

# 國立臺北科技大學 101 學年度碩士班招生考試

系所組別：4120 工業工程與管理系碩士班乙組

## 第二節 作業研究 試題

第一頁 共一頁

### 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。

1. Please use parametric programming to show the optimal solutions associated with the range of  $t$  for the following linear programming problem. 15%

$$\text{Maximize } z = x_1 + 4x_2 + t(x_1 - x_2)$$

$$\text{s.t. } 2x_1 + x_2 \leq 10, x_1 + x_2 \leq 6, x_2 \leq 4, x_1, x_2 \geq 0.$$

2. Finco Investment Corporation must determine investment strategy for the firm during the next three years. At present (time 0), \$100,000 is available for the investment. Investments A, B, C, D, and E are available. The cash flow associated with investment \$1 in each is given in the following table. For example, \$1 invested in investment B required a \$1 cash outflow at time 1 and returns 50¢ at time 2 and \$1 at time 3. To insure that the company's portfolio is diversified, Finco requires that at most \$75,000 be placed in any single investment. In addition to investments A-E, Finco can earn interest at 8% per year by keeping uninvested cash in money market funds. Returns from investments can be immediately reinvested. For example, the positive cash flow received from investment C at time 1 may immediately be invested in investment B. Finco cannot borrow funds, so the cash available for investment at any time is limited to cash on hand. Please formulate an LP that will maximize cash on hand at time 3 (Don't have to solve it). 10%

Cash flow at time

	Time 0 (present)	Time 1	Time 2	Time 3
A	-\$1	+\$0.5	+\$1	\$0
B	\$0	-\$1	+\$0.5	+\$1
C	-\$1	+\$1.2	\$0	\$0
D	-\$1	\$0	\$0	+\$1.9
E	\$0	\$0	-\$1	+\$1.5

3. Finco has \$6,000 to invest, and three investments are available. If  $d_j$  dollars (in thousands) are invested in investment  $j$ , then a net present value (in thousands) of  $r_j(d_j)$  is obtained, where the  $r_j(d_j)$ 's are as follows:

$$r_1(d_1) = 7d_1 + 2$$

$$r_2(d_2) = 3d_2 + 7$$

$$r_3(d_3) = 4d_3 + 5$$

$$r_1(d_0) = r_2(d_0) = r_3(d_0) = 0 \text{ and } d_1, d_2, d_3 > 0.$$

The amount placed in each investment must be an exact multiple of \$1,000. To maximize the net present value obtained from the investments, please use dynamic programming to determine how Finco should allocate the \$6,000. 25%

4. Four jobs must be processed on a single machine. The time required to process each job and the data the job is due are shown in the following table. The delay of a job is the number of days after the due day that a job is completed (if a job is completed on time or early, the job's delay is zero). Please use branch-and-bound approach to determine in what order the jobs should be processed to minimize the total delay of the four jobs. 25%

	Time Required to Complete Jobs (in days)	Due Date
Job 1	6 days to complete	End of day 8
Job 2	4	End of day 4
Job 3	5	End of day 12
Job 4	8	End of day 16

5. The Police Department has 5 patrol cars. A patrol car breaks down and requires service once every 30 days. The police department has two repair workers, each of whom takes an average of 3 days to repair a car. Breakdown times and repair time are exponential.
  - (a) Determine the average number of police cars in good condition. 13%
  - (b) Find the fraction of the time a particular repair worker is idle. 12%