DEPARTMENT OF HUMANITIES AND MANAGEMENT

HUM 3021: ENGINEERING AND ECONOMICS AND FINANCIAL MANAGEMENT

IA 3 – Take Home Assignment

Instructions:

- ✓ The assignment must be written by hand on plain A4 paper, and neatness and presentation of the report earn points.
- ✓ The assignment is a case study on Part 1: project risks (3 marks) and Part 2: ratio analysis (2 marks) with a total mark of 05.
- ✓ Because the topics in the assignment are significant and part of the syllabus, you will be getting questions on these topics in the semester examination.
- ✓ If you have any questions, please contact your course instructor.

Part 1

Case study on Methods of Describing Project Risks

Boston Metal Company (BMC), a small manufacturer of fabricated metal parts, must decide whether to enter the competition to become the supplier of transmission housings for Gulf Electric, a company that produces the housings in its own in-house manufacturing facility, but that has almost reached its maximum production capacity. Therefore, Gulf is looking for an outside supplier. To compete, BMC must design a new fixture for the production process and purchase a new forge. The available details for this purchase are as follows:

- The new forge would cost $125,000. This total includes retooling costs for the transmission housings.
- If BMC gets the order, it may be able to sell as many as 2,000 units per year to Gulf Electric for $50 each, in which case variable production costs,2 such as direct labor and direct material costs, will be $15 per unit. The increase in fixed costs,3 other than depreciation, will amount to $10,000 per year.
- The firm expects that the proposed transmission-housings project will have about a five-year product life. The firm also estimates that the amount ordered by Gulf Electric in the first year will be ordered in each of the subsequent four years. (Due to the nature of contracted production, the annual demand and unit price would remain the same over the project after the contract is signed.)
- The initial investment can be depreciated on a MACRS basis over a seven-year period, and the marginal income tax rate is expected to remain at 40%. At the end of five years, the forge is expected to retain a market value of about 32% of the original investment.
- On the basis of this information, the engineering and marketing staffs of BMC have prepared the cash flow forecasts shown in Table 12.1. Since the NPW is positive ($40,168) at the 15% opportunity cost of capital (MARR), the project appears to be worth undertaking.

What Makes BMC Managers Worry: BMC's managers are uneasy about this project, because too many uncertain elements have not been considered in the analysis:

- If it decided to take on the project, BMC would have to invest in the forging machine to provide Gulf Electric with some samples as a part of the bidding process. If Gulf Electric were not to like BMC's sample, BMC would stand to lose its entire investment in the forging machine.
- If Gulf were to like BMC's sample, then if it was overpriced, BMC would be under pressure to bring the price in line with competing firms. Even the possibility that BMC would get a smaller order must be considered, as Gulf may utilize its overtime capacity to produce some extra units. Finally, BMC is not certain about its projections of variable and fixed costs.

Recognizing these uncertainties, the managers want to assess the various possible future outcomes before making a final decision. Put yourself in BMC's management position, and describe how you may resolve the uncertainty associated with the project. ***In doing so, perform a sensitivity analysis for each variable and develop a sensitivity graph.***

DISCUSSION: Table 1 shows BMC's expected cash flows—but that they will indeed materialize cannot be assumed. In particular, BMC is not very confident in its revenue forecasts. The managers think that if competing firms enter the market,

Table 1: After-Tax Cash Flow for BMC's Transmission-Housings Project

	0	1	2	3	4	5
Revenues:						
Unit price		$ 50	$ 50	$ 50	$ 50	$ 50
Demand (units)		2,000	2,000	2,000	2,000	2,000
Sales revenue		$100,000	$100,000	$100,000	$100,000	$100,000
Expenses:						
Unit variable cost		$ 15	$ 15	$ 15	$ 15	$ 15
Variable cost		30,000	30,000	30,000	30,000	30,000
Fixed cost		10,000	10,000	10,000	10,000	10,000
Depreciation		17,863	30,613	21,863	15,613	5,575
Taxable income		$ 42,137	$ 29,387	$ 38,137	$ 44,387	$ 54,425
Income taxes (40%)		16,855	11,755	15,255	17,755	21,770
Net income		$ 25,282	$ 17,632	$ 22,882	$ 26,632	$ 32,655
Cash flow statement:						
Operating activities:						
Net income		25,282	17,632	22,882	26,632	32,655
Depreciation		17,863	30,613	21,863	15,613	5,575
Investment activities:						
Investment	(125,000)					
Salvage						40,000
Gains tax						(2,611)
Net cash flow	$(125,500)	$ 43,145	$ 48,245	$ 44,745	$ 42,245	$ 75,619

