

## 國立台灣科技大學九十六學年度碩士班招生試題

系所組別：工業管理系碩士班甲組

科目：作業研究

Total 100 Points. Show all your calculations. Each problem is 25 points.

1. Consider the following Linear programming problem:

$$\text{Maximize } z = 7x_1 + 3x_2 + 2x_3$$

Subject to

$$4x_1 + x_2 + x_3 \leq 18$$

$$3x_1 + 2x_2 + x_3 \leq 14$$

$$x_1, x_2, x_3 \geq 0$$

Let the slack variables for the respective constraints be denoted by  $x_4$  and  $x_5$ . The tableau of the following table represents the current basic solution.

	$z$	$x_1$	$x_2$	$x_3$	$x_4$	$x_5$	RHS
$z$	1	$a_1$	$a_4$	$a_7$	1	1	$a_{10}$
$x_1$	0	$a_2$	$a_5$	$a_8$	1	-1	$a_{11}$
$x_3$	0	$a_3$	$a_6$	$a_9$	-3	4	$a_{12}$

- (a) Determine the values of the missing entries ( $a_1$  to  $a_{12}$ ) in the tableau. (12 pts)  
 (b) Is the tableau optimal? Give brief reasons. (7 pts)  
 (c) Is the optimal solution unique? Give brief reasons. (6 pts)
2. Construct the shortest-path network for the following production lot size problem with set-up cost to 50 (same in all periods).

Period	1	2	3	4
Demand	1000	500	2000	100
Unit Cost	12	14	9	20
Holding Cost	3	2	3	4

- (a) Draw the shortest-path network for this problem. (15 pts)  
 (b) Find the shortest path and the minimal cost. (10 pts)
3. Erica is going to fly to London on August 5 and return home on August 20. It is now July 1. On July 1, she may buy a one-way ticket (for \$350) or a round-trip ticket (for \$660). She may also wait until August 1 to buy a ticket. On August 1, a one-way ticket will cost \$370, and a round-trip ticket will cost \$730. It is possible that between July 1 and August 1, her sister (who works for the airline) will be able to obtain a free one-way ticket for Erica. The probability that her sister will obtain the free ticket is 0.30. If Erica has bought a round-trip ticket on July 1 and her sister has obtained a free ticket, she may return "half" of her round-trip to the airline. In this case, her total cost will be \$330 plus a \$50 penalty. Use a decision tree approach to determine how to minimize Erica's expected cost of obtaining round-trip transportation to London. (25 pts)
4. The Industrial Management Department is trying to determine whether to rent a slow or a fast copier. The department believes that an employee's time is worth \$15 per hour. The slow copier rents for \$4 per hour and it takes an employee an average of 10 minutes to complete copying (exponentially distributed). The fast copier rents for \$15 per hour and it takes an employee an average of 6 minutes to complete copying. An average of 4 employees per hour need to use the copying machine (interarrival times are exponential). Which machine should the department rent? (25 pts)