**EASTERN MEDITERRANEAN UNIVERSITY**

 **Department of Industrial Engineering**

**IENG516 Network Flows**

**HOMEWORK 4 Spring 2016-17**

1. Consider the transportation problem corresponding to the following tableau:

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | 1 | 2 | 3 | 4 | *si* |
| 1 | 5 | 2 | 6 | 5 | 25 |
| 2 | 7 | 12 | 5 | 6 | 30 |
| 3 | 8 | 9 | 7 | 8 | 50 |
| *dj* | 17 | 38 | 20 | 30 |  |

1. Solve the problem by the transportation algorithm.
2. Find the simplex tableau associated with optimal tableau.
3. Suppose that c24 is replaced by 2. Without resolving the problem, find a new optimal solution.
4. How large should c12 be made before some optimality condition of the solution in Part (a) is violated?
5. The following is a transportation tableau:

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | 1 | 2 | 3 | 4 | *si* |
| 1 | 9 |  | 7 |  | 12 |  | 8 |  | 18 |
|  | 4 |  | 14 |  |  |  |  |
| 2 | 15 |  | 12 |  | 12 |  | 15 |  | 4 |
|  |  |  |  |  | 4 |  |  |
| 3 | 8 |  | 9 |  | 6 |  | 12 |  | 6 |
|  | 2 |  |  |  | 4 |  |  |
| 4 | 14 |  | 12 |  | 11 |  | 12 |  | 12 |
|  |  |  |  |  | 7 |  | 5  |
| *dj* | 6 | 14 | 15 | 5 |  |

1. Is the solution is basic?
2. Show the solution is optimal?
3. Dose this problem have alternative optimal solutions?
4. Give the original linear programming problem and its dual.
5. Compute the optimal solution to the dual problem.
6. Add 10 to each *cij* . Applying the cycle method, Is the tableau still optimal?
7. Multiply each *cij* by 10. Applying the cycle method, Is the tableau still optimal?
8. Consider the following data for a transportation problem:

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | 1 | 2 | 3 | 4 | *si* |
| 1 | 14 | 87 | 48 | 27 | 71 |
| 2 | 52 | 35 | 21 | 81 | 47 |
| 3 | 99 | 20 | 71 | 63 | 95 |
| *dj* | 71 | 35 | 47 | 60 |  |

1. Indicate a starting basic feasible solution by minimum cost method.
2. Find an optimal solution. Draw the related basis tree.
3. Construct the simplex tableau associated with the optimal basic feasible solution.
4. Show that if we define



then by a proper choice of  we can totally avoid degeneracy in the transportation problem (and maintain an equivalent problem).

1. Show that the polyhedral of assignment problem is bounded and the number of its extreme points is *m!*.
2. Find the degree of degeneracy for each basic feasible solution of assignment problem, and show that every basic feasible solution has *(2m-1)(mm-2)* bases representing it.
3. Show how one can construct the simplex tableau associated with the optimal assignment matrix.
4. Apply the Hungarian method to the following assignment problem.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | 1 | 2 | 3 | 4 | 5 |
| 1 | 2 | 6 | 4 | -1 | 3 |
| 2 | 1 | 5 | 4 | 4 | 6 |
| 3 | 0 | 2 | 5 | 1 | 5 |
| 4 | 4 | 1 | 3 | 2 | 5 |
| 5 | 6 | 2 | 5 | 2 | 5 |