

SFWR ENG 3003 / COMP SCI 4003 (6003)
Linear Optimization

Problem Set 2 – 22 points

Posted: October 9, 2018 / Due date: November 6, 2018

** JUSTIFY YOUR ANSWERS **

1. While solving an LP *maximization* problem we obtain the following tableau. The basic variables are x_1 , x_3 , and x_5 .

$-z$	x_1	x_2	x_3	x_4	x_5	x_6	
1	0	c	0	a	0	b	$= -12$
0	0	e	0	-2	1	2	$= 6$
0	1	-7	0	-6	0	4	$= 9$
0	0	d	1	3	0	0	$= 5$

Give conditions on the parameters a , b , c , d and e required to make each of the following statements true:

1.1 The current tableau is optimal. **2p**

1.2 The current basic solution is feasible, but the objective function value can be improved by bringing x_2 into the basis and pivoting x_3 out. **2p**

1.3 The problem is unbounded. **2p**

2. Consider the following LP problem:

$$\begin{aligned} \max \quad & z = x_1 + 2x_2 + 3x_3 \\ & x_1 + x_2 + x_3 \leq 16 \\ & 3x_1 + 2x_2 + 2x_3 = 26 \\ & x_1 + x_3 \geq 10 \\ & x_1, x_2, x_3 \geq 0 \end{aligned}$$

2.1 Convert the problem to standard form. **2p**

2.2 Form the Phase One problem from the linear program you formulated in **2.1**. **2p**

2.3 Solve the Phase One problem using tableaus. For each iteration indicate the entering and leaving variables. **3p**

2.4 Does the original LP problem have an initial feasible solution? If so, solve the Phase Two part of the problem using the simplex method. For each iteration write out the tableau and indicate the pivot element. **3p**

3. Consider the following knapsack problem:

$$\begin{aligned} \max \quad & 4x_1 + 9x_2 + 7x_3 + 6x_4 + 13x_5 \\ & 5x_1 + 6x_2 + 4x_3 + 3x_4 + 7x_5 \leq 11 \end{aligned}$$

3.1 Solve the problem for $x_i \in \{0, 1\}$.

3p

3.2 Solve the problem for $x_i \in Z_+$ (non-negative integers: 0, 1, 2, 3,...).

3p

- Your solution must reach your instructor or the TA by or before the due date.
- You, or your reliable friend must give your work to the TA hand-to-hand or deliver at class to your instructor.
- You have to sign your assignment; your signature certifies that the assignment is **your** work.
- If you use some software to reach a solution, explain how and print the code you write (if any).