國立成功大學 109 學年度碩士班招生考試試題

系　　所：工程科學系

考試科目：計算機數學

考試日期：0211，節次：3

※ 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。

1. Choose the most appropriate answer for the following questions. (40%)

(a) Two sets A and B contains *a* and *b* elements respectively. If the power set of A contains 16 more elements than that of B, value of '*b*' and '*a*' are respectively

(1) 4, 5
(2) 6, 7
(3) 2, 3
(4) None of the mentioned

(b) Find the coefficient of x^8 in the expansion of $(x+2)^{11}$.

(1) 640
(2) 326
(3) 1320
(4) 456

(c) For matrix A, $(A^3) = I$, A^{-1} is equals to:

(1) A^2
(2) A^{-2}
(3) Can't say
(4) None of the mentioned

(d) If A is an invertible square matrix, then:

(1) $(A^T)^{-1} = (A^{-1})^T$
(2) $(A^T)^T = (A^{-1})^T$
(3) $(A^T)^{-1} = (A^{-1})^{-1}$
(4) None of the mentioned

(e) If $f(x) = (x^3 - 1) / (3x + 1)$, then f(x) is

(1) $O(x^2)$
(2) $O(x)$
(3) $O(x^2 / 3)$
(4) $O(1)$

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(f) What is the recurrence relation for 1, 7, 31, 127, 511 ?

(1) $b_{n+1} = 5b_{n-1} + 3$

(2) $b_n = 4b_n + 7!$

(3) $b_n = 4b_{n-1} + 3$

(4) $b_n = b_{n-1} + 1$

(g) Consider the recurrence relation $a_1=4$, $a_n = 5n + a_{n-1}$. What is the value of a_{64} ?

(1) 10399

(2) 23760

(3) 75100

(4) 53700

(h) Determine the interval of convergence for $\sum_{n=0}^{\infty}(x-7)^{n+1} \ / \ n^n$.

(1) $-1 < x < 1$

(2) $-\infty < x < \infty$

(3) $-2 < x < 2$

(4) $-1 < x < \infty$

(i) What is the maximum number of edges in a bipartite graph on 14 vertices?

(1) 78

(2) 15

(3) 214

(4) 49

(j) Let D be a simple graph on 10 vertices such that there is a vertex of degree 1, a vertex of degree 2, a vertex of degree 3, a vertex of degree 4, a vertex of degree 5, a vertex of degree 6, a vertex of degree 7, a vertex of degree 8 and a vertex of degree 9. What can be the degree of the last vertex?

(1) 4

(2) 0

(3) 2

(4) 5

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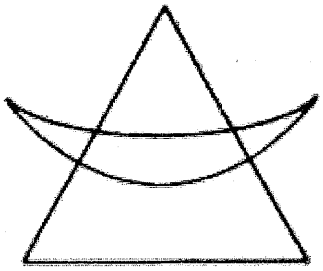
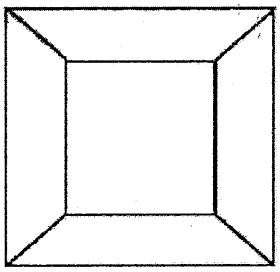
2. Consider the 3×3 numbered grid below. Each square in the grid will be painted either BLACK or WHITE. The color for each square is decided by tossing a fair coin. Find the probability that the grid does not have a 2×2 BLACK square (that is all 4 squares are painted BLACK). (20%)

1	2	3
4	5	6
7	8	9

3. Consider the two figures below which are a child's puzzles. The puzzles expect a child to start from any intersection point and trace each line or curved segment with a colored pencil without raising the pencil or going over any line/curved segment more than once. Can a child solve the puzzles? Justify. (15%)





4. You have a fair die with 6 faces marked 1 to 6. You continue to roll the die repeatedly and only stop when either you roll a 1 or you voluntarily decide to stop at some point. When you stop you get a score that is equal to the value of the last roll. So your last score is either 1 or the value of the last roll before you decided to stop.
   (a) Let S(v) be the expected score if we stop at value v or larger. What are the values of S(6) and S(5)? (10%)
   (b) What stopping strategy will you choose to maximize your expected score? (10%)
   (c) If the score was the square of the last rolled value what stopping strategy will maximize your expected score? (5%)