would be unchanged from $zzz. Note that if you did the full calculations and found that the price did not change, but did not explain why, then you would receive 1 mark. *(2 marks)*

Question 4: 8 marks.

AFM 271 students are very entrepreneurial. They have rushed down to the Gulf coast to collect tar balls and are bringing them back to Canada (assume that all tax implications are Canadian so that the CCA system is used). They plan on turning them into impressionist art, and can make 10,000 paintings a year for 5 years. The factory needed to do this will cost $1 million. In year 1, each painting will sell for $300.15 and the price will rise by 5% each year. During the first year, variable costs will be $26.25 per painting and will rise by 3% each year. The factory will depreciate at a CCA rate of 25%

The students expect to be able to sell the factory for $751,342.16 at the end of year 5. The proceeds will be invested in a new factory so that the CCA pool will be continued. The discount rate for all cash flows is 25%. Cash flows, except the initial investment occur at the end of the year. The corporate tax rate is 38%. What is the NPV of this project?

We have:

PV of after-tax revenues: $\$3,001,500(.62)\left[\dfrac{1-(1.05/1.25)^5}{.25-.05}\right] = \$5,413,334.96$ *(1.5 marks)*

PV of after-tax expenses: $\$262,500(.62)\left[\dfrac{1-(1.03/1.25)^5}{.25-.03}\right] = \$458,754.57$ *(1.5 marks)*

PV of salvage: $\$752,342.16/1.25^5 = \$246,527.48$ *(1 mark)*

PV perpetual tax shield: $\dfrac{\$1,000,000(.25)(.38)}{.25+.25} \times \dfrac{1.125}{1.25} = \$171,000$ *(1.5 marks)*

PV lost tax shield: $\dfrac{\$752,342.16(.25)(.38)}{.25+.25} \times 1.25^{-5} = \$-46,777.96$ *(1.5 marks)*

Initial investment: $\$1,000,000.00$

NPV: $-\$1,000,000.00 + \$5,413,334.96 - \$458,754.57 + \$246,527.48 + \$171,000 - \$46,777.96$
 $= \$4,325,001.52$ *(1 mark)*

(Since the firm will continue the CCA pool by replacing the plant, there are no further tax implications from the sale of the factory.)

Question 5: 7 marks. Assess whether each of the following statements is true, false, or uncertain. Justify your answer. All marks are based on the quality of your argument supporting your answer.

(a) (3 marks) An investment which would be acceptable under the discounted payback rule would not have a negative NPV.

Uncertain. Assuming that all cash flows after the cutoff date are positive, the statement is true since the sum of the discounted cash flows up to and including the cutoff date exceed the initial cost of the investment, and any additional cash flows are positive. However, if there is a large negative cash flow after the cutoff date, then the NPV could be negative.

(b) (4 marks) Consider the following 4 NPV profiles for 4 different projects. Let projects A and B be mutually exclusive and C and D be mutually exclusive. The (non-incremental) IRR criterion would tell us to implement projects B and C.
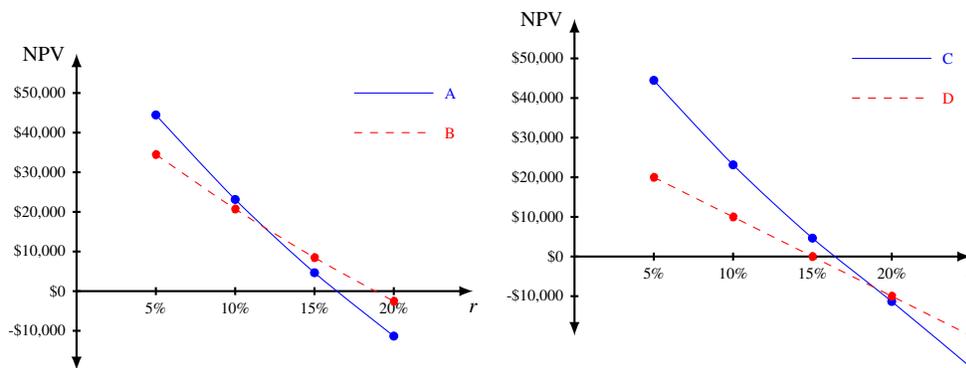
Uncertain. It is true that if we naively used the IRR criterion, it would tell us to take B over A and C over D since those projects can be accepted for higher discount rates. However, since we do not know what the interest rate, we cannot determine whether the IRR criterion will tell us to implement B and C. If r is to the left of where B and C intersect the r-axis, then the IRR criterion will admit both B and C. If r is to the right of where B and C intersect the r-axis, then neither will be implemented. If r is between the two intersection points, then from the diagram it appears that B will be taken on while C will not.