Q24)2) $\neg[\exists x, \exists y, \forall z, ((x \neq y) \wedge (C(x,z) \leftrightarrow C(y,z))]$

$C(x,z) \rightarrow C(y,z) = \neg C(x,z) \vee C(y,z) = P_1(z)$

$C(y,z) \rightarrow C(x,z) = \neg C(x,z) \vee C(y,z) = P_2(z)$

$\neg[\exists x, \exists y, \forall z, (x \neq y) \wedge P_1(z) \wedge P_2(z)]$

$= \forall x, \neg(\exists y, \forall z, (x \neq y) \wedge P_1(z) \wedge P_2(z))$

$= \forall x, \forall y, \exists z, \neg((x \neq y) \wedge P_1(z) \wedge P_2(z))$

$= \forall x, \forall y, \exists z, (x = y) \vee \neg P_1(z) \vee \neg P_2(z)$

$= \forall x, \forall y, \exists z, (x=y) \vee (C(y,z) \wedge \neg C(x,z)) \vee (C(x,z) \wedge \neg C(y,z))$. (don't forget this!)

LP: Can make $[C(x,z) \wedge \neg C(y,z)] \vee [C(y,z) \wedge \neg C(x,z)]$

$= [C(x,z) \vee C(y,z)] \wedge [\neg C(x,z) \vee \neg C(y,z)]$.

Q25) $\forall x \in D, P(x) \rightarrow Q(x) = \forall x \in D, \neg Q(x) \vee P(x)$

LP $= \forall x \in D, \neg(\neg\neg Q(x) \wedge \neg P(x)) = \forall x \in D, \neg(Q(x) \wedge \neg P(x))$ ✗

TA: Trick is to use $Q(x) = \neg\neg Q(x)$, then convert back to implication.

TA: $\forall x \in D, \neg Q(x) \vee P(x)$ ✗

LP: $A \rightarrow B = \neg A \vee B$ NOT $\neg B \vee A$ because $\neg B \rightarrow \neg A$!

CTA: $\forall x \in D, P(x) \rightarrow Q(x) = \forall x \in D, \neg P(x) \vee Q(x)$

$= \forall x \in D, Q(x) \vee \neg P(x) = \forall x \in D, \neg\neg Q(x) \vee \neg P(x)$

$= \forall x \in D, \neg Q(x) \rightarrow \neg P(x)$. ✓

Q26) $\neg(\forall x, P(x) \rightarrow Q(x)) = \exists x, \neg(P(x) \rightarrow Q(x)) = \exists x, \neg(\neg P(x) \vee Q(x))$

$= \exists x, \neg\neg P(x) \wedge \neg Q(x) = \exists x, P(x) \wedge \neg Q(x)$. ✓

Q27) False. ✗ TA: 2 is a prime and $2 = 2 \times 1$.

Q28) $S = \{$students$\}$. $C = \{$courses$\}$.

$\forall s \in S$ ✗

TA: $D = \{$SCE students$\}$. $P(x) =$ "x studies DM".

$\forall x \in D, P(x)$.

$\forall x \in D, P(x)$; Jackson $\in D$; $\therefore P($Jackson$)$. ✓