ISLAMIC UNIVERSITY OF TECHNOLOGY (IUT)
ORGANISATION OF ISLAMIC COOPERATION (OIC)
DEPARTMENT OF BUSINESS AND TECHNOLOGY MANAGEMENT

Semester Final Examination   Winter Semester, A. Y. 2022-2023
Course No.   : BTM 4701   Time   : 3 hours
Course Title : Operation Research   Full Marks : 150

Answer **all 6 (six)** questions. All questions carry equal marks. Marks of each question and corresponding CO and PO are written in the right margin with brackets.

1.	a)	Explain major phases of Operations Research.	05 (CO1) (PO1)
	b)	Discuss the opportunities and shortcomings of Operation Research for decision making.	07 (CO2) (PO2)
	c)	"Operations Research is not one rather it consists of many techniques" – Explain your understanding about this statement.	13 (CO3) (PO3)
2.	a)	Explain the process of formulating linear programming problems. What are the advantages and disadvantages of linear programming?	10 (CO3) (PO1)
	b)	A company has three operational departments (weaving, processing and packing) with capacity to produce three different types of clothes namely suiting, shirtings, and woolens yielding the profit 2000, 4000, 3000 per meter respectively. One meter suiting requires 3 minutes in weaving, 2 minutes in processing and 1 minute in packing. Similarly, one meter of shirting requires 4 minutes in weaving, 1 minute in processing and 3 minutes in packing while one meter woolen requires 3 minutes in each department. In a week, total run time of each department is 80, 40 and 60 hours of weaving, processing and packing departments respectively. **Formulate the linear programming problem to find the product mix to maximize the profit.**	15 (CO2) (PO2)
3.	a)	Describe essential elements of Queuing Systems and its applications in your real life.	05 (CO1) (PO1)
	b)	A road transport company has one reservation clerk on duty at a time. She handles information of bus schedules and makes reservations. Customers arrive at a rate 8 per hour and the clerk can service 12 customers on an average per hour. After stating your assumptions, answer the following: i. What is the average number of customers waiting for the service of the clerk in the system? ii. What is the average time a customer has to wait before getting service in the system and queue?	07 (CO2) (PO2)
	c)	The management is contemplating to install a computer system to handle the information and reservations. This is expected to reduce the service time from 5 to 3 minutes. The additional cost of having the new system works out to Tk. 50 per day. If the cost of goodwill of having a customer to wait is estimated to be 12 paise per minute spent waiting before being served, should the company install the computer system? Assume an 8-hour working day.	13 (CO4) (PO4)

4. The following table shows all the necessary information on the availability of supply to each warehouse, the requirement of each market and the unit transportation cost (in Rs.) from each warehouse to each market. **25 (CO1) (PO4)**

		Market				
		P	Q	R	S	Supply
Warehouse	A	6	3	5	4	22
	B	5	9	2	7	15
	C	5	7	8	6	8
Requirement		7	12	17	9	

The shipping clerk has worked out the following schedule from experiences: 12 units from A to Q, 1 unit from A to R, 9 units from A to S, 15 units from B to R, 7 units from C to P and 1 unit from C to R.

   i.   Check and see if the clerk has the optimum schedule.
   ii.   Find the optimum schedule and minimum total transportation cost.
   iii.   If the clerk is approached by a carrier of route C to Q, who offers to reduce his rate in the hope of getting some business, by how much must the rate be reduced by the driver before the clerk will offer him the business?
   iv.   If the supply from warehouse B reduces to 12 units and simultaneously the requirement of market R reduces to 14 units, find the optimum transportation schedule.

5. A city corporation has decided to carry out road repairs on the main four arteries of the city. The government has agreed to make a special grant of Tk. 50 lakhs towards the cost with a condition that the repairs must be done at the lowest cost and quickest time. If conditions warrant, then a supplementary token grant will also be considered favorably. The corporation has floated tenders and 5 contractors have sent in their bids. In order to expedite work, one road will be awarded to only one contractor. **25 (CO4) (PO4)**

	Cost of repairs (Tk. Lakhs)			
Contractors/ Road	R1	R2	R3	R4
C1	9	14	19	15
C2	7	17	20	19
C3	9	18	21	18
C4	10	12	18	19
C5	10	15	21	16

   i.   Find the best way of assigning the repair work to the contractors and the costs.
   ii.   If it is necessary to seek supplementary grants, then what should be the amount sought?
   iii.   Which of the five contractors will be unsuccessful in his bid?

6. An engineering firm has installed a machine costing Tk. 4 lacs and is in the process of deciding on an appropriate number of a certain spare parts required for repairs. The spare parts cost Tk. 4000 each but are available only if they are ordered now. In case the machine fails, and no spares are available, the cost to the company of mending the plant would be Tk. 18000. The plant has an estimated life experience with similar machines, is as follows: **25 (CO3) (PO4)**

Number of failures during 8 yearly period	0	1	2	3	4	5
Probability	0.1	0.2	0.3	0.2	0.1	0.1

Ignoring any discounting for time value of money, determine the following:

   i.   The optimal number of units of spare part on the basis
      1. Minimax principle
      2. Minimum principle
      3. Laplace principle
      4. Expected cost principle

  ii.   The expected number of failures in the 8-year period.
 iii.   The regret table, and the optimal choice based on least expected regret criterion.
 iv.   Calculate EVPI.