世新大學九十九學年度碩士班招生考試試題卷

系所組別	考 試 科 目
資訊管理學系資訊科技組	離散數學

※本考題 □可使用 ☑禁止使用 簡易型電子計算機

※考生請於答案卷內作答

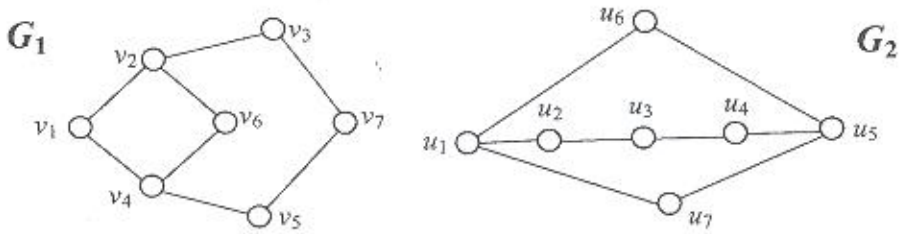
1. Let $A = \{1, \{1\}, \{2\}, 2\}$. Which of the following are true? Which of the following are false? (20 分、每小題 2 分) (請回答 "T (True)" 或 "F (False)")

   (1) $\{1\} \in A$ (2) $\{1\} \subseteq A$ (3) $\{1, 2\} \in A$ (4) $\{1, 2\} \subseteq A$

   (5) $\{2\} \in A$ (6) $2 \in A$ (7) $\{2\} \subset A$ (8) $\{\{1, 2\}\} \subset A$

   (9) $\{\{1\}, \{2\}\} \subseteq A$ (10) $|P(A)| = 8$, where $P(A)$ is the power set of A.

2. Are the following two graphs isomorphic? Prove it or explain the reason. (10 分)



3. (a) $A = \{1, 2, 3, 4\}$ and $B = \{a, b, c\}$. Write three different onto functions from A to B. (3 分)

   (b) $C = \{1, 2, 3, 4\}$ and $D = \{a, b, c, d, e\}$. Write two different one-to-one functions from C to D. (2 分)

   (c) $Y = \{3, \{6\}\}$. Write the power set of Y, $P(Y)$. (5 分)

4. Let $x = \gcd(750, 111)$ and $x = 750t + 111s$. Find the general solution of t and s. (5 分)

5. Solve the recurrence relation $L_n = L_{n-1} + L_{n-2}, n \geq 2, L_0 = 2, L_1 = 1$. (8 分)

6. Let $A = \{3, 6, 9, 12, 15, 18, 21, 24, 27, 30, 45\}$ and $R = \{(x, y) \mid x \text{ divides } y\}$ is a relation on A.

   (a) Prove that R is a partial order on A. (9 分)

   (b) Draw the Hasse Diagram of R. (6 分)

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7. Determine the number of all integer solutions of $x_1 + x_2 + x_3 < 30$, where x_1, $x_2 > 0$, and $x_3 \geq 0$. (7 分)

8. Prove the following statement. (7 分)

   Suppose that we select any 20 distinct integers from $A = \{1, 2, \cdots, 36, 37\}$, i.e. A contain the integers from 1 to 37. There must exist two numbers x and y of them such that $x + y = 38$.

9. Let $G(V, E)$ be a n-vertex loop-free connected planar graph with $m > 2$ edges and r regions. Show that $3r \leq 2m$ and $m \leq 3n - 6$. (Hint: You can use the result of Euler's Theorem: $n - m + r = 2$) (10 分)

10. Let $S(n)$: n can be written as the sum of $k \geq 1$ numbers $a_1, \ldots, a_k$ such that $a_j \in \{2, 5\}$, for all $1 \leq j \leq k$. Prove that $S(n)$ is true for all positive integers $n \neq 1, 3$. (8 分)