

國立臺北科技大學九十七學年度碩士班招生考試

系所組別：4112 工業工程與管理系碩士班甲組

第二節 作業研究 試題

填准考證號碼

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第一頁 共二頁

注意事項：

1. 本試題共 5 題，配分共 100 分。
2. 請標明大題、子題編號作答，不必抄題。
3. 全部答案均須在答案卷之答案欄內作答，否則不予計分。

[本題 15 分]

1. Consider the following linear programming (minimization) tableau:

| | x_1 | x_2 | x_3 | x_4 | x_5 | Right Hand Side |
|-------|-------|-------|-------|-------|-------|-----------------|
| Z | a | -2 | 0 | 0 | 0 | -10 |
| x_3 | -1 | b | 1 | 0 | 0 | 4 |
| x_4 | c | -4 | 0 | 1 | 0 | 1 |
| x_5 | d | 3 | 0 | 0 | 1 | e |

Under what values of a,b,c,d,e could the following conditions occur? Give values (e.g. <0 , \geq , arbitrary, etc.) for all.

- (1) The tableau is optimal.
- (2) The solution is unbounded.
- (3) The current solution is infeasible.
- (4) No feasible solutions exist.
- (5) The solution is degenerate.

[本題 15 分]

2. Consider the following linear programming(LP):

$$\begin{aligned} &\text{Minimize } cx \\ &\text{s.t. } Ax = b \\ &\text{and } x \geq 0 \end{aligned}$$

For each question, answer "true" or "false" and give explanation:

- (1) If LP has a finite optimal solution, its constraint set is bounded.
- (2) During Phase 1, an artificial variable will never be chosen as the entering variable.
- (3) LP has a solution if and only if $\text{rank}(A, b) \leq \text{rank } A$.
- (4) Each iteration of the simplex procedure generates a new solution.
- (5) Each iteration of the simplex procedure generates an improved solution.

[本題 25 分]

3. Consider the following problem.

$$\begin{aligned} &\text{Maximize } Z = 2x_1 + 4x_2 + 3x_3, \\ &\text{s.t.} \\ &x_1 + 3x_2 + 2x_3 = 20 \\ &x_1 + 5x_2 \geq 10 \\ &\text{and } x_1 \geq 0, \quad x_2 \geq 0, \quad x_3 \geq 0. \end{aligned}$$

Let \bar{x}_4 be the artificial variable for the first constraint. Let x_5 and \bar{x}_6 be the surplus variable and artificial variable, respectively, for the second constraint.

You are now given the information that a portion of the final simplex tableau is as follows:

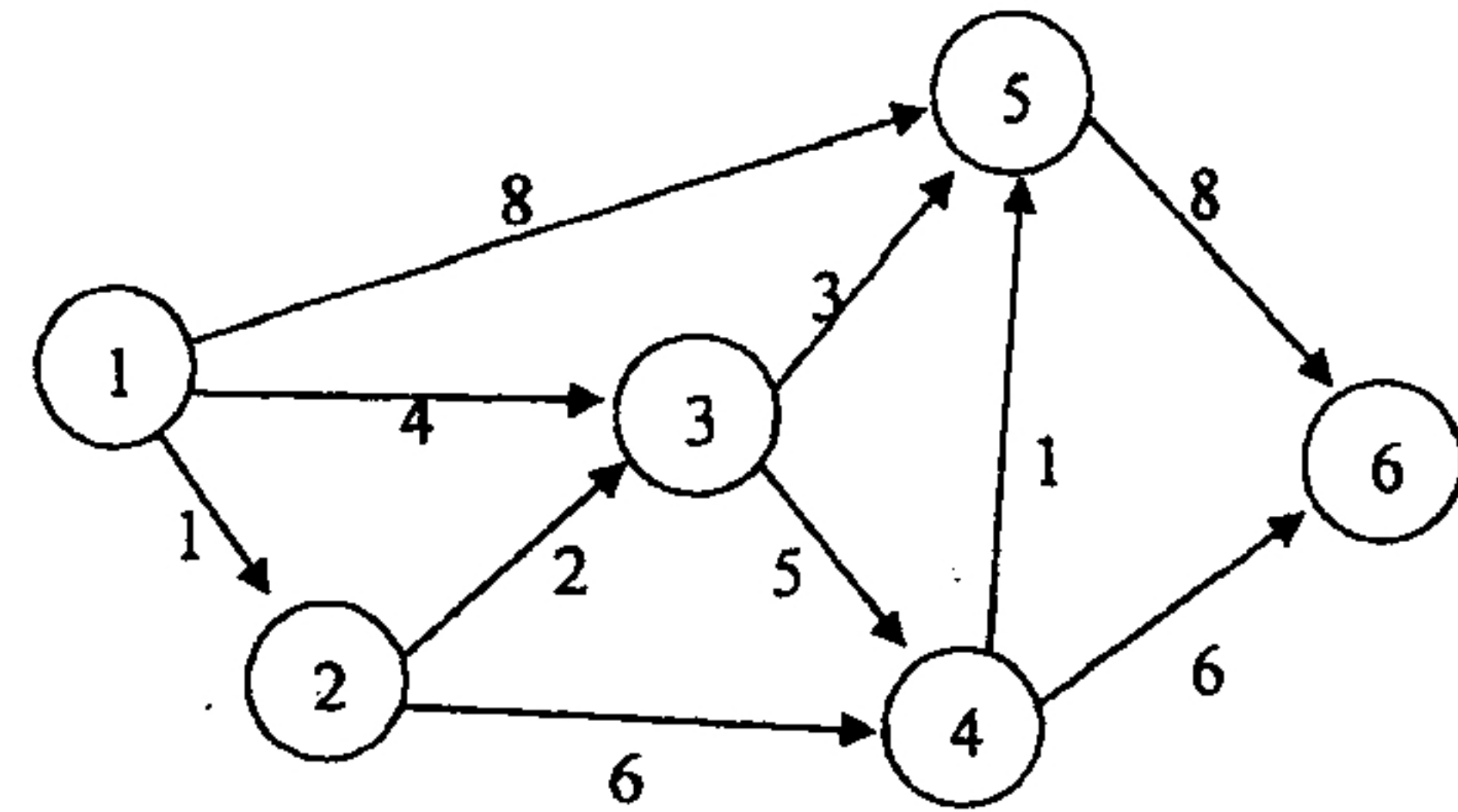
| | x_1 | x_2 | x_3 | \bar{x}_4 | x_5 | \bar{x}_6 | Right Hand Side |
|-------|-------|-------|-------|-------------|-------|-------------|-----------------|
| Z | | | | M+2 | 0 | M | |
| x_1 | | | | 1 | 0 | 0 | |
| x_5 | | | | 1 | 1 | -1 | |

Use the revised simplex method to find the missing numbers in the final simplex tableau. Show your calculations.

注意：背面尚有試題

[本題 25 分]

4. Consider the directed network where the number on each arc is the distance between two nodes. Use dynamic programming to find the shortest path and its distance from node 1 to node 6.



[本題 20 分]

5. Customers arrive at an ice cream store with one server according to a Poisson process at a mean rate of 30 per hour. The server has resigned. Two candidates, X (fast but expensive) and Y (slow but inexpensive), are applying for the job. Both candidates would have an exponential distribution for service times with X having a mean of one minute and Y having a mean of 1.5 minutes. Restaurant revenue per month is given by $\$6,000/W$ where W is the expected waiting time (in minutes) of a customer in the system. Determine the upper bound on the difference in their monthly compensations that would justify hiring X rather than Y .