# 元智大學 107 學年度 碩士班 招生試題卷

系(所)別：工業工程與管理學系碩士班　組別：不分組　科目：作業研究　

●不可使用電子計算機

1. Consider the following linear programming problem.

Maximize $z = 5x_1 + x_2$

Subject to

$$x_1 - x_2 \leq 9$$
$$-x_1 - x_2 \leq 2$$
$$x_1 + x_2 \leq 7$$
$$x_1 \geq 0$$
$x_2$ unrestricted

(a) Solve this problem graphically. (13%)

(b) Transform the problem so that all variables are nonnegative and solve resulting problem by the simplex algorithm. (12%)

2. Consider the cost matrix in the following table for a transportation problem in which the objective is to minimize cost.

| Source | Destination | | | Supply |
|---|---|---|---|---|
| | 1 | 2 | 3 | |
| 1 | $8 | $5 | $4 | 40 |
| 2 | $6 | $8 | $9 | 40 |
| Demand | 30 | 20 | 30 | |

(a) Write down the linear programming formulation for this problem. (9%)

(b) Set up the transportation tableau and use the northwest corner rule to find an initial basic feasible solution. (8%)

(c) Beginning with the initial solution found in part (b), solve the problem using the transportation simplex method. (8%)

3. For the one-step transition probability matrix of the following Markov Chain (1~6 are the states), try to answer the following problems.

| | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|
| 1 | 0.3 | 0.2 | 0.0 | 0.5 | 0.0 | 0.0 |
| 2 | 0.2 | 0.4 | 0.0 | 0.4 | 0.0 | 0.0 |
| 3 | 0.0 | 0.0 | 1.0 | 0.0 | 0.0 | 0.0 |
| 4 | 0.5 | 0.2 | 0.0 | 0.3 | 0.0 | 0.0 |
| 5 | 0.0 | 0.0 | 0.3 | 0.3 | 0.2 | 0.2 |
| 6 | 0.0 | 0.0 | 0.0 | 0.0 | 0.5 | 0.5 |

(a) Draw the transition probability diagram. (13%)

(b) Which states are transient? (4%) Which states are recurrent? (4%) Which states are absorbing? (4%)

4. Peter is the coach of a university basketball team. He is trying to choose the starting lineup for the basketball team. The team consists of seven players who have been rated (on a scale of 1=poor to 3=excellent) according to their ball-handling, shooting, rebounding, and defensive abilities. The positions (G= guard, F=forward, C=center) that each player is allowed to play and the player's abilities are listed in the following Table.

| Player | Position | Ball-Handling | Shooting | Rebounding | Defense |
|---|---|---|---|---|---|
| 1 | G | 3 | 3 | 1 | 3 |
| 2 | G-C | 2 | 1 | 3 | 2 |
| 3 | G-F | 2 | 3 | 1 | 2 |
| 4 | F-C | 1 | 3 | 2 | 1 |
| 5 | G | 3 | 3 | 2 | 3 |
| 6 | F | 3 | 1 | 2 | 3 |
| 7 | G-F | 3 | 2 | 2 | 1 |

The five-player starting lineup must satisfy the following restrictions:

(1) At least 4 members must be able to play guard, at least 2 members must be able to play forward, and at least 1 member must be able to play center.

(2) The average rebounding level of the starting lineup must be at least 2.

(3) If player 3 starts, then player 6 cannot start.

(4) If player 1 starts, then players 4 must start.

Given these constraints, Peter wants to maximize the total defensive ability of the starting team. Formulate an IP that will help him choose his starting team. (25%)