OPERATIONAL ANALYSIS FOR ECONOMISTS –EXAMPLE TEST

Name:

Total points: Mark:

1. **Yes or No? [6 p.]**
   1. Dual problem of a dual problem is a primal problem.
   2. Linear programming is a special case of a mathematical programming.
   3. The north-west method always gives an optimal solution to a transportation problem.
2. **Fill in the gaps ……. [6 p.]:**
   1. The worst initial solution of a transportation problem is given by …………….
   2. If both the primal and the dual problem has a finite optimal solution, then optimal objective functions are …………………….
   3. In the case of the exceed of supply, the transportation problem can be balanced using …………………...
3. **Draw [8 p.]:**
   1. Minimal spanning tree containing 3 nodes with total value of the tree 5 units
   2. Complete graph containing 5 nodes
   3. Plane graph with 5 nodes
   4. Graph with 5 nodes with the maximal flaw of 5 units
   5. Multigraph with 3 nodes
4. **For the next transportation problem:**

**Capacities of sources:**

|  |  |
| --- | --- |
| Source 1 | 350 |
| Source 2 | 50 |
| Source 3 | 380 |
| Source 4 | 250 |

**Demands of destinations:**

|  |  |
| --- | --- |
| Destination 1 | 230 |
| Destination 2 | 260 |
| Destination 3 | 410 |
| Destination 4 | 130 |

**Unit costs:**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Destination 1 | Destination 2 | Destination 3 | Destination 4 |
| Source 1 | 10 | 12 | 20 | 17 |
| Source 2 | 17 | 46 | 21 | 15 |
| Source 3 | 55 | 20 | 15 | 84 |
| Source 4 | 65 | 54 | 13 | 12 |

**Find the minimal total transportation cost. (10 p.)**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | Destination 1 | Destination 2 | Destination 3 | Destination 4 |  |
| Source 1 |  |  |  |  | 350 |
| Source 2 |  |  |  |  | 50 |
| Source 3 |  |  |  |  | 380 |
| Source 4 |  |  |  |  | 250 |
|  | 230 | 260 | 410 | 130 |  |

**Transportation costs:**

**5. In the graph, find the minimal spanning tree** **(9 p.)**

9

8

6

12

5

9

11

17

19

13

**6** Producer of tea mixtures is producing three kinds of tea mixtures from Chinese, Ceylon and Indian teas. In table, there are set capacities of available teas, the ratio of components needed to produce a mixture and profits for 1 ton of mixture.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Mixture 1 | Mixture 2 | Mixture 3 | Capacity (t) |
| Chinese tea | 0,4 | 0,1 | 0 | 160 |
| Ceylon tea | --- | 0,5 | 0,3 | 90 |
| Indian tea | 0,6 | 0,4 | 0,7 | 200 |
| Profit (Euro/t) | 12000 | 8000 | 9000 |  |

1. Write down the mathematical model maximizing the firm’s profit (optimal production program). **(5 p.)**

2. Solve the problem using MS Excel program (4 p.)

Solution:

4.Write down one impossible solution. **(1 p.)**

5. Write down the dual problem of the model **(5p.)**

.6 Solve the dual problem using MS Excel program (4 p.)

Solution:

7. Write down the stability intervals for Chinese, Ceylon and Indian tea. (6 p.)

8.Is vector (20000,30000,40000) feasible solution to the dual problem? (2 p.)

9. Is vector (80,120,50) a feasible solution to the primal problem? (2 p.)

10. Write down the profit corresponding to a vector (50,40,30). (1 p.)