Finance

Mid-Term Exam – Fall 2012/2013

Version A

Use the following information to answer Problems 1-3:

Becas, your bank manager, suggests you should invest € 700 in a savings account with an interest rate of 5% (stated annual) with monthly compounding.

Problem 1
If you follow Becas' advice, how much will you have in 3 years time?

$$€700 \times \left(1 + \frac{5\%}{12}\right)^{3\times12} = 813.0306$$

Problem 2
What is the effective annual rate (EAR) of this savings account?

$$EAR = \left(1 + \frac{5\%}{12}\right)^{12} - 1 = 5.1162\%$$

Problem 3
How much should you deposit every month in this account if you want to withdraw exactly € 3,000 in three years? Consider that you do the first deposit today and then make equal deposits every month.

$$\frac{Deposit}{5\%/12} \times \left(1 - \frac{1}{(1+5\%/12)^{12\times3+1}}\right) \times (1+5\%/12) = \frac{€3000}{(1+5\%/12)^{12\times3}}$$

$$Deposit = €75.1601$$

We will also accept 36 deposits, instead of 37, and so the deposit would be €77.0915

Use the following information to answer Problems 4-6:

Egas borrowed € 80,000 today to buy an apartment. The loan will be paid back through constant monthly instalments during 10 years, and starting next month. The loan interest rate is 3% (stated annual).

Problem 4
What is the value of the instalment?

$$\frac{Instalment}{3\%/12} \times \left(1 - \frac{1}{(1+3\%/12)^{12\times10}}\right) = €80{,}000$$

$$Instalment = €772.4860$$

Problem 5

How much will Egas owe the bank after the payment of the second instalment?

$$\frac{€772.4860}{3\%/12} \times \left(1 - \frac{1}{(1+3\%/12)^{12\times 10-2}}\right) = €78{,}853.5969$$

Problem 6

What is the value of the monthly instalment, if the first instalment is to be paid exactly one year from now (maintaining 10 years of monthly instalments)?

$$\frac{Instalment}{3\%/12} \times \left(1 - \frac{1}{(1+3\%/12)^{12\times 10}}\right) = €80{,}000 \times (1+3\%/12)^{11}$$

$$Instalment = €793.9969$$

Use the following information to answer Problems 7-10:

The following zero coupon and annual coupon bonds, with a face value of € 100, are available in the market:

Maturity	Dirty Price	Coupon Rate
0.5 year	104,02	5%
1 year	97,56	0%
1.5 year	95,52	0%
2 years	108,04	8%

Problem 7

What are the 1-year and the 1.5 years maturity spot rates?

$$Spot_{1Y} = \frac{€100}{€97.56} - 1 = 2.5010\%$$

$$Spot_{1.5Y} = \left(\frac{€100}{€95.52}\right)^{\frac{1}{1.5}} - 1 = 3.1028\%$$

Problem 8

What are the 0.5 and 2 years maturity sport rates?

$$Spot_{0.5Y} = \left(\frac{€105}{€104.02}\right)^{\frac{1}{0.5}} - 1 = 1.8931\%$$

$$Spot_{2Y} = \left(108/\left(€108.04 - \frac{€8}{(1+Spot_{1Y})}\right)\right)^{\frac{1}{2}} - 1 = 3.8011\%$$

Problem 9

What is the forward rate from 1.5 years to 2 years?

$$(1 + Spot_{2Y})^2 = (1 + Spot_{1.5Y})^{1.5} \times \left(1 + Forward_{1.5;2Y}\right)^{0.5}$$

$$Forward_{1.5;2Y} = 5.9243\%$$

Problem 10
What is the clean price of an 8% coupon bond that pays annual coupons and matures in one semester?

$$Clean\ Price = \frac{€108}{(1 + Spot_{0.5Y})^{0.5}} - \frac{€8}{2} = €102.9920$$

Problem 11
What is the dirty price of a 5% coupon bond that pays annual coupons and matures in one and a half (1.5) years?

$$Dirty\ Price = \frac{€5}{(1 + Spot_{0.5Y})^{0.5}} + \frac{€105}{(1 + Spot_{1.5Y})^{1.5}} = €105.2493$$

Use the following information to answer Problems 12-16:

Company XPTO is a publicly listed company with 1,000,000 shares outstanding that generates constant earnings of € 25,000,000 per year. The company has just distributed dividends to its shareholders. The appropriate discount rate is 10%.

