大同大學 102 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 甲組　　

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

1. (20 points) Find a basis for the span of the vectors [2,1,3], [1,1,1], [3,2,4], and [5,3,7] in R^3.

2. (30 points) Let $A = \begin{pmatrix} 3 & 6 \\ 1 & -2 \end{pmatrix}$
   (1) Find the eigenvalues.
   (2) Find two linearly independent eigenvaectors of A.
   (3) Find A^n.

3. (30 points) The joint distribution of two random variables X and Y is known to be
   $f(x,y)=c\cdot\frac{1}{4^{x+y}}$, for $x = 0, 1, 2, \ldots$ and $y = 0, 1, 2, \ldots$
   (1) Find c.
   (2) Find the marginal distribution of X.
   (3) Find $E(Y)$.

4. (20 points) In an experiment, A, B, C, D are events with probabilities
   $P(A)=\frac{3}{8}$, $P(A\cup B)=\frac{5}{8}$, $P(C)=\frac{1}{2}$, $P(C\cap D)=\frac{1}{3}$.
   Furthermore, A and B are disjoint, while C and D are independent.
   (1) Are A and B independent? Explain.
   (2) Are C and D' independent? Explain.

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3. (20 points) Consdier $\frac{dy}{dx} = \frac{1-3x^2}{3y^2}$, $y(0) = 1$.
   (1) What is $y(x)$?
   (2) What is $y(1)$?

4. (30 points) Consider $y'' - 2y' - 8y = f(t)$, $y(0) = 3$, $y'(0) = 0$, $f(t) = \begin{cases} 0, & 0 \le t < 1 \\ 4, & t \ge 1 \end{cases}$
   Find the Laplace transform of $y(t)$.