

中原大學 102 學年度 碩士班 入學考試

102/3/2 10:00 ~ 11:30 電子工程學系晶片與系統組

誠實是我們珍視的美德，
我們喜愛「拒絕作弊，堅守正直」的你！

科目：工程數學(範圍：線性代數、機率)

(共 1 頁第 1 頁)

可使用計算機，惟僅限不具可程式及多重記憶者

不可使用計算機

1. (15%) Find the determinant of $A = \begin{pmatrix} 3 & 0 & 1 \\ 3 & 1 & 2 \\ 5 & 4 & 6 \end{pmatrix}$.

2. (20%) Find the eigen-values and eigen-vectors of $B = \begin{pmatrix} 2 & -12 \\ 1 & -5 \end{pmatrix}$.

3. (15%) Find the inverse of $C = \begin{pmatrix} 1 & 4 & 2 \\ -1 & -2 & 0 \\ 0 & 2 & 3 \end{pmatrix}$.

4. (15%) Suppose that X is a continuous random variable whose probability density function (pdf) is given by

$$f_X(x) = \begin{cases} 0.5 & 0 < x < 2 \\ 0 & \text{otherwise} \end{cases}$$

Let $Y = X^3$, find the pdf of Y and $E[Y]$.

5. (20%) (a) For a Poisson random variable X with probability mass function (pmf) $p(i) = e^{-a} \frac{a^i}{i!}$, $i = 0, 1, 2, \dots$ and $a > 0$. Find the moment generating function of X , $E[X]$ and $\text{Var}(X)$. (b) If X and Y are independent Poisson random variables with respective parameters a_1 and a_2 , compute the distribution of $X+Y$.

6. (15%) Let X and Y be two zero-mean random variables with joint density

$$f_{X,Y}(x, y) = \frac{1}{2\pi\sigma^2\sqrt{1-\rho^2}} \exp\left(-\frac{x^2 + y^2 - 2\rho xy}{2\sigma^2(1-\rho^2)}\right), |\rho| < 1.$$

(a) Find the marginal pdfs of X and Y . (b) Find $E[Y|x]$.