國立臺北科技大學九十九學年度碩士班招生考試

系所組別：4210 商業自動化與管理研究所甲組

第一節　統計學　試題

注意事項：

1. 本試題共五題，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. Suppose that the joint pdf of (X, Y) is given by

$$f(x,y)=\begin{cases} e^{-y} & for\ \mathrm{x}>0, \mathrm{y}>\mathrm{x} \\ 0 & \text{elsewhere} \end{cases}$$

   a. (5%) Please find the marginal pdf of X
   b. (5%) Please find the marginal pdf of Y
   c. (5%) Please evaluate $P(X>2|\ Y<4)$

2. (15%) Suppose that X, the length of a rod, has distribution N(10,2). Instead of measuring the value of X, it is only specified whether certain requirements are met. Specifically, each manufactured rod is classified as follows: $X < 8$, $8 \le X < 12$, and $X \ge 12$. If 18 such rods are manufactured, what is the probability that an equal number of rods fall into each of the above categories? (Hint: $\Phi(\sqrt{2}) = 0.9207$)

3. (10%) Obtain the moment-generating function of a random variable having a geometric distribution. Does this distribution possess a reproductive property under addition?

4. (10%) Let X be a vector of three-dimensional random variables with

$$\begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix} = N\left(\begin{bmatrix} 2 \\ -3 \\ 1 \end{bmatrix}, \begin{bmatrix} 1 & 1 & 1 \\ 1 & 3 & 2 \\ 1 & 2 & 2 \end{bmatrix}\right)$$

   Please find the distribution of $3x_1 - 2x_2 + x_3$

5. Given the following table and variable's definition, please answer the questions as follows.
   a. (5%) Determine the multiple linear regression equation $y = f(x_1, x_2, x_3)$
   b. (5%) Discuss the regression coefficients and explain what they indicate ?
   c. (15%) Conduct the model assumptions diagnostic.
   d. (15%) How many independent variables should be in the model ?
   e. (10%) Is there any nonlinear relationship between x and y ?

Sample	y	x_1	x_2	x_3
1	125	29	6	18
2	180	24	8	30
3	82	30	14	9
4	21	50	12	27
5	46	54	10	18
6	100	25	10	15
7	177	8	12	21
8	145	5	20	30
9	115	17	18	33
10	60	45	4	15
Average	105.1	28.7	11.4	21.6

y : the burned area of the forest (in hectare)
x_1 : relative humidity in %
x_2 : outside rain in mm/m2
x_3 : wind speed in km/h

(Hint: $\sum x_{1i}y_i = 23235$, $\sum x_{2i}y_i = 12384$, $\sum x_{3i}y_i = 24045$, $\sum (x_{1i} - \bar{x}_1)^2 = 2524.1$, $\sum (x_{2i} - \bar{x}_2)^2 = 224.4$, $\sum (x_{3i} - \bar{x}_3)^2 = 572.4$, $\sum x_{1i} = 287$, $\sum x_{2i} = 114$, $\sum x_{3i} = 216$, $\sum y_i = 1051$)