E120: Principles of Engineering Economics

Midterm Exam 2

April 4th, 2005

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Part 1: Concepts.

1.1) (5%) A bond with a face value of $1,000 has annual coupon payments of $100 and was issued 7 years ago. The bond currently sells for $1,000 and has 8 years remaining to maturity. This bond's _________ must be 10%.

I. yield to maturity
II. market premium
III. coupon rate

a. I only
b. I and II only
c. III only
d. I and III only
e. I, II and III

Answer: d

1.2) (5%) Which of the following statements is/are **True**?

I. In the constant dividend growth model with a constant discount rate (greater then the dividend growth rate) forever, the stock price will grow at the same rate as the dividends.
II. All else held the same, an increase in the dividend growth rate will increase a stock's market value.
III. All else held the same, an increase in the required return on a stock will increase its market value.

a. I only
b. II only
c. III only
d. I and II only
e. I, II, and III

Answer: d

1.3) (5%) Which capital investment criteria rule has the advantage of taking the time value of money into consideration, but the disadvantage that at times, it may suggest acceptance of projects that actually reduce shareholder wealth?

a. Payback period
b. Discounted payback
c. IRR
d. NPV
e. AAR

Answer: b or c. You get full credit if you answered either b or c.

1.4) (5%) If financial managers only invest in projects that have a profitability index greater than one,

I. firm value will increase.
II. firm value will not only increase, but be maximally increased.
III. the stock price will increase.

a. I only
b. II only
c. III only
d. I and III only
e. I, II, and III

Answer: d

1.5) (5%) 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 = the life of the project
d. IRR = required return
e. PI = 1

Answer: a

Part 2: calculations.

2. (20%) Firm A issues just issues 30-year bond with annual coupon rate of 12% paid semi-annually. Assume that the face value is $1,000 and that YTM is 10%.

a. (8%) How much should bond prices be?

*c = 1,000*12%/2 = 60*
r = 10% /2 = 0.05
*n = 30*2 =60*
Bond price = 60 [1-1/1.05^60]/0.05 +1,000/1.05^60 =1,189.29

b. (12%) If instead of paying equal semi-annual coupons, the firm decides that in each year, the middle-of-year coupon is 8% of the par value, while the end-of-year coupon is 4% of the face value. How much should bond prices be now?

*Middle-of-year coupon =1,000*8% = 80*
*End-of-year coupon = 1,000*4% = 40*
r = EAR = 1.05^2-1= 0.1025
*Bond price = (1.05)*80[1-1/1.1025^30]/0.1025 + 40[1-1/1.1025^30]/0.1025+1,000/1.05^60*
= 1198.53

*or Find equivalent cash flow C for each year = 80*1.05 + 40 = 124*
Bond price = 124[1-1/1.1025^30]/0.1025+1,000/1.1025^30 =1,198.53

3. (35%, 7% for each part) You have the following information of three projects

Project	Initial outlay	Project life	Yearly After-tax project cash flows
A	250	forever	$60 in year 1, decreasing at a constant rate of 5% forever.
B	500	forever	$80 forever
C	200	2 years	$200 in year 1, $300 in year 2

The net working capital changes are ignored. The market return is 10%

a. What is the IRR of Project A?

0=NPV= -250+60/IRR-(-0.05); IRR=0.19

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

Year 10: 80[1-1/1.1^10]/0.1=491.57
Discounted payback period = 10+(500-491.57)/(80/1.1^11) =10.3
If you use: 500 = 80[1-1/1.1^n]/0.1 and solve for n, 3 points will be deducted as this is not how discounted payback is defined.

c. What is the crossover rate of Projects A and B?

NPV(A) =NPV(B) ; -250+60/R-(-0.05) = -500+80/R ; R=0.14

d. If you want to launch project A and B together, what is the IRR of the combined projects A and B?

NPV(A+B)= 0 ; -250+60/R-(-0.05) -500+80/R = 0 ; R=0.168

e. Suppose that you have $600, and the budget limit is the only constraint that you consider. Which of the projects should you choose (partial investment of a project results in no money back)?

Under the budget constraint, it's possible to choose more than two projects at the same time.

NPV(A) =-250+60/0.1-(-0.05) =150
NPV(B) = -500+80/0.1=300
NPV(C)= -200+200/1.1+300/1.1^2 = 229.75
Should choose A&C: cost =450<600, NPV =150+229.75=379.75
Which is better than B: cost = 500<600, NPV =300

4. (20%) You are considering a potential project for The Ultimate recreational tennis racket, guaranteed to correct that wimpy backhand. In order to evaluate this project, you have spent $10,000 to hire the BlahBlah consultant company to estimate the market, and you were told the sales volume will be 1,200 units per year. The project has a 3 year life. Variable costs amount to $225 per unit and fixed costs are $100,000 per year. The project requires an initial investment of $165,000 which is depreciated straight-line to zero over the 3 year project life. The actual market value of the initial investment at the end of year 3 is $35,000. Initial net working capital investment is $75,000 and maintains constant each year thereafter. The tax rate is 34% and the required return on the project is 10%. How much should you set the prices of the rackets?

Note:
1. The consulting fee, $10,000, should be considered as part of the cost in this project as we are for sure to take the project and need the estimate of sales volume to be able to calculate the bid price. However, you'll still get credit if you treat the consulting fee as sunk cost like in other problems.
2. The investment in net working capital can be interpreted as initial investment of $75,000 and then recovered $75,000 at the end of the project. Or, invest $75,000 as NWC for three years and then recover $225,000 at the end.

	0	1	2	3
OCF		OCF	OCF	OCF
NWC	-75,000			75,000
C.S.	-165,000			231,000 = 35,000*(1-0.34) After-tax salvage value

NPV = -75,000-165,000+OCF[1-1/1.1^3]/0.1 + (75,000+231,000)/1.1^3 = 0
OCF= 66,870.09 =[(p-225)(1200)-100,000](1-0.34)+(165000/3)(0.34) ; p=369.15

Or:

	0	1	2	3
OCF		OCF	OCF	OCF
NWC	-75,000			75,000
C.S.	-165,000			231,000 = 35,000*(1-0.34) After-tax salvage value
	-10,000			

NPV = -75,000-165,000-10,000+OCF[1-1/1.1^3]/0.1 + (75,000+231,000)/1.1^3 = 0
OCF= 70,891 =[(p-225)(1200)-100,000](1-0.34)+(165000/3)(0.34) ; p=374.23

Or:

	0	1	2	3
OCF		OCF	OCF	OCF
NWC	-75,000	-75000	-75000	225,000
C.S.	-165,000			231,000 = 35,000*(1-0.34) After-tax salvage value

NPV = -75,000-165,000-75,000[1-1/1.1^]/0.1+OCF[1-1/1.1^3]/0.1 + 456,000/1.1^3 = 0
OCF= 73,894.26 =[(p-225)(1200)-100,000](1-0.34)+(165000/3)(0.34) ; p=378.02