

大同大學 九十四 學年度研究所碩士班入學考試題

考試科目：工程數學

所別：通訊工程研究所

第1頁 共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) Find the condition for which the following system is consistent and solve the system.

$$\begin{aligned}2x - y + 3z &= a \\3x + y - 5z &= b \\-5x - 5y + 21z &= c\end{aligned}$$

2. (10 points) Evaluate the determinant of

$$\begin{bmatrix} 1 & 1 & 1 & 1 \\ t & 1 & 1 & 1 \\ t & t & 1 & 1 \\ t & t & t & 1 \end{bmatrix}$$

3. (15 points) Find the characteristic polynomial, the eigenvalues, and the associated eigenvectors of this

matrix. $\begin{bmatrix} 1 & 1 & 1 \\ 0 & 0 & 1 \\ 0 & 0 & 1 \end{bmatrix}$

4. (10 points) Suppose that in a block of B bits, the individual bits are in error independently with probability p . The approximation, $P_B \approx B \times p$, is often made for the probability of a block being in error. Show the conditions under which this approximation is justified.
5. (10 points) Messages arrive to a switch at a Poisson rate with an average of 10 messages in a 3-min interval. Calculate the probability of less than 175 messages in a busy hour.
6. (10 points) Consider two independent binomially distributed random variables with parameters (M, p) and (N, p) , respectively. Show that their sum is also binomial.
7. (10 points) Draw the result of convolving two rect functions, $\text{rect}(t/a)$ and $\text{rect}(t/b)$, with $a < b$.
8. (10 points) The Fourier transform of the function $e^{-\pi x^2}$ is $e^{-\pi \omega^2}$. Find the Fourier transform of the function $t e^{-t x^2}$, where t is a positive real number.
9. (10 points) Find $\int_{-\infty}^{\infty} \frac{\sin^2 a \omega}{\omega^2} d\omega$.