

# 大同大學 99 學年度研究所碩士班入學考試試題

考試科目：工程數學

所別：通訊工程研究所

第 1/1 頁

註：本次考試 不可以參考自己的書籍及筆記； 不可以使用字典； 不可以使用計算器。

1. [15 points] For which values of  $a$  does this system have a unique solution?

$$x + y - w = 2$$

$$y - w = 2$$

$$-2y + z = 3$$

$$x + ay = 4$$

2. [20 points] For matrix  $A = \begin{bmatrix} 3 & 2 \\ 0 & 1 \end{bmatrix}$ ,

(1) find the characteristic equation, the eigenvalues and the associated eigenvectors.

(2) Diagonalize matrix  $A$ .

3. [15 points] Prove that matrix  $A = \begin{bmatrix} 1 & 2 & 0 \\ 2 & 1 & 1 \\ 1 & -1 & 2 \end{bmatrix}$  is row equivalent to matrix  $B = \begin{bmatrix} 2 & 4 & 0 \\ 1 & -1 & 2 \\ 4 & -1 & 5 \end{bmatrix}$ .

4. [15 points] A Web server can handle a maximum of 15 requests per second. During the peak hour, requests arrive at the average rate of 10 per second. Assume that the number of requests arriving per second follows a Poisson distribution. Find the exact probability by giving an expression that the server will be overloaded during a peak hour.

5. [20 points] Assume that  $X$  is a continuous random variable with the following probability density function:

$$f(x) = \begin{cases} c(x - \frac{x^2}{2}) & 0 < x < 2 \\ 0 & \text{elsewhere} \end{cases}$$

(1) What is the value of  $c$ ?

(2) Find  $P[X > 1]$ .

6. [15 points] In the communication network shown below, link failures occur independently with probability  $p$ . What is the probability of the failure of communication between S and D?

