**EASTERN MEDITERRANEAN UNIVERSITY**



**Department of Industrial Engineering**

**IENG511 Optimization Theory**

**HOMEWORK 5 Spring 2017-18**

1. The starting and current tableaux of a given problem are shown. Find the values of unknowns *a* through *l.*

Starting Tableau

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| *Z* | *x1* | *x2* | *x3* | *x4* | *x5* | *x6* | *RHS* |
| *1* | *a* | *-1* | *4* | *0* | *0* | *0* | *0* |
| *0* | *b* | *1* | *d* | *1* | *0* | *0* | *9* |
| *0* | *1* | *1* | *e* | *0* | *1* | *0* | *2* |
| *0* | *c* | *1* | *1* | *0* | *0* | *1* | *4* |

Current Tableau

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| *Z* | *x1* | *x2* | *x3* | *x4* | *x5* | *x6* | *RHS* |
| *1* | *f* | *-4* | *0* | *j* | *0* | *-2* | *k* |
| *0* | *g* | *h* | *0* |  | *0* |  |  |
| *0* | *0* | *2* | *0* | *0* | *1* | *1* | *6* |
| *0* | *0* | *i* | *1* |  | *0* |  | *l* |

1. The following is the optimal simplex tableau of a given minimization linear programming problem. The objective is *2x1* + *3x2*+ *4x3, x4* and *x5* are the slack variables. The constraints are greater or equal type and all of the variables are non-negative.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | *z* | *x1* | *x2* | *x3* | *x4* | *x5* | *RHS* |
| *Z* | *1* | *a* | *0* | *d* | *e* |  |  |
| *x2* | *0* | *b* | *1* |  |  |  |  |
| *x1* | *0* | *c* | *0* |  |  |  | *f* |

a) Find the value of the unknowns *a* through f in the tableau.

b) Find B.

c) Find original problem.

1. Show that in the simplex method if a variable leaves the basis, it cannot enter the basis in the next iteration.
2. Solve the following LP by the two-phase simplex method.



1. Solve the following LP by the Big-M method.



1. Write the KKT optimality condition for a minimization linear programming problem in its standard format.
2. In Two-phase method if at the end of the phase I, , what can say for original problem.
3. Assume that in Big-M Method the problem P(M) has an unbounded optimal solution that is . What we can say about problem P (original problem)?
4. Let and ***c=****(-1,4 ).*Which of the following two system has a solution?

System 1: 

System 2: 

1. Consider the following LP,



Use K.K.T optimality conditions to show that *X\*=()* is the optimal solution.

1. Consider the following problem.



1. Write the dual problem and find the optimal solution of dual problem.
2. Find optimal solution of primal problem. *(Hint: Use the complementary slackness conditions)*
3. The following simplex tableau shows the optimal solution of a linear programming problem. It is known that *x4* and *x5* are slack variables in the first and second constraints of the original problem. The constraints are of the  type.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | *z* | *x1* | *x2* | *x3* | *x4* | *x5* | *RHS* |
| *z* | *1* | *0* | *-2* | *0* | *-3* | *-2* | *-40* |
| *x3* | *0* | *0* |  | *1* |  | *0* |  |
| *x1* | *0* | *1* |  | *0* |  |  |  |

1. Write the original problem.
2. What is the dual of the original problem?
3. Obtain the optimal solution of the dual problem from the tableau.