

# 國立臺北科技大學九十七學年度碩士班招生考試

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## 第一節 工程數學 試題

填准考證號碼

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第一頁 共一頁

### 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。

一. Find the general solution of the homogeneous system by using Gauss-Jordan reduction. In this case, also determine the dimension of the solution space.

$$2x_1 - 4x_5 + x_7 + x_8 = 0$$

$$2x_2 - x_6 + x_7 - x_8 = 0$$

$$x_3 - 4x_4 + x_8 = 0$$

$$x_2 - x_3 + x_4 = 0$$

$$x_2 - x_5 + x_6 - x_7 = 0$$

(20%)

二. A fuse manufacturer know that 5% of this production is defective. He gives a guarantee on his shipment to 10000 fuses by promising to refund the money if more than  $c$  fuses are defective. Determine the smallest value of  $c$  so that he need not give a refund more than 1% of the time, next, calculate this value by using of Chebyshev's inequality, and compare with the above result. Reference data:

For  $\phi(z) = P\{Z \leq z\}$ , where  $Z \sim N(0,1)$

$$\phi(2.327) = 0.99, \quad \phi(2.575) = 0.995$$

(20%)

三. Let  $X_1, X_2, \dots, X_N$  be a set of independent random variables, where each  $X_i$  is normal random variable with mean equal to  $\mu$  and variance equal to  $\sigma^2$ . Please derive the moment generating function  $Y$ , where  $Y = X_1 + X_2 + \dots + X_N$  and  $N$  is a Poisson random variable with mean  $\lambda$ .

(20%)

四. Given that the following joint probability density function (pdf) of random variables  $X$  and  $Y$ :

$$f_{xy}(x,y) = \begin{cases} C_{xy} & 0 \leq x \leq a, 0 \leq y \leq b \\ 0 & \text{elsewhere} \end{cases}$$

(a) Solve  $C$ . (10%)

(b) Solve the pdf of the random variable  $Z = \max\{2X, 3Y\}$ , where the operation  $\max\{A, B\}$  picks the largest value of  $A$  and  $B$ . (10%)

五. Use elementary row and column operations to evaluate the determinant. (20%)

$$\begin{vmatrix} 5 & 15 & 3 & 1 & 7 & 2 \\ 0 & 0 & 1 & 4 & -5 & 2 \\ 1 & 7 & -1 & 3 & 1 & 9 \\ 0 & 0 & 1 & -3 & -1 & 4 \\ 1 & 1 & 7 & -4 & 1 & 6 \\ 1 & 0 & 0 & 3 & -9 & -4 \end{vmatrix}$$