

Seminar 5:

Transportation and assignment problem, traveling salesman problem

Problem 1: Consider the transportation problem having 4 suppliers and 3 customers with unit costs of transport given by the following parameter table:

| | S1 | S2 | S3 | S4 | request |
|----------|-----|----|----|-----|---------|
| C1 | 11 | 11 | 7 | 12 | 50 |
| C2 | 6 | 9 | 6 | 10 | 200 |
| C3 | 5 | 8 | 11 | 10 | 150 |
| capacity | 120 | 90 | 70 | 120 | |

- Formulate mathematical model for this transportation problem
- Introduce a dummy line to balance the problem if necessary.
- Use the northwest corner rule to construct an initial basic feasible solution.
- Starting with the initial basic solution from part (b), interactively apply the transportation simplex method (MODI) to obtain an optimal solution.
- Check the solution using Excel Solver

Problem 2: (modified from Hillier and Lieberman, 8.3-2.) Four cargo ships will be used for shipping goods from one port to four other ports (labeled 1, 2, 3, 4). Any ship can be used for making any one of these four trips. However, because of differences in the ships and cargoes, the total cost of loading, transporting, and unloading the goods for the different ship-port combinations varies considerably, as shown in the following table:

| | Port | | | |
|------|-------|-------|-------|-------|
| Ship | 1 | 2 | 3 | 4 |
| A | \$500 | \$400 | \$600 | \$700 |
| B | \$600 | \$300 | \$700 | \$500 |
| C | \$700 | \$500 | \$800 | \$600 |
| D | \$600 | \$400 | \$700 | \$600 |

The objective is to assign the four ships to four different ports in such a way as to minimize the total cost for all four shipments.

- a) Formulate mathematical model for this assignment problem
- b) Obtain an optimal solution using Hungarian method.
- c) Check the optimality of the solution using Excel Solver

Problem 3: The Financial Office recruits candidates for positions of heads of the three departments, requiring different skills and knowledge. Five candidates were selected for the assessment center where their competence for individual jobs has been tested. The results are shown in the table (the highest possible score was 30 points).

| | Applicant | | | | |
|------------|-----------|----|----|----|----|
| Department | A | B | C | D | E |
| D_1 | 25 | 27 | 24 | 27 | 28 |
| D_2 | 28 | 23 | 25 | 24 | 27 |
| D_3 | 22 | 21 | 23 | 20 | 24 |

Introduce dummy lines to balance the problem if necessary and use the Hungarian method to assign the candidates to appropriate positions so that their competence for work in the individual departments is as high as possible. (Maximization problem!)

Problem 4: Traveling salesman living in the city A has to visit places B, C, D, E and come back to A. The distance table is given below.

| | A | B | C | D | E |
|---|----|----|----|----|----|
| A | X | 50 | 70 | 40 | 60 |
| B | 50 | X | 40 | 30 | 80 |
| C | 70 | 40 | X | 40 | 60 |
| D | 40 | 30 | 40 | X | 50 |
| E | 60 | 80 | 60 | 50 | X |

In what order should he visit the cities so as the total length of the round-trip is minimal? Use the closest neighbor method.