Jukka Perttunen

Name: _____

Student number: _____

All the answers on these sheets only!

Allowed material:
– calculator of any kind
– one sheet of student's own notes

1. Calculate the following interest rates.

a) Annually compounded two-year rate is 3.790%. Express the two-year rate in terms of continuous compounding.

b) Continuously compounded three-year rate is 4.528%. Express the three-year rate in terms of semiannual compounding.

c) Continuously compounded six-month rate is 3.789%, and the 6m × 12m simple six-month forward rate is 4.255%. Determine the one-year rate in terms of continuous compounding.

d) Four-year discount factor is 0.87089. Determine the four-year discount rate in terms of continuous compounding.

2. Evaluate the interest rate sensitivity of the following three bonds and a portfolio of them.

a) A 1000-euro fixed-coupon bond is paying 50 euros annual coupons. The next coupon payment is to take place six months from now, and the time-to-maturity of the bond is 3.50 years. The continuously compounded yield-to-maturity of the bond is 7.562%. The bond trades currently at 940 euros. Determine the duration of the bond.

b) A 1000-euro risk-free floating-rate bond is paying six-month Euribor rate on a semiannual basis. The next reset of the coupon is to take place three months from now, and the time-to maturity of the bond is 4.25 years. The bond trades currently at 996 euros. Determine the duration of the bond.

c) A 1000-euro zero-coupon bond trades currently at 656 euros. The time-to-maturity of the bond is 6.75 years, and the yield-to-maturity of the bond is 6.246%. Determine the duration of the bond.

c) Determine the duration of a portfolio of the three bonds above, and apply it to approximate the change in the portfolio value, if the interest rates rise by one percentage unit in terms of continous compounding.

3. The table below provides the expected returns $E(R_i)$ and the volatilities σ_i of three asset $(i = 1, 2, 3)$, as well as the weights w_i of them in three different portfolios $(p = A, B, C)$. The table also provides the volatilities σ_p of two of the three portfolios and the Sharpe's ratios S_p of two of the three portfolios.

i	$E(R_i)$	σ_i	Portfolio A w_i	Portfolio B w_i	Portfolio C w_i
1	0.0748	0.2888	0.293	0.656	0.851
2	0.1346	0.4538	0.368	0.106	0.052
3	0.1209	0.4291	0.339	0.238	0.097
σ_p			0.2924		0.2621
S_p				0.2906	0.2381
Tangent portfolio			☐	☐	☐
Minimum variance portfolio			☐	☐	☐
Randomly chosen portfolio			☐	☐	☐

a) Indicate (tick the appropriate box in the table) which of the portfolios represents i) the minumum variance portfolio, ii) the tangent portfolio, and iii) a randomly chosen portfolio.

b) Create such a portfolio of the three assets and the risk-free asset, which provides the highest possible expected return at the volatility level of 40%. What is the expected return of the portfolio?

4. The performance of a portfolio of 25 stocks is evaluated over a five-year period of monthly data. The average *monthly* excess return of the portfolio is 1.22% and the standard deviation of the *monthly* excess return is 6.35%

a) Calculate the Sharpe's ratio of the portfolio.

b) Caclulate the *t*-statistic for the null-hypothesis that the ratio does not differ from zero.

5. The attached tables include the latest income statement and the balance sheets of MBA Corporation. Also, the projected income statements, capital investment budget, and net working capital budget over the period 2015-2018 are provided. In the projections, it is assumed that the *Net Sales*, *Costs of goods sold*, *Depreciation*, and *Capital expenditures* are to grow at a 10% annual rate over a two-year period 2015-2016. Thereafter the growth rate is expected to stabilize at a constant level of 5%. Regarding working capital requirement, the projections assume that 10% of annual *Net sales* appear in the balance sheet in terms of current assets. Similarly, 10% of annual *Costs of goods sold* appear as current liabilities. The required rate of return on assets of the MBA Corporation is estimated on the basis of an approximated unlevered beta, and is found to be 8.5% in terms of annual compounding. Estimate the value of the firm's equity by the unlevered free cash flow approach. Apply 35% corprate tax rate. Explain your calculations.

Income statement	2014		Balance sheet	2013	2014
Net sales	1010		Current assets		
Costs of goods sold	650		Cash	200	200
Deprecation	200		Other current assets	92	101
Earnings before interest and taxes	160		Fixed assets	1600	1650
Interest paid	60				
Taxes	35		Current liabilities	59	65
Net income	65		Long-term debt	850	880
			Retained earnings	183	206
			Stockholders' equity	800	800

Budget	2015	2016	2017	2018
Net sales	1111.00	1222.10	1283.21	1347.37
Costs of goods sold	715.00	786.50	825.83	867.12
Depreciation	220.00	242.00	254.10	266.81
Earnings before interest and taxes	176.00	193.60	203.28	213.44
Capital expenditures	275.00	302.50	317.63	333.51
Change in Net working capital	3.60	3.96	2.18	2.29