國立嘉義大學九十四學年度
運輸與物流工程研究所碩士班招生考試試題

科目：統計學　*可使用計算機*

1. A traffic engineer studying the relationship between population density and traffic accident rate in medium-sized U.S. cities collected the following data for a random sample of six cities; X is the population density of the city (number of people per unit area), and Y is the traffic accident rate (number of accidents per 100,000 people).

Accident rate (Y)	21	18	17	20	22	25
Population density (X)	58	49	48	56	72	76

Construct the equation of the estimated regression line.

a. Calculate and interpret the value of b_0 in this problem. (7%)

b. Calculate and interpret the value of b_1 in this problem. (7%)

c. Calculate and interpret the value of r^2 for this data set. (7%)

d. What can you say about the average traffic accident rate for a city with population density equal to 200? (4%)

2. Ships arrive at a port in accordance with a Poisson probability distribution. On the average there are 3 ships in port.

a. What percentage of time during the year will there be more than 3 ships present? (10%)

b. Suppose that the cost of an idle berth is $500/day. What would be the annual costs of idle berth time at a port that has seven berths? (15%)

3. A sample of seven CDs is obtained. Upon testing, it is found that the first, third, fifth and sixth CDs are defective, whereas the others are not. Let p denote the probability that a CD is defective and define X_i, i=1..7 by X_i = 1 if the i-th CD is defective and 0 otherwise.

a. Please show the joint probability mass function of the sample. (15%)

b. What value of p is the observed sample most likely to have occurred?(10%)

4. A store operates both an advance sales system and a spot sales system. On a randomly selected day, let x = the proportion of time that the advance sales system is in use (at least one customer is being served or waiting to be served) and y = the proportion of time that the spot sales system is in use. Then, the set of possible values for (x, y) is the rectangle
D = $\{(x, y) \mid 0 \leqq x \leqq 1, 0 \leqq y \leqq 1\}$. Suppose the joint probability density function of (x, y) is given by

$$f(x,y)=\begin{cases} ax^2+\frac{2}{3}y, & 0\le x\le 1, 0\le y\le 1, \\ 0, & otherwise. \end{cases}$$

a. For $f(x, y)$ to be a probability density function, what is the value of a? (15%)

b. What is the probability that neither system is busy more than 70% of the time? (10%)