

# 淡江大學 102 學年度進修學士班轉學生招生考試試題

系別：資訊工程學系三年級

科目：離散數學

考試日期：7月22日(星期一) 第4節

本試題共 9 大題， 1 頁

- For primitive statements  $p, q, r$ , verify that  $p \rightarrow (q \vee r) \equiv (p \wedge \neg q) \rightarrow r$  are logically equivalent by using
  - truth table (10%)
  - logical equivalence (10%)
- In an island where there are two inhabitants, knights and knaves, where knights always tell the truth and knaves always lie. You encounter two people, A and B. Determine if possible, what A and B are if they address you in the ways described.
  - A says "The two of us are opposite types", and B says "A is a knave". (5%)
  - A says "We are both knights" and B says "We are both knaves." (5%)
- Prove that for every positive number  $n$ ,  $1*2 + 2*3 + \dots + n(n+1) = n(n+1)(n+2)/3$ . (10%)
- Prove or disprove. Use Venn diagram to show it. (10%)
  - $A - (B \cap C) = (A - B) \cup (A - C)$ .
  - $A - (B \cap C) = (A - B) \cap (A - C)$ .
- Suppose  $f: A \rightarrow B$  where  $A = \{a, b, c\}$  and  $B = \{0,1\}$ , find
  - all functions  $f$  (5%)
  - all 1-1 functions  $f$  (5%)
- Give a recursive definition for the set below. (10%)
  - $S$ , where  $S = \{\dots -4, -2, 0, 2, 4, 6, \dots\}$
  - The set  $P$  of all bit strings that have even number of 0s,  
i.e.  $\{1,00,11,001,010,100,0011,0101,0110,1001,1010, 1100, 0000, \dots\}$
- Solve the recurrence relation  $a_n = 3a_{n-1} + 3^n$  where  $a_0=0$ . (10%)
- For the regular grammar below, (10%)  
 $G=(V, T, S, P)$ ,  $T=\{0,1\}$ ,  $V=\{0, 1, S, A, B\}$ ,  $P=\{S \rightarrow 0A, S \rightarrow 1B, A \rightarrow 0A, A \rightarrow 1B, B \rightarrow 1B, B \rightarrow \lambda\}$ 
  - Show the derivation of string 000111 from  $G$ .
  - What language does  $G$  generate? List all strings in  $G$  up to length 4.
- Let  $S$  be the set of strings beginning with 1 and ending with 0, e.g.,  
 $\{10,100,110,1000,1010,1100,1110, \dots\}$ .  
Construct a deterministic finite automaton for  $S$ . (10%)