班级 计71 姓名 张程远 编号 2017011429 科目 离散 第 1 页

T4.

(3). $(\exists x)P(x,y) \leftrightarrow (\forall z)Q(z)$

$= (\neg(\exists x)P(x,y) \vee (\forall z)Q(z)) \wedge ((\exists x)P(x,y) \vee \neg(\forall z)Q(z))$

$= ((\forall x)\neg P(x,y) \vee (\forall z)Q(z)) \wedge ((\exists u)P(u,y) \vee (\exists v)\neg Q(v))$

$= (\forall x)(\forall z)(\exists u)(\exists v)((\neg P(x,y) \vee Q(z)) \wedge (P(u,y) \vee \neg Q(v)))$

(4). $(\neg(\exists x)P(x) \vee (\forall y)Q(y)) \longrightarrow (\forall z)R(z)$

$= \neg(\neg(\exists x)P(x) \vee (\forall y)Q(y)) \vee (\forall z)R(z)$ *

$= ((\exists x)P(x) \wedge (\exists y)\neg Q(y)) \vee (\forall z)R(z)$

$= (\exists x)(\exists y)(\forall z)((P(x) \wedge \neg Q(y)) \vee R(z))$

(10). $(\exists y)(\forall x)(\forall z)(\exists u)(\forall v)P(x,y,z,u,v)$

$= (\forall x)(\forall z)(\forall v)$ P([redacted] $x, a, z, f(x,z), v)$

T_5

(1) 推理规则

①	$(\forall x)(P(x) \vee Q(x))$	前提
②	$(\forall x)(Q(x) \rightarrow \neg R(x))$	前提.
③	$Q(x) \vee P(x)$	全称量词消去
④	$Q(x) \rightarrow \neg R(x)$	全称量词消去.
⑤	$\neg Q(x) \rightarrow P(x)$	③置换.
⑥	$R(x) \rightarrow \neg Q(x)$	④置换.
⑦	$R(x) \rightarrow P(x)$	⑤⑥三段论
⑧	$(\forall x)(R(x) \rightarrow P(x))$	全称量词引入.

归结法:

建立子句集 G

$\{P(x) \vee Q(x),\ \neg Q(x) \vee \neg R(x),\ R(x),\ \neg P(x)\}$

(1)	$P(x) \vee Q(x)$	
(2)	$\neg Q(x) \vee \neg R(x)$	
(3)	$\neg P(x)$	
(4)	$R(x)$	
(5)	$Q(x)$	(1) (3) 归结.
(6)	$\neg R(x)$	(2) (5) 归结
(7)	$\square$	(4) (6) 归结.

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(4) 设 $P(x)$：x是学生；$Q(x)$：x是本科生；$R(x)$：x是研究生；$S(x)$：x是高材生.

要证：$(\forall x)(P(x)\rightarrow Q(x)\bar{\vee}R(x))\wedge(\exists x)(P(x)\wedge S(x))\wedge(\neg R(John)\wedge S(John))$

$$\Rightarrow (P(John)\rightarrow Q(John))$$

推理规则：

① $(\forall x)(P(x)\rightarrow Q(x)\bar{\vee}R(x))$ 前提引入

② $P(x)\rightarrow Q(x)\bar{\vee}R(x)$ ①全称量词消去

③ $\neg R(John)$ 前提引入

④ $P(John)$ 附加前提引入

⑤ $Q(John)\bar{\vee}R(John)$ ②④分离

⑥ $Q(John)$ ③⑤分离

⑦ $P(John)\rightarrow Q(John)$ 条件证明规则

归结法：建立子句集

$\{\neg P(x)\vee(Q(x)\bar{\vee}R(x)),\ P(a),\ S(a),\ \neg R(John),\ S(John),\ P(John),\ \neg Q(John)\}$

(1) $\neg P(x)\vee(Q(x)\bar{\vee}R(x))$

(2) $P(a)$

(3) $S(a)$

(4) $\neg R(John)$

(5) $P(John)$

(6) $\neg Q(John)$

(7) $Q(John)\bar{\vee}R(John)$ (1)(5)归结

(8) $Q(John)$ (4)(7)归结

(9) $\square$ (6)(8)归结