# 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<br>(25) | 2<br>(20) | 3<br>(25) | 4<br>(30) | Total<br>(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**?
The price of the stock will grow at the same rate as the dividends.
If all others are the same, then an increase in the dividend growth rate will decrease the stock price.
If all others are the same, then an increase in the required rate of return will decrease the stock price.

I only
I and II
I and III
II and III
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?

Payback period
Discounted payback period
AAR
IRR
Profitability index

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

AAR = Required return
NPV = 0
Discounted payback period = The life of the project

IRR = Required return
PI = 1

D 1.5) Conducting scenario analysis helps managers see the:

impact of an individual variable on the outcome of a project.
changes in long-term debt over the course of a proposed project.
allocation distribution of funds for capital projects under conditions of hard rationing.
potential range of outcomes from a proposed project.
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 $10^{th}$ year to the $30^{th}$ year. Starting from the $31^{st}$ year, the dividend will grow at 10% annually forever. (i.e., the dividend in $31^{st}$ 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
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?

NPV= 100/1.1 + 100/1.1^2 + 300 /1.1^3 = 398.95
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. )

NPV_A = -250 + 40/(.1-.02) = 250
NPV_B = -500 + 80/.1 = 300
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 NPV_A + NPV_C = 443.95 > 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*10)*.34 = 868,000
After-tax salvage value of the warehouse and equipment is
$800,000–3*50,000-(800,000–3*50,000-100,000*7)*.34+50,000*.1*(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*(1-1/1.2^3)/.2
=-538,896.99 + OCF * 2.11 = 0
So OCF = 255828.02

OCF = Net Income + (100,000+50,000/3)
Net Income = 255828.02 - (100,000+50,000/3) = 139,161.36

Net Income = (S – C – D)*(1-T)
= (S-10,000-10*1,000-(100,000+50,000/3))*(1-.34)
So S = 228,513.16

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

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