Capital Budgeting, Fall 2017
Final Exam 2, Saturday, December 2nd, 2017
Writing time: 4 hours. Use of Hanken calculator is allowed.

Exam maximum score is 75 points. 50% of the available points, 37.5p, in the final exam, and 50p course total, are required for a passing grade.
Avoid essay answers longer than a single page. Make sure your answers are legible.

1. Fill in the blanks (BMA chapter 12): (**+3p/term; 12p total**)

   "A project's economic income for a given year equals the project's (a) __________ less its (b) ______________ depreciation. New projects may take several years to reach full profitability. In these cases book income is (c) ______________ than economic income early in the project's life and (d) ____________ than economic income later in its life."

2. Discuss briefly the pros and cons of decision trees as a project analysis tool. (mainly BMA, ch. 11). (**12p**)

3. Suppose your firm has a manufacturing investment project with a NPV=+5 MEUR with an overall inflation assumption of 2% p.a. Your boss disagrees and believes inflation will be 4%, and orders a new valuation of the project to be undertaken. Do you think the value of the project goes up or down with the revised inflation forecast? Discuss the proper treatment of inflation in capital budgeting based on the given scenario. You are encouraged to illustrate with a numerical example. (**13p**)

4. a. Machines Zenox and Renox are mutually exclusive and are expected to produce the following real cash flows:

	Cash Flows ($ thousands)			
Machine	C_0	C_1	C_2	C_3
Zenox	-200	+275	+300	
Renox	-450	+320	+380	+440

The real opportunity cost of capital is 7% p.a. Which machine should you buy? (**5p**)

b. Machine Venox was purchased five years ago for $500000 and produces an annual real cash flow of $200000. It has no salvage value but is expected to last another five years. The company can replace machine Venox with machine Zenox or Renox *either* now *or* at the end of five years. Which should it do? (**5p; 10p total**)

Turn page!

5. You run a perpetual encabulator machine, which generates revenues averaging \$20 million per year. Raw material costs are 50% of revenues. These costs are variable – they are always proportional to revenues. There are no other operating costs. The cost of capital is 9%. Your firm's long-term borrowing rate is 6%.

Now you are approached by Studebaker Capital Corp., which proposes a fixed-price contract to supply raw materials at \$10 million per year for 10 years.

a. What happens to the operating leverage and business risk of the encabulator machine if you agree to this fixed-price contract? **(5p)**
b. Calculate the present value of the encabulator machine with and without the fixed-price contract. Interpret the results. **(10p; 15p total)**

6. The value [=PV(cash flows)] of an investment project by Heavy Metal Corp. (HM) changes only once a month; either it goes up by 20% or it falls by 16.7%. The present value of the project is now \$40 million. With a starting cost of \$40 million, the project NPV, if started immediately, is zero. HM can, however, postpone the launch of the project by up to two months. If HM were to sell the whole project now instead of launching it, what would be the minimum required selling price? The interest rate is 12.7% per year or about 1% per month. **(13p)**

FORMULAS

$$r - r_f = (r_m - r_f)\beta \qquad WACC = r_D(1-\tau_C)\frac{D}{E+D} + r_E\frac{E}{E+D} \qquad \tau_C = \text{corporate tax rate}$$

$$\beta_A = \beta_D \cdot \frac{D}{V} + \beta_E \cdot \frac{E}{V} \qquad \beta_i = \frac{\text{cov}(r_i, r_m)}{\sigma_m^2} \qquad i\text{=any asset } i,$$

$$E[x_i] = \sum_i p_i x_i \qquad \text{cov}(x,y) = \sum p_i (x_i - E[x_i]) \times (y_i - E[y_i]),$$

$$\text{var}(x) = \sum p_i (x_i - E[x_i]) \times (x_i - E[x_i])$$

Risk-neutral probability $p = \dfrac{1+rf-d}{u-d} = \dfrac{rf-d\%}{u\%-d\%}$ (where u and d are 1+u% and 1+d%-change!). Example: rf=1%, u%=+20%, d%= -10%, then p=(1.01-0.90/(1.20-0.90)=(0.01-(-0.10))/(0.20-(-0.10))=0.36667.

Call option delta = ΔCall price / ΔStock price (where Δ=change)

Put option delta = ΔCall price / ΔStock price - 1

Put-call parity $S + put = call + PV(X)$

Price of option: $\dfrac{[p \times option\_cash\_flow\_up + (1-p) \times option\_cash\_flow\_down]}{1+rf}$