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**Vidyavihar, Mumbai- 400077**

**Program: PGDM- FS, Trim-II**  
**Subject: Operations Research**  
**(End term exam)**

**Maximum Marks: 50**  
**Duration: 3hrs.**

**Date: 30<sup>th</sup> Dec., 2016**

**Instructions**

- 1. This exam will be conducted in the computer lab. All answers are to be written in the answer sheet. Use Excel where required.**
- 2. Keep saving the folder on the desktop and d-drive every ten minutes or so.**
- 3. Question No 1 is compulsory.**
- 4. Attempt any four questions from the remaining five questions.**

**QUESTION 1**  
(10)

The employee credit union at State University is planning the allocation of funds for the coming year. The credit union makes four type of loans to its members. In addition, the credit union invests in risk-free securities to stabilize income. The various revenue producing investments together with annual rates of returns are as follows:

Type of Loan/investment	Annual Rate of Return (%)
Automobile Loans	8
Furniture Loans	10
Other Secured Loans	11
Signature Loans	12
Risk-free Loans	9

The credit union will have \$2,000,000 available for investment during the coming year. State laws and credit union policies impose the following restrictions on the composition of the loans and investment.

- (i) Risk-free securities may not exceed 30% of the total funds available for investment.
  - (ii) Signature loans may not exceed 10% of the funds available in all loans (automobile, furniture, other secured, and signature loans).
  - (iii) Furniture loans plus other secured loans may not exceed the automobile loans.
  - (iv) Other secured loans plus signature loans may not exceed the funds invested in risk-free securities.
- (a) How should the \$2,000,000 be allocated to each of the loan/ investment alternatives to maximize total annual return? What is the projected total annual return?

- (b) Suppose that the annual rate of return increases to 9% for Automobile Loans and the annual rate of return for signature loans decreases to 7%. Would the optimal solution change?

**QUESTION 2**

(10)

Well done Company has taken the third floor of a multistoried building for rent with a view to locate one of their zonal offices. There are five main rooms in this floor to be assigned to five managers. Each room has its own advantages and disadvantages. Some have windows; some are closer to the washrooms or to the canteen or secretarial pool. The rooms are of all different sizes and shapes. Each of the five managers was asked to rank their room preferences amongst the rooms 301, 302, 303, 304 and 305. Their preferences were recorded in a table as indicated below.

Manager				
M <sub>1</sub>	M <sub>2</sub>	M <sub>3</sub>	M <sub>4</sub>	M <sub>5</sub>
302	302	303	302	301
303	304	301	305	302
304	305	304	304	305
	301	305	303	
		302		

Most of the managers did not list all the five rooms since they were not satisfied with some of these rooms and they have left off these from the list. Assuming that their preferences can be quantified by numbers, find out as to which manager should be assigned to which rooms so that their total preference ranking is a minimum.

**QUESTION 3**

(10)

The distribution system for the Herman Company consists of three plants, two warehouses, and four customers. Plant capacities and shipping costs (\$) from each plant to each warehouse are

Plant	Warehouse		Capacity
	1	2	
1	4	7	450
2	8	5	600
3	5	6	380

Customer demand and shipping cost per unit (in \$) from each warehouse to each customer are

Warehouse	Customer			
	1	2	3	4
1	6	4	8	4
2	3	6	7	7
Demand	300	300	300	400

- Develop a network model of this problem.
- Formulate a linear programming model of the problem
- Solve with Excel Solver. Find the optimum shipping plan.

**QUESTION 4**

(10)

The management of Brinkley Corporation is interested in using simulation to estimate the profit per unit for a new product. Probability distribution for the purchase cost, the labor cost, and the transportation cost are as follows:

Purchase Cost (\$)	Probability	Labor Cost (\$)	Probability	Transportation Cost (\$)	Probability
10	0.25	20	0.10	3	0.75
11	0.45	22	0.25	5	0.25
12	0.30	24	0.35		
		25	0.30		

Assume that these are the only costs and that the selling price for the product will be \$45 per unit.

- Provide the base-case, worst-case, and best-case calculations for the profit per unit.
- Run the simulation 500 times, calculate the profit per unit.

**QUESTION 5**

(10)

The following table reports the percentage of stocks in a typical portfolio in nine quarters from 2005 to 2007.

Quarter	Stock (%)	Quarter	Stock (%)
1 <sup>st</sup> ---2005	29.8	2 <sup>nd</sup> ---2006	31.5
2 <sup>nd</sup> ---2005	31.0	3 <sup>rd</sup> ---2006	32.0
3 <sup>rd</sup> ---2005	29.9	4 <sup>th</sup> ---2006	31.9
4 <sup>th</sup> ---2005	30.1	1 <sup>st</sup> ---2007	30.0
1 <sup>st</sup> ---2006	32.2		

- Use exponential smoothing to forecast this time series. Consider smoothing constants of  $\alpha = .2, .3, \text{ and } .4$ . What value of the smoothing constant provides the best forecast?
- What is the forecast of the percentage of assets committed to stocks for the second quarter of 2007?

**QUESTION 6**

(10)

The B. Hall Real Estate Investment Corporation has identified four small apartment buildings in which it would like to invest. Mrs. Hall has approached three savings and loan companies regarding financing. Because Hall has been a good client in the past and has maintained a high credit rating in the community, each savings and loan company is willing to consider providing all or part of the mortgage loan needed on each property. Each loan officer has set differing interest rates on each property (rates are affected by the neighborhood of the apartment building, condition of the property, and desire by the individual saving and loan to finance various size buildings). And each loan company has placed a maximum credit ceiling on how much it will lend Hall in total. This information is summarized in the following table.

Each apartment building is equally attractive as an investment to Hall, so she has decided to purchase all buildings possible at the lowest total payment of interest. From which savings and loan companies should her barrow to purchase which buildings? More than one savings and loan can finance the same property?

	Property (Interest Rates %)				
Saving and Loan Company	Hill St.	Banks St.	Park Ave.	Drury Lane	Maximum Credit Line (\$)
First Homestead	8	8	10	11	80,000
Common Wealth	9	10	12	10	1000,000
Washington Federal	9	11	10	9	120,000
Loan required to purchase building	60,000	40,000	130,000	70,000	