

(共 11 題，總計 100 分) (18 條規則附錄於第二頁)

符號說明： $\bullet$ : and  $\vee$ : or  $\sim$ : not  $\supset$ : If... then...  $\equiv$ : ...if and only if...

(也可用相當的符號，如  $\wedge$ ， $\vee$ ， $\neg$ ， $\rightarrow$ ， $\leftrightarrow$ )

(關於(III)大題，考生可以用類似的證明系統，但是使用 truth tree 或 semantic tableau 或 analytic tableau 等方法者，除非另行證明該方法等價於這裡使用的系統，將酌予扣分。)

(I) 命題邏輯語意：判斷下面論證是否有效(valid)

- (1) 1.  $M \supset N$   
 2.  $K \vee N$   
 3.  $M \vee K \quad \therefore N$  (10 points)

(II) 請將下列語句符號化。(合計 40 分)

(2) Dinosaurs cannot be cloned unless scientists can both obtain samples of dinosaur DNA and fill in the missing gaps in dinosaur DNA. (D = "Dinosaurs can be cloned"; G = "scientists can fill in the missing gaps in dinosaur DNA"; S = "scientists can obtain samples of dinosaur DNA") (8 points)

(3) I can be blamed for my mistakes only if I make mistakes and someone discovers them. (B = "I can be blamed for my mistakes"; M = "I make mistakes"; D = "someone discovers my mistakes") (8 points)

(4) No one is afraid of Biff. (8 points)  
 (Axy = "x is afraid of y"; Hx = "x is a human"; b = Biff; domain: unrestricted.)

(5) Biff is not afraid of anyone who is afraid of Percy. (8 points)

(Axy = "x is afraid of y"; b = Biff; p = Percy; domain: all humans.)

(6) No one will pass the final unless he/she studies hard. (8 points) (Dx = "x studies hard"; Bx = "x passes the final"; domain: all students)

(III) 使用 18 條規則或 CP (Conditional Proof)、IP (Indirect Proof)、QN (Quantifier Negation)、UI (Universal Instantiation)、EI (Existential Instantiation)、UG (Universal Generalization)、EG (Existential Generalization) 證明下列論證。(合計 40 points)

(7) 1.  $(A \supset B) \supset B \quad \therefore (B \supset A) \supset A$  (10 points)

(8) 1.  $\sim(x)(Ax \vee \sim Ax) \quad \therefore \sim(y)(Ay \equiv Cy)$  (10 points)

(9) 1.  $(x) [(Fx \vee Gx) \supset Wx]$   
 2.  $(x) [(Wx \vee Kx) \supset Hx] \quad \therefore (x) (Fx \supset Hx)$  (10 points)

(10) 1.  $(x)(Sx \supset Tx)$ 2.  $(\exists x)Sx \vee (\exists x)Tx \therefore (\exists x)Tx$ 

(10 points)

(IV) 述詞邏輯語意：舉反例說明下列論證無效(invalid)

(11) 1.  $(x)(Fx \supset Hx)$ 2.  $(x)(Hx \supset Gx) \therefore (\exists x)(Fx \vee Gx)$ 

(10 points)

附錄：18 條規則 (Appendix: the 18 valid argument forms)

- |   |  |   |   |
|---|--|---|---|
| 1. MP $p \supset q$<br>$p \therefore q$   | 2. MT $p \supset q$<br>$\sim q \therefore \sim p$  | 3. DS $p \vee q$<br>$\sim p \therefore q$   | 3. DS $p \vee q$<br>$\sim q \therefore p$ |
| 4. Simp $p \bullet q \therefore p$<br>$p \bullet q \therefore q$  | 5. Conj $p$<br>$q \therefore p \bullet q$  | 6. HS $p \supset q$<br>$q \supset r \therefore p \supset r$                             |   |
| 7. Add $p \therefore p \vee q$  | 8. CD $p \supset q$<br>$r \supset s$<br>$p \vee r \therefore q \vee s$   |   |   |
| 9. DN $p \therefore \sim \sim p$  | 10. DeM $\sim(p \bullet q) \therefore \sim p \vee \sim q$<br>$\sim(p \vee q) \therefore \sim p \bullet \sim q$   | 11. Comm $(p \vee q) \therefore (q \vee p)$<br>$(p \bullet q) \therefore (q \bullet p)$ |   |
| 12. Assoc $[p \vee (q \vee r)] \therefore [(p \vee q) \vee r]$<br>$[p \bullet (q \bullet r)] \therefore [(p \bullet q) \bullet r]$                  | 13. Dist $[p \bullet (q \vee r)] \therefore [(p \bullet q) \vee (p \bullet r)]$<br>$[p \vee (q \bullet r)] \therefore [(p \vee q) \bullet (p \vee r)]$ |   |   |
| 14. Contra $(p \supset q) \therefore (\sim q \supset \sim p)$   | 15. Impl $(p \supset q) \therefore \sim p \vee q$  |   |   |
| 16. Exp $[(p \bullet q) \supset r] \therefore [p \supset (q \supset r)]$  | 17. Taut $p \therefore (p \bullet p)$<br>$p \therefore (p \vee p)$   |   |   |
| 18. Equiv $(p \equiv q) \therefore [(p \supset q) \bullet (q \supset p)]$<br>$(p \equiv q) \therefore [(p \bullet q) \vee (\sim p \bullet \sim q)]$ |  |   |   |