

P1

(a) $\exists P \in \mathcal{K}. S(P) \wedge A(P)$.(b) $\forall P \in \mathcal{K}. S(P) \wedge T(P) \rightarrow A(P)$.(c) ~~$\forall P \in \mathcal{K} \rightarrow (\exists P \in \mathcal{K}. T(P) \wedge \neg A(P))$~~ (d) $\exists P_1, P_2, P_3. T(P_1) \wedge T(P_2) \wedge T(P_3), \wedge \neg S(P_1) \wedge \neg S(P_2) \wedge \neg S(P_3)$

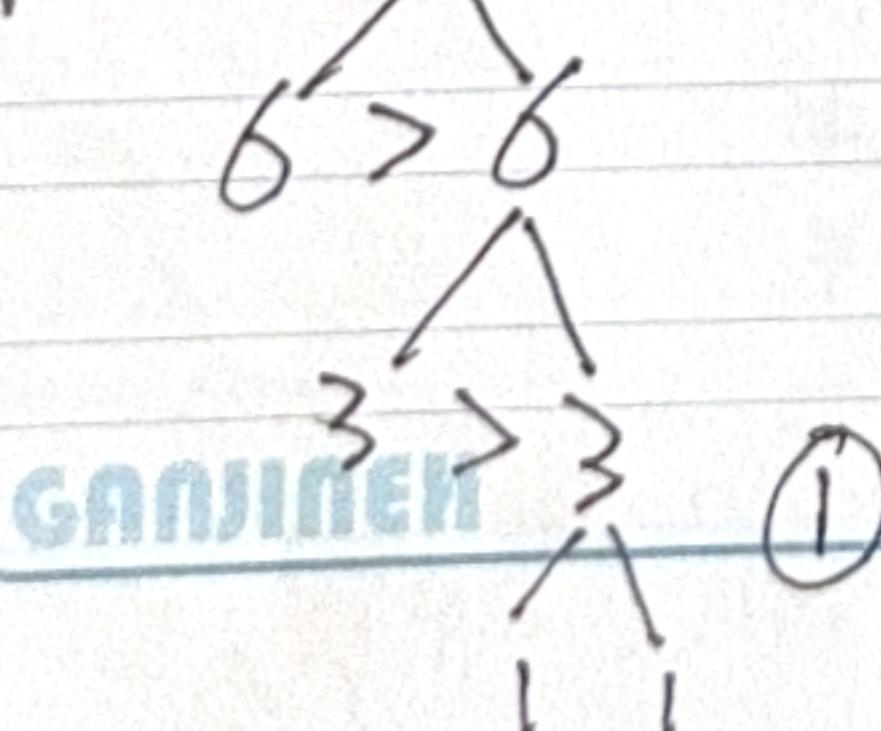
P2

(a)	T	P	Q	R	b(P,Q,R)	Valid
(b)	F	T	T	F	F	invalid

P3(a)

(i) $\neg(\text{A} \text{ hand } \text{B})$ (ii) $\neg(\neg(\neg \text{A} \text{ hand } \neg \text{B})) = \neg \text{A} \text{ hand } \neg \text{B}$ (iii) $\text{A hand } \neg \text{B}$ (b) A hand A (c) $\text{A hand } \neg \text{A} = \text{T}$ $\neg(\text{A hand } \neg \text{A}) = \text{F}$

P4 12



P5

$$R(r^{\frac{1}{5}}) \rightarrow R(r)$$

$$r^{\frac{1}{5}} = \frac{a}{b} \rightarrow r = \frac{a^5}{b^5} \quad \exists a, b \in \mathbb{Z}$$

P6

$$\underline{E(z) \rightarrow E(n, y, z)}$$

Case 1: 2 odd, 1 Even

$$\begin{aligned} & (2i+1)^2 + (2j+1)^2 + (2k)^2 \\ &= 2i^2 + 2i + 1 + 2j^2 + 4j + 1 + 4k^2 \\ &\equiv 4m + 2 \equiv 2 \pmod{4} \end{aligned}$$

Case 2: 2 Even, 1 odd

$$\begin{aligned} & (2i)^2 + (2j)^2 + (2k+1)^2 \\ &= 4i^2 + 4j^2 + 4k^2 + 4k + 1 \equiv 1 \pmod{4} \end{aligned}$$

Case 3: 3 odd

$$\begin{aligned} & (2i+1)^2 + (2j+1)^2 + (2k+1)^2 \\ &= 4i^2 + 4i + 1 + 4j^2 + 4j + 1 + 4k^2 + 4k + 1 \\ &\equiv 3 \pmod{4} \end{aligned}$$

$$\text{Case 4: } 4i^2 + 4j^2 + 4k^2 = 4L \quad \checkmark$$