

國立中央大學99學年度碩士班考試入學試題卷

所別：企業管理學系碩士班 企業電子化庚組(一般生)

科目：離散數學

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本科考試禁用計算器

*請在試卷答案卷(卡)內作答

PART ONE: Multiple Choice Questions (single answer) (30%, 5% each question)

- [] (1) Find a theta notation in terms of n for the number of times the statement $x = x + 1$ is executed:
- for $i = 1$ to n
- for $j = 1$ to n
- for $k = 1$ to i
- $x = x + 1$
- A. $\Theta(n)$
B. $\Theta(n^2)$
C. $\Theta(n^3)$
D. $\Theta(n!)$
- [] (2) The relation $R = \{(1, 1), (2, 2), (3, 3), (4, 4), (1, 2), (2, 3), (2, 1), (3, 2)\}$ has the properties of
- A. Reflexive, symmetric, and not transitive
B. Reflexive, not symmetric, and transitive
C. Not reflexive, symmetric, and transitive
D. Not reflexive, not symmetric, and transitive
- [] (3) Suppose that strings of length 4 are formed using the letters $ABCDEF$ if repetitions are not allowed. How many strings do not begin with the letter B ?
- A. 120
B. 180
C. 240
D. 300
- [] (4) In the following pairs (α, β) , which α is lexicographically less than β ?
- A. (1324, 132)
B. (13246, 1342)
C. (1342, 1324)
D. (21354, 13542)
- [] (5) Find the number of integer solutions of $x_1 + x_2 + x_3 = 15$ subject to $x_1 > 0, x_2 = 1, x_3 \geq 0$.
- A. 136
B. 78
C. 16
D. 14
- [] (6) $572^5 \bmod 713 = ?$
- A. 470
B. 152
C. 630
D. 634

PART TWO: Short-Answer Questions (30%)

- (1) According to the generalized De Morgan's laws for logic, please write the negation of $\forall x \exists y P(x, y)$ and $\exists x \exists y P(x, y)$. (6%)

注意：背面有試題

參考用

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- (2) Define homeomorphic graphs. (4%)
- (3) What is a binary search tree? (5%)
- (4) Please describe the shuffle algorithm in words. (5%)
- (5) Check whether the relation $\{(1, 1), (2, 2), (3, 3), (4, 4), (5, 5), (1, 3), (3, 1), (1, 4), (4, 1), (3, 4), (4, 3)\}$ is an equivalence relation on $\{1, 2, 3, 4, 5\}$. If the relation is an equivalence relation, please list the equivalence classes. (6%)
- (6) Demonstrate an example of a recursive function. (4%)

PART THREE: Long-Answer Questions (40%)

- (1) If the input of pairs includes $(8, 9), (1, 5), (5, 9), (8, 4), (12, 10), (2, 2), (13, 8), (1, 10), (3, 7), (3, 11), (16, 10), (11, 7), (7, 6), (11, 3), (8, 7),$ and $(5, 4)$, please describe how to apply the closest-pair algorithm to find the closed pair of points. (10%)

- (2) Suppose the nondeterministic finite-state automaton $A = (I, S, f, A, \sigma)$ has input symbols $I = \{a, b\}$, state $S = \{\sigma, C, F\}$, accepting state $A = \{\sigma\}$ and the next-state function f

| S \ I | a | b |
|----------|-----------------|--------------|
| σ | $\{C, F\}$ | \emptyset |
| C | $\{\sigma, C\}$ | $\{F\}$ |
| F | \emptyset | $\{\sigma\}$ |

- a). Draw the transition diagram of the nondeterministic finite-state automaton A. (10%)
- b). Draw the finite-state automata equivalent to the nondeterministic finite-state automaton A. (8%)
- (3) If we select 101 distinct courses numbered between 1 and 200 inclusive, please show that at least 2 courses are consecutively numbered. (6%)
- (4) Suppose that there are 11 cells (indexed from 0 to 10) in a computer memory. Show how the data of 52, 14, 281, 743, 377, 20, 8, and 796 would be inserted into the initially empty memory cells according to the hash function and collision resolution policy. (6%)

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