UNIVERSITY OF KELANIYA – SRI LANKA
FACULTY OF SCIENCE

Bachelor of Science External Degree Examination –January 2026
2023 Intake – Semester I

Statistics

STAT 26522– Optimization II

No. of Questions: **Four (04)**   No. of Pages: **Three (03)**   Time: **Two (02) hrs.**

Answer **all** questions

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1. (a) Define what is meant by 'a transportation model' and 'a balanced transportation model' in the context of operational research.

    (b) Formulate a general transportation problem as a linear programming model to minimize the total transportation cost. Clearly define all variables, parameters, the objective function, and constraints.

    (c) A company has factories in cities, F1 F2, and F3 which supply goods to warehouses, W1, W2, W3 and W4 in different cities. Weekly factories' capacities are 250, 300, and 400 respectively. Weekly warehouses requirements are 200, 225, 275 and 250 units respectively. Unit shipping costs in Dollars are given in the below table:

	W1	W2	W3	W4
F1	11	13	17	14
F2	16	18	14	10
F3	21	24	13	10

    (i). Find the starting feasible solution to the above problem using Least Cost method.
    (ii). Considering the solution obtained in (c) (i), as the starting feasible solution, find the optimal solution to the above problem using simplex multipliers method.

2. (a) Compare the Assignment Problem with the Transportation Problem by listing three key characteristics of the Assignment Problem.

    (b) A department head has four assistants, and four tasks have to be performed. Assistants differ in efficiency and tasks differ in their intrinsic difficulty. Time in hours each assistant would take to perform each task is given in the following effectiveness matrix.

Task \ Assistant	T1	T2	T3	T4
A1	16	26	17	11
A2	23	28	14	26
A3	38	19	16	15
A4	19	26	24	10

(i) How should the tasks be allocated to each assistant in order to minimize the total man-hours? Clearly state the steps of the algorithm used.

(ii) What will be the total man-hours corresponding to the optimal assignment?

3. *(a)* Define the following terms used in network optimization:
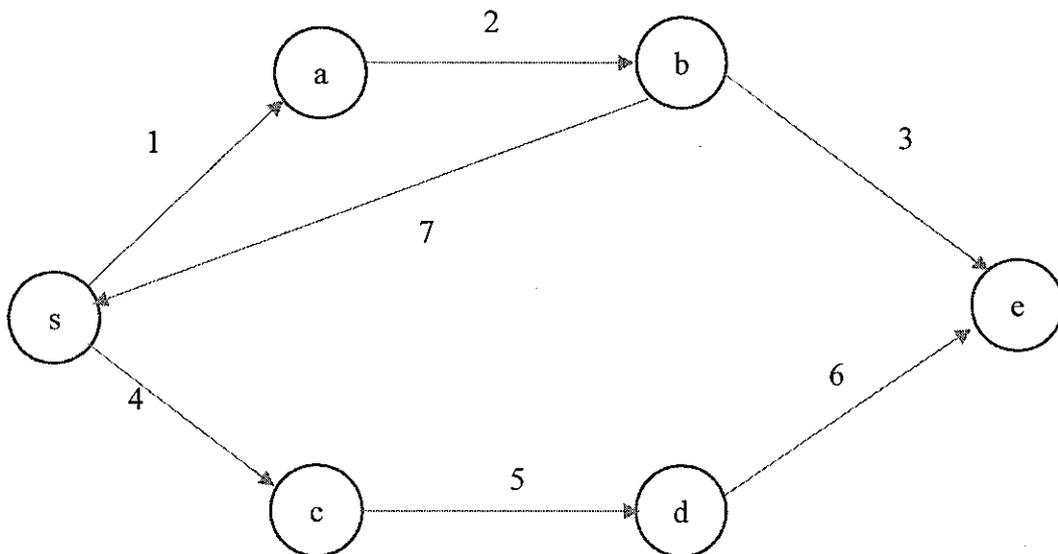
   (i). Tree.
   (ii). Spanning tree.
   *(iii).* Path.
   (iv). Cycle.

   (b) Write the main difference between the Floyd Algorithm and the Dijkstra Algorithm used for finding the shortest path in a network.

   (c) Consider the following network:

Find the shortest path from node s to node e using the Floyd Algorithm.

4. The national disaster management authority is coordinating the distribution of emergency medical supplies after a natural disaster. The distribution network is given below:
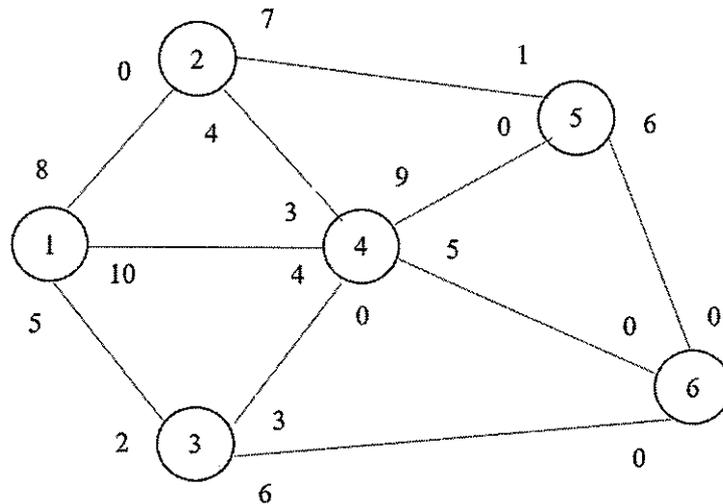
Node 1 - Central Medical Warehouse
Node 6 - Main Disaster Relief Hospital
Nodes 2, 3, 4, and 5 - Intermediate Regional Distribution Centers

Each connection between two nodes represents a transport route (road or rail). The number written on each branch indicates the maximum number of supply units that can be transported per day along that route due to vehicle availability, road conditions, and fuel limitations. Using the given network and the flow capacities of each transport route, determine the maximum number of medical supply units that can be delivered per day from the central warehouse to the disaster relief hospital.

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