MIE 374s Final Exam
Engineering Economics, April 20, 2001

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Note:
1) Marks as indicated [n]
2) Type C exam - Aid sheet only allowed - Tables to be handed out
3) Explain clearly the rationale for the steps in your procedures. Full marks will **NOT** be given for numbers only.
4) Only non-programmable calculators allowed

1)

(a) Explain your understanding of and the significance of the following for the economic design of engineering systems..

    (i) [3] deadweight losses.

    (ii) [3] the effects of user fees on a benefit/cost calculation

    (iii) [3] the quick ratio in a firm's financial position

    (iv) [3] the use of Bayes' Theorem about conditional probabilities in decision tree analysis

    (v) [3] the dual variables in linear programming

(b) Compute the numerical answer to the following

    (i) [3] Find the external rate of return for cash flows of $-100, 200$ and -110 when the MARR is 10%.

    (ii) [3] If cost = 6 and benefit = 7 but there are negative external effects of 1, find the correct b/c ratio

    (iii) [3] For an investment of 100, a cca rate of 20% and an investment tax credit of 10%, find the depreciation for the first 3 years and the book value at the end of 3 years.

    (iv) [6] Find the monthly mortgage payment required to repay a $100000 loan that is to be paid back over 25 years at a nominal rate of 10% annually when the payments are made monthly and compounded quarterly.

2) Consider   max $3x_1 + x_2$
        subj to x_1 $=L= 4$
               $2x_1 + x_2$ $=L= 3$
               $x_i =G= 0$

(a) [15] Solve by the Simplex Method
(b) [5] If the objective function represents the present worth of investments in two types of projects and the constraints represent the amounts of capital available in periods 1 and 2. Find the amount you would be willing to pay for an extra unit of capital in period 2.
(c) [5] How does your answer in (b) relate to the interest rate for borrowing funds in the market?

3) [20] A firm has a major initiative which will cost $2,000,000 for starting up and $400,000 for each of the next 6 years. It is expected to increase revenues permanently by $400,000 per year. Additional revenues will be gained in the pattern of an arithmetic gradient with $200,000 in the first year declining by $50,000 per year to zero in year 5. Find the IRR of the investment. Show your calculations clearly.

4) An old (fully depreciated) asset cost $8000 five years ago. It has O&M costs of $1500 this year and these increase by $1500 each year. The current salvage value is $4500 and will decline by $750 per year. The new asset costs $9000, has O&M costs of $1400 per year increasing by $500 per year and salvage value of $5000 after one year declining by 10% each year. Depreciation is 20% cca. The firm has a tax rate of 40% and a MARR of 15%. Planning period is 5 years.

(a) [10] What should the firm do now?

(b) [5] If the new asset is installed now find its optimal replacement interval

(c) [5] If the new asset is installed now and the firm intends to use a similar device for 10 years, find the optimal replacement times.

(d) [5] If the decline rate of the new asset is uncertain (10% with probability 0.4 and 15% with prob 0.6) , find the best action for the firm based on expected costs.