

E-120: Principles of Engineering Economics

Midterm Exam II

Apr 04, 2007

Name: _____ (please print)

SID: _____

- Clearly state all the formula and mathematical expressions that are needed to solve the problems.

No credit will be given to numerical answers without the proper setup.

- Answer each of the following questions in the space provided. If you need more space to show major computations you performed to obtain your answer for a particular problem, use the back of the preceding page.

- Present your work in an organized and neat fashion.

Good Luck!

Problem	1 (25)	2 (20)	3 (25)	4 (30)	Total (100)
Score					

Part 1: Concepts. (25 points, 5 each) (Only one correct answer)

C 1.1) In a constant dividend growth model, the required rate of return is known (larger than the growth rate). Which of the following statements is/are **TRUE**?

- I. The price of the stock will grow at the same rate as the dividends.
- II. If all others are the same, then an increase in the dividend growth rate will decrease the stock price.
- III. If all others are the same, then an increase in the required rate of return will decrease the stock price.

- A. I only
- B. I and II
- C. I and III
- D. II and III
- E. I, II and III

E 1.2) If a project has a positive NPV, based on which of the following criteria, you **MUST ACCEPT** this project?

- A. Payback period
- B. Discounted payback period
- C. AAR
- D. IRR
- E. Profitability index

B 1.3) Which of the following costs should be considered in an incremental cash of a project?

- I. Sunk costs
- II. Opportunity costs
- III. Financing costs

- A. I only
- B. II only
- C. III only
- D. I and II
- E. II and III

A 1.4) In setting the bid price, the firm seeks the price that will cause the project to “breakeven” in a financial sense. The lowest acceptable bid price results in all of the following **EXCEPT**:

- A. AAR = Required return
- B. NPV = 0
- C. Discounted payback period = The life of the project

- D. IRR = Required return
- E. PI = 1

D 1.5) Conducting scenario analysis helps managers see the:

- A. impact of an individual variable on the outcome of a project.
- B. changes in long-term debt over the course of a proposed project.
- C. allocation distribution of funds for capital projects under conditions of hard rationing.
- D. potential range of outcomes from a proposed project.
- E. possible range of market prices for their stock over the life of a project.

Part 2: Calculations.

2. (20 points) The P&K Co. is a profitable company that is not paying a dividend on its common stock. John Muller believes that it will start to pay \$2.00 per share dividend from the 10th year to the 30th year. Starting from the 31st year, the dividend will grow at 10% annually forever. (i.e., the dividend in 31st year is \$2.00(1+10%)). John agrees that the required return for P&K is 15%. What is the price of the P&K stock today?

$$P = 2 * ((1 - 1/1.15^{21}) / .15) / 1.15^9 + 2 * (1.1 / (.15 - 1)) / 1.15^{30}$$

$$= 4.25$$

3. (25 points) You have the following three potential projects to choose:

Project	Initial outlay	Project life	Yearly After-tax project cash flows
A	250	forever	\$40 in year 1, increasing at a constant rate of 2% forever.
B	500	forever	\$80 starting from year 1, forever
C	200	3 years	\$100 in year 1 and 2, \$300 in year 3

The required return is 10%

a. What is the IRR of project A?
 $NPV = -250 + 40 / (IRR - .02) = 0$
 $IRR = 40 / 250 + .02 = 18\%$

b. What is the discounted payback period of project B?

$$NPV_{10} = -500 + 80 * (1 - 1/1.1^{10}) / .1 = -8.43$$

$$\text{Discounted payback period} = 10 + 8.43 / (80 / 1.1^{11}) = 10.3$$

(Note: We didn't deduct points if you use $-500 + 80 * (1 - 1/1.1^t) / .1 = 0$ to solve for t. But it is not consistent with the definition of discounted payback period.)

c. What is the PI of project C?

$$\text{NPV} = 100/1.1 + 100/1.1^2 + 300/1.1^3 = 398.95$$

$$\text{PI} = 398.95/200 = 1.99$$

d. Suppose that you only have \$500, and this is your only constraint. Which projects would you choose? (There is no return if you invest on a partial investment on any project. You can choose multiple projects.)

$$\text{NPV}_A = -250 + 40 / (.1 - .02) = 250$$

$$\text{NPV}_B = -500 + 80 / .1 = 300$$

$$\text{NPV}_C = -200 + 100/1.1 + 100/1.1^2 + 300/1.1^3 = 198.95$$

We should choose A and C, which total return is $\text{NPV}_A + \text{NPV}_C = 448.95 > \text{NPV}_B = 300$

4. (30 points) Macro Inc. hires you as a consultant to decide the bidding price of product A which will be supplied to the government for 1000 units per year for the next 3 years. Your service fee for this project is \$2,000. Macro has an idle warehouse that can be used as a plant. The warehouse is depreciated to zero in the next 10 years at a constant amount \$100,000 per year. The warehouse can be sold at \$800,000 now. You anticipate that the price of the warehouse will drop \$50,000 per year for the next 10 years. To produce the product A, Marco need to buy new equipment which costs \$50,000. It is straight-line depreciated to zero in 3 years. It can be sold at 10% of the initial price at the end of the 3rd year. The fixed cost is \$10,000 per year and the variable cost is \$10 per unit. Net working capital is required as \$20,000 for the first year and increases 5% each year. Macro expects the return of this project to be 20% and the marginal tax rate of Macro is 34%. How much is the unit bidding price of product A that you suggest Macro to ask for?

The after-tax opportunity cost of the warehouse is

$$\$800,000 - (800,000 - 100,000 \times 10) \times .34 = 868,000$$

After-tax salvage value of the warehouse and equipment is

$$\$800,000 - 3 \times 50,000 - (800,000 - 3 \times 50,000 - 100,000 \times 7) \times .34 + 50,000 \times .1 \times (1 - .34) = 670,300$$

	OCF	Capital Spending	Change in NWC	Total Cash Flow
0	0	868,000+50,000	20,000	- 938,000
1	OCF	0	20,000*.05	-1,000+OCF
2	OCF	0	20,000*(1.05^2-1.05)	-1,050+OCF
3	OCF	-670,300	-20,000*1.05^2	692,350+OCF

$$NPV = -938,000 - 1,000/1.2 - 1,050/1.2^2 + 692,350/1.2^3 + OCF \times (1 - 1/1.2^3)/.2 = -538,896.99 + OCF \times 2.11 = 0$$

$$\text{So } OCF = 255828.02$$

$$OCF = \text{Net Income} + (100,000 + 50,000/3)$$

$$\text{Net Income} = 255828.02 - (100,000 + 50,000/3) = 139,161.36$$

$$\text{Net Income} = (S - C - D) \times (1 - T)$$

$$= (S - 10,000 - 10 \times 1,000 - (100,000 + 50,000/3)) \times (1 - .34)$$

$$\text{So } S = 228,513.16$$

$$P = S/Q = 228,513.16/1000 = \$228.51$$