國立成功大學
111學年度碩士班招生考試試題

編　號：237

系　所：工業與資訊管理學系

科　目：作業研究

日　期：0220

節　次：第 2 節

備　註：可使用計算機

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※ 考生請注意：本試題可使用計算機。　請於答案卷(卡)作答，於本試題紙上作答者，不予計分。

1. (15%) Given the following small project, please answer the following questions:

Activity	Immediate Predecessor(s)	Duration
A	----	12
B	----	9
C	A	10
D	B	10
E	B	24
F	A	10
G	C	35
H	D	40
I	A	15
J	E, G, H	4
K	F, I, J	6

a. (5%) Please draw the network.

b. (10%) What is the critical path? Why?

2. (20%)An automobile manufacturer that produces sedans and SUVs (Sports Utility Vehicles). Manufacturing is organized into four departments: sheet metal stamping, engine assembly, sedan assembly, and SUV assembly. The capacity of each department is limited. The following table provides the percentages of each department's monthly capacity that would be consumed by constructing a thousand sedans or a thousand SUVs.

Department	sedan	SUV
sheet metal stamping	5%	3%
engine assembly	4%	5%
sedan assembly	3%	0%
SUV assembly	0%	6%

The marketing department estimates a profit of $3,000 per sedan produced and $2,500 per SUV produced.

a. Please formulate a linear programming problem that would maximize the profit (in thousand dollars).

b. Please solve the formulated problem from a.

c. The manager has found that the costs of increasing 1% capacity of metal stamping and increasing 1% capacity of engine assembly would cost the same. Which department the manager should invest on?

d. Please formulate the dual problem from a.

3. (15%) Consider the following mathematical programming problem:

$Maximize\ Z = 3x_1^2 + 2x_2^2 + 11x_3$

$Subject\ to$

$x_1x_2x_3 = 8$

$x_1, x_2, x_3 \geq 0\ and\ are\ integer.$

Please solve the problem by dynamic programming method.

4. The rule of a game is that one can bet any amount of money and then either wins or loses this amount of money. The probability of winning (or losing) each game is 0.5. A smart gambler proposes a strategy to guarantee winning one dollar for each series of games. The strategy is to bet one dollar for the first game. If he wins, then he will bet one dollar again. If he loses, then he will bet two dollars for the next game. At this time, if he wins, then he will start over by betting one dollar again. If he loses, then he will bet four dollars for the third game. The process of doubling the bet continues until he wins a game. Once he wins a game, this process starts over by betting one dollar again. Is this strategy going to work as the gambler expected? Answer the question by calculating (1) the expected number of games needed in each series of games to win one dollar and (2) the expected amount of money needed to win one dollar. (20%)

5. People arrive at a service station according to a Poisson process with the arrival rate of six persons per hour. The station has two servers with the same service rate of serving four customers per hour, and the service time follows an exponential distribution. The manager of this station is considering two strategies: one queue for the two servers and two independent queues for the two servers. For the latter case, switching lines is allowed for customers in either line. Which strategy do you think is better? Answer the question by comparing the expected waiting time in the system for each customer under the two strategies. You need to use the balance equation to derive P_n, the probability of having n persons in the system, first. Then calculate the expected number of persons in the system and the expected waiting time in the system for each person. (30%)