Problem 12
If the company behaves as a cash cow, what is the price per share today?

$$Price = \frac{EPS}{10\%} = \frac{€25{,}000{,}000/1{,}000{,}000}{0.1} = €250$$

Problem 13
What would be the required rate by investors if the price per share of Company XPTO was € 100?

$$Rate = \frac{EPS}{€100} = 25\%$$

Problem 14
If company XPTO decides to change its dividend policy such that is starts retaining 40% of its earnings every year (starting exactly one year from now) to invest each year in growth opportunity projects that allow earnings to grow at a rate of 5% per year forever, what is the value of the NPVGO?

$$ROIC = \frac{g}{plowback} = \frac{5\%}{40\%} = 12.5\%$$

$$NPVGO = \frac{-EPS \times plowback + \left(\frac{EPS \times plowback \times ROIC}{discount\ rate}\right)}{discount\ rate - g}$$

$$NPVGO = \frac{-€25 \times 40\% + \left(\frac{€25 \times 40\% \times 12.5\%}{10\%}\right)}{10\% - 5\%} = €50$$

Problem 15
What is the current price per share if the firm decides to change its dividend policy according with the previous question?

$$Price = Price\ with\ no\ growth + NPVGO = €300$$

Problem 16
Imagine that the Financial Advisor of XPTO tells you that the value of the company will increase further if the company starts retaining 80% of its earnings instead of the above 40%. In this case, earnings will grow at a rate of 6% per year forever. Is the Financial Advisor right or wrong? What is the value of the NPVGO and what is the new price of the share?

$$ROIC = \frac{g}{plowback} = \frac{6\%}{80\%} = 7.5\%$$

The Financial Advisor must be wrong, as $ROIC < discount\ rate$.

$$NPVGO = \frac{-€25 \times 80\% + \left(\frac{€25 \times 80\% \times 7.5\%}{10\%}\right)}{10\% - 6\%} = -€125$$

$$Price = Price\ with\ no\ growth + NPVGO = €125$$

Use the following information to answer Problems 17-19:

A company must choose between the two mutually exclusive perpetual projects with the following cash flows (in Euros):

	Project A	Project B
Year 0	-1500	-750
Year 1	400	245
Perpetual growth rate	2%	3%

The appropriate discount rate is 10% for both projects.

Problem 17
What are the NPVs of projects A and B?

$$NPV = -Investment + \frac{Cash\ Flow}{discount\ rate - growth\ rate}$$

$$NPV_A = -€1500 + \frac{€400}{10\% - 2\%} = €3500$$

$$NPV_B = -€750 + \frac{€245}{10\% - 3\%} = €2750$$

Problem 18

What are the internal rates of return of projects A and B?

$$-€1500 + \frac{€400}{IRR_A - 2\%} = €0 \iff IRR_A = 28.6667\%$$

$$-€750 + \frac{€245}{IRR_B - 3\%} = €0 \iff IRR_B = 35.6667\%$$

Problem 19

Which project should the company choose (or none of them)?

Since the projects are mutually exclusive, we can choose only one (or none). We should choose project A since it has the higher positive NPV. (The internal rate of return is not a good criterion to use in this choice).

Problem 20

You have an idea to buy a bakery machine to make a special type of bread. The machine costs € 150. If your business is a success, you can estimate the annual free cash flow to be € 20 in perpetuity. If the business does not succeed as you imagined, the annual free cash flow is always € 5.50. Success and failure are equally likely next year. Also, your "fortune" will never reverse in the future (i.e. if it is a failure in year 1, it will remain so in the years to come; success in year 1 will also be forever). You will need to wait one year to know if the project is a success or a failure. Discount rate is 10%. At any time, you can sell the machine at second-hand market prices (it is € 100 today). Obviously, if you sell the machine, your future cash flow goes to zero and your business is closed, as you cannot produce any more bread.

What is the NPV of the project, with and without the option to shut down your business?

$$NPV_{no\ option} = -€150 + \frac{50\% \times €20 + 50\% \times €5.50}{10\%} = -€22.50$$

$$NPV_{with\ option} = -€150 + 50\% \times \frac{€20}{10\%} + 50\% \times \left(\frac{€5.50}{1 + 10\%} + €100\right) = €2.50$$

We considered the present value of the machine to be €100 when sold in the second hand market. We also accept an answer with the machine sold at €100 one year from now, and so the NPV with option would be -€2.0455.