TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Thapathali Campus
2072 Bhadra

Exam	Internal Assessment		
Level	BE	Full Mark	80
Program	BME	Pass Mark	32
Year/Part	IV/II	Time	3 hrs

Subject: - Operations Research *(Elective II)* ***(ME 76507)***

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ Attempt ***All*** questions.
- ✓ All questions carry equal marks.
- ✓ Assume suitable data if necessary.

Examination must be conducted in a computer lab. Each student has to be provided with a PC or is to be allowed to use his laptop, which must have Microsoft Office and CRYSTAL BALL Pro. The Microsoft Office must have EXCEL with SOLVER and Analysis Tool Pack. Each student must be provided with a CD to attempt the questions and save them or his answers to be copied in a pen drive. If the PC has some problem, the student should be provided with another usable PC and the time elapsed should be considered. Time series formula sheet should be allowed.

1. A bank has $650,000 in assets to allocate among investments in bond, home mortgages, car loans, and personal loans. Bonds are expected to produce a return of 10%, mortgages 8.5%, car loans 9.5% and personal loans 12.5%. To make sure the portfolio is not too risky, the bank wants to restrict personal loans to no more than the 25% of the total portfolio. The bank also wants to ensure that more money is invested in mortgages than in personal loans. It also wants to invest more in bonds than personal loans.
    a. Formulate an LP model for this problem with the objective of maximizing the expected return on the portfolio.
    b. Implement your model in a spreadsheet and solve it.
    c. What is the optimal solution?

2. An information systems consultant who lives in Dallas must spend the majority of the month of March onsite with a client in San Diego. Her travel schedule for the month is as follows:

Leave Dallas	Leave San Diego
Monday, March 2	Friday, March 6
Tuesday, March 9	Thursday, March 12
Tuesday, March 17	Friday, March 20
Monday, March 23	Wednesday, March 25

The usual round-trip ticket price between Dallas and San Diego is $750. However, the airline offers a 25% discount if the dates on a round-trip ticket cover less than 7 nights and include a weekend. A 35% discount is offered for round-trip tickets covering 10 or more nights, and a 45% discount is available for round-trip tickets covering 20 or more nights. The consultant can purchase four round-trip tickets in any manner that allows her to leave Dallas and San Diego on the days indicated.
    a. Draw a network flow model for this problem.
    b. Implement the problem in a spreadsheet and solve it.
    c. What is the optimal solution? How much does this save for four full-cost round-trip tickets?

3. One of Philip Mahn's investments is going to mature and he wants to determine how to invest the proceeds of $30,000. Philip is considering two new investments: a stock mutual fund and a one-year certificate of deposit (CD). The CD is guaranteed to pay an 8% return. Philip estimates the return on the stock mutual fund as 16%, 9% or -2%, depending on whether market conditions are good, average or poor respectively. Philip estimates the probability of a good, average and poor market to be 0.1, 0.85 and 0.05 respectively.
    a. Construct a payoff matrix for this problem.
    b. What decision should be made according to maximax decision rule?
    c. What decision should be made according to maximin decision rule?
    d. What decision should be made according to minimax regret decision rule?
    e. What decision should be made according to EMV decision rule?
    f. What decision should be made according to EOL decision rule?
    g. How much should Philip be willing to pay to obtain a market forecast that is 100% accurate?

4. Jim Allison, the chief of operations at Sound's Alive and a quantitative methods specialist, plays a key role in providing Marissa with estimates for the various revenues and costs. He is uneasy about the basic estimates for the growth rates. For example, although market research indicates that a 9% gross revenue increase per year is reasonable, Jim knows that if this value is 7%, for example the profit values and the NPV would be quite different. Even more troublesome is a potential tax increase, which would hit Sound's Alive hard. Jim believes that the tax rate could vary around the expected of 18% for the SG&A rate. Jim thinks this value could be higher or even lower.
The Sound's Alive problem is too complicated for solving with what-if analysis because seven assumed values could change: the growth rates for gross revenues, labor, materials, overhead costs, tax rate, SG&A percent, and whether or not Bose enters the market. Jim believes of these variables can be modeled as follows:
Gross Revenues (%): normally distributed, mean = 9.9, std. dev = 1.4
Labor Growth (%): normally distributed, mean = 3.45, std. dev = 1.0

Materials (%)	Probability
4	0.10
5	0.15
6	0.15
7	0.25
8	0.25
9	0.10

Overhead (%)	Probability
2	0.20
3	0.35
4	0.25
5	0.20

Tax Rate (%)	Probability
30	0.15
32	0.30
34	0.30
36	0.25

SG&A (%)	Probability
15	0.05
16	0.10
17	0.20
18	0.25
19	0.20
20	0.20

Simulate Gross Revenue, labor growth, materials expenses, overhead expenses, tax rates and sales, general and administrative expenses (SG & A) using crystal ball. And find probable increase in profits within 95% confidence interval.

5. Use an appropriate Holtz winter's method to forecast the sales for the first quarter of 1999 and also find the optimal values for α, β and γ using solver so that it minimizes the value of MAD.

Year	*Qrtr*	*Sales*	*Year*	*Qrtr*	*Sales*
1993	1	147.60	1996	1	168.80
	2	251.80		2	322.60
	3	273.10		3	393.50
	4	249.10		4	404.30
1994	1	139.30	1997	1	259.70
	2	221.20		2	401.10
	3	260.20		3	464.60
	4	259.50		4	479.70
1995	1	140.50	1998	1	264.40
	2	245.50		2	402.60
	3	298.80		3	411.30
	4	287.00		4	385.90