BMC will lose a substantial portion of the projected revenues by not being able to increase its bidding price. Before undertaking the project, the company needs to identify the key variables that will determine whether it will succeed or fail. The marketing department has estimated revenue as follows:

$$\text{Annual revenue} = (\text{Product Demand})\ (\text{Unit Price})$$

$$= (2000)\ (\$50) = \$100{,}000$$

The engineering department has estimated variable costs, such as those of labour and materials, at $15 per unit. Since the projected sales volume is 2,000 units per year, the total variable cost is $30,000. After first defining the unit sales, unit price, unit variable cost, fixed cost, and salvage value, we conduct a sensitivity analysis with respect to these key input variables. This is done by varying each of the estimates by a given percentage and determining what effect the variation in that item will have on the final results. If the effect is large, the result is sensitive to that item. Our objective is to locate the most sensitive item(s).

Extending the Case to Perform Breakeven Analysis

Through the sensitivity analysis for this case, BMC's managers become convinced that the NPW is most sensitive to changes in annual sales volumes. Determine the break-even NPW value as a function of that variable.

Extending the Case to Perform Scenario Analysis

Consider again BMC's transmission-housings project first presented in above case discussion on sensitivity analysis. Assume that the company's managers are fairly confident of their estimates of all the project's cash flow variables, except the estimates of unit sales. Assume further that they regard a drop in unit sales below 1,600 or a rise above 2,400 as extremely unlikely. Thus, a decremental annual sale of 400 units defines the lower bound, or the worst-case scenario, whereas an incremental annual sale of 400 units defines the upper bound, or the best-case scenario. (Remember that the most likely value was 2,000 in annual unit sales.) Discuss the worst- and best-case scenarios, assuming that the unit sales for all five years are equal.

DISCUSSION: To carry out the scenario analysis, we ask the marketing and engineering staffs to give optimistic (best-case) and pessimistic (worst-case) estimates for the key variables. Then we use the worst-case variable values to obtain the worst-case NPW and the best-case variable values to obtain the best-case NPW.

The case study is extracted from the reference material source mentioned below:

Source: Park, C. S. (2007). *Contemporary engineering economics* (4th edition). Upper Saddle River, NJ: Prentice Hall.

PART 2

FINANCIAL STATEMENT ANALYSIS- RATIO ANALYSIS

1) The Financial Statement of Skanda Pvt. Ltd. is provided below in Table 1 and Table 2. You are required to calculate the following ratios for the year 20x5:

a) Quick Ratio	d) Fixed Asset Turnover
b) Interest Coverage Ratio	e) Gross Profit Margin Ratio
c) Inventory Turnover Ratio	f) Return on Equity

Table 1: Skanda Ltd: Profit and Loss Account for year ending 31st March 20x5

	20X5	*20X4*
Net sales	70.1	62.3
Cost of goods sold	55.2	47.5
Stocks	42.1	37.0
Wages and salaries	6.8	5.5
Other manufacturing expenses	6.3	5.0
Gross profit	14.9	14.8
Operating expenses	5.6	4.9
Depreciation	3.0	2.6
General administration	1.2	1.1
Selling	1.4	1.2
Operating profit	9.3	9.9
Non-operating surplus/deficit	(0.4)	0.6
Earnings befcre interest and tax	8.9	10.5
Interest	2.1	2.2
Profit before tax	6.8	8.3
Tax	3.5	4.1
Profit after tax	3.3	4.2
Dividends	2.7	2.7
Retained earnings	0.6	1.5
Per share data (in rupees)		
Earnings per share	2.2	2.8
Dividend per share	1.8	1.8
Market price per share	21.0	20.0
Book value per share	17.46	17.07

Table 2: Skanda Ltd: Balance Sheet as on 31st March 20x5

(Rs in million)

Liabilities	*20X5*	*20X4*	*Assets*	*20X5*	*20X4*
Share capital	15.00	15.00	Fixed assets (net)	33.00	32.20
Equity	15.00	15.00	Gross block	59.00	46.20
Preference	—	—	Acc. depr'n	26.00	14.00
Reserves & surplus	11.20	10.60	Investments	1.00	1.00
Secured loans	14.30	13.10	Current assets, loans,		
Term loans	7.00	5.80	and advances	23.40	15.60
Cash credit	7.30	7.30	Cash & bank	1.00	0.60
Unsecured loans	6.90	2.50	Debtors	11.40	6.80
Bank credit	2.50	2.50	Inventories	10.50	7.20
Inter-corporate	4.40	—	Pre-paid exp.	0.50	1.00
Current liabilities and provisions	10.50	8.10	Miscellaneous expenditures and losses	0.50	0.50
	57.90	49.30		57.90	49.30