

國立成功大學

113學年度碩士班招生考試試題

編 號： 179

系 所： 電腦與通信工程研究所

科 目： 通訊數學

日 期： 0201

節 次： 第 1 節

備 註： 不可使用計算機

系 所：電腦與通信工程研究所

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考試日期：0201，節次：1

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※ 考生請注意：本試題不可使用計算機。請於答案卷(卡)作答，於本試題紙上作答者，不予計分。

- (10%) You choose at random an integer from 1, 2, ..., 6. Next you roll a fair die until you get an outcome that is larger than or equal to the randomly chosen integer. What is the probability mass function (PMF) of the number of times you will roll the die?
- (20%) Let X and Y be independent random variables each having the probability density function (PDF)

$$f_X(x) = \begin{cases} e^{-x}, & x > 0 \\ 0, & \text{otherwise} \end{cases}$$

Assume $U = X + Y$ and $V = X/(X + Y)$. Are random variables U and V independent?

- Let X and Y be independent random variables. X is a continuous uniform random variable within the range $[0, 1]$ and Y is a Bernoulli random variable with parameter 0.5. Set $W = (X + Y)/2$.
 - (10%) Determine the cumulative distribution function and PDF of W .
 - (10%) Find the pmf of $E[W|Y]$.
- (20%) Let A and B be two diagonalizable matrices of the same size. Choose from the following the matrices that are also diagonalizable in general. (a) A^2 (b) $B + I$ (c) $A + B$ (d) AB . (In the above, I denotes the identity matrix of the same size as A .)
- (30%) Consider a linear transformation T on \mathbb{R}^3 , define by

$$T\left(\begin{bmatrix} x \\ y \\ z \end{bmatrix}\right) = \begin{bmatrix} y \\ z \\ x \end{bmatrix}$$

Find the standard matrix of T . Also, find the inverse of T . (Express your answer as

$T^{-1}\left(\begin{bmatrix} x \\ y \\ z \end{bmatrix}\right) = \dots$). What is the rank of T ?

$$T^{-1}\left(\begin{bmatrix} x \\ y \\ z \end{bmatrix}\right) = \begin{bmatrix} z \\ x \\ y \end{bmatrix}$$