

國立勤益技術學院九十二學年度研究所招生初試試題卷

所別：生產系統工程與管理

組別：產業決策資訊

身分別：一般生

科目：作業研究

准考證號碼：

(考生自填)

考生注意事項：

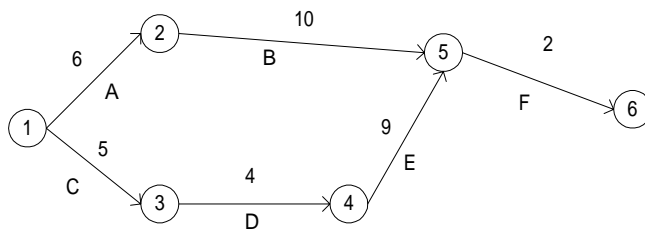
- 一、考試時間 100 分鐘
- 二、不得帶計算機

試題：

(一) A service station has one gasoline pump. Cars wanting gasoline arrive according to a Poisson process at a mean rate of 15 per hour. However, if the pump already is being used, these potential customers may balk (drive to another service station). In particular, if there are n cars already at the service station, the probability that an arriving potential customer will balk is $n/3$ for $n=1,2,3$. The time required to service a car has an exponential distribution with a mean of 4 minutes.

- (a) Construct the rate diagram for this queueing system.(5%)
- (b) Develop the balance equations.(5%)
- (c) Solve these equations to find the steady-state probability distribution of the number of cars at the station.(5%)
- (d) Find the expected waiting time (including service) for those cars that stay.(5%)

(二)、下列為一 PERT 資料，數字為期望作業時間，字母為作業名稱。



- (a)、要徑為何？，期望完工時間為何？(需列出計算過程)(10%)
- (b)、若以線性規劃(LP)處理，請寫出其線性規劃模式(無需求解)。(10%)

(三) Consider the transportation problem with the tableau below: (each 2 points, total 20 points)

| | | destinations | | | supply |
|---------|---|--------------|---|----|--------|
| | | 1 | 2 | 3 | |
| sources | 1 | 5 | | | 5 |
| | 2 | | | | 18 |
| | 3 | | | | 7 |
| demand | | 10 | 5 | 15 | |

- How many basic variables will this problem have? ____
- An initial basic feasible solution is found using the "Northwest Corner Method"; complete the computation (excluding x_{11}) $x_{21} = \underline{\hspace{1cm}}$, $x_{22} = \underline{\hspace{1cm}}$, $x_{23} = \underline{\hspace{1cm}}$, $x_{33} = \underline{\hspace{1cm}}$.
- If u_1 (the dual variable for the first source) is equal to 0, what is the value of
 - u_2 (the dual variable for the second source)? ____
 - v_1 (the dual variable for the first destination)? ____
 - v_2 (the dual variable for the second destination)? ____
- Will increasing x_{12} improve the objective function? ____ (yes/no).
- Regardless of whether the answer to (d) is "yes" or "no", what will be the value of x_{12} if it is entered into the solution? ____

(四) You have been assigned to arrange the songs on the cassette version of Madonna's latest album. A cassette tape has two sides (#1 and #2). The length and type of each song are given in the table below (Each 4 points, total 20 points):

:

| Song | Type | Length (minutes) |
|------|------------------------|------------------|
| 1 | Ballad | 4 |
| 2 | Hit | 5 |
| 3 | Ballad | 3 |
| 4 | Ballad & hit | 2 |
| 5 | Ballad | 4 |
| 6 | Hit | 3 |
| 7 | neither ballad nor hit | 5 |
| 8 | Ballad & hit | 4 |

Define the variables $y_i =$ $\begin{cases} 1 & \text{if song } \#i \text{ is on side 1;} \\ 0 & \text{otherwise (i.e., if on side 2)} \end{cases}$

Thus, $1 - y_i =$ $\begin{cases} 1 & \text{if song } \#i \text{ is on side 2;} \\ 0 & \text{otherwise (i.e., if on side 1)} \end{cases}$

For each restriction, choose a linear constraint from the list (a) through (i) below.

- ___ 1. Side #2 must have at least 3 ballads
 ___ 2. Side #1 must have at least 2 hit songs
 ___ 3. If song #2 is on side 1, then song #3 must be on side 2
 ___ 4. The number of hit songs on side 2 should be no more than 2
 ___ 5. If both songs 1 & 2 are on side 1, then song 3 must be on side 2.
- a. $y_2+y_4+y_6+y_8 \geq 3$ b. $y_2+y_4+y_6+y_8 \leq 2$ c. $y_2+y_4+y_6+y_8 \geq 2$ d. $y_2+y_3 \leq 1$
 e. $y_1+y_2-y_3 \leq 2$ f. $y_1+y_2+y_3 \leq 2$ g. $y_1+y_3+y_4+y_5+y_8 \leq 2$ h. $y_2+y_3 \geq 1$
 i. $y_1+y_2-y_3 \geq 2$ j. $y_1+y_2+y_3 \leq 1$ k. $y_1+y_3+y_4+y_5+y_8 \leq 3$ l. *None of the above*

(五) A company is developing a replacement plan for its car fleet for a 5-year planning horizon. At the start of each year, a decision is made as to whether a car should be kept in operation or replaced. A car must be in service at least 1 year but must be replaced after 3 years. The following table gives the replacement cost as a function of the year a car is acquired and the number of years in operation. (Each 2 points, total 20 points)

| Year acquired | Replacement cost for given years in operation | | |
|---------------|-----------------------------------------------|------|------|
| | 1 | 2 | 3 |
| 1 | 4000 | 5400 | 9800 |
| 2 | 4300 | 6200 | 8700 |
| 3 | 4800 | 7100 | - |
| 4 | 4900 | - | - |

- (a) Using nodes 1 to 5 represent years, fill the blanks next to arcs that represent the replacement costs.
 (b) The total cost of shortest path is _____.

