

Problem Set 4 (for Lecture 6) Solutions

April 13, 2017

- A1. (c). $\neg(\forall x)[P(x) \implies (Q(x) \vee R(x))] \iff (\exists x)[P(x) \wedge \neg(Q(x) \vee R(x))] \iff (\exists x)[P(x) \wedge \neg Q(x) \wedge \neg R(x)]$
- A2. $(\forall p)(\exists q)(\exists t)[W(p, q, t)]$ means for all tennis players, there exists a player that they win a game against.
- (a) Same.
 - (b) Not the same.
 - (c) Not the same.
 - (d) Not the same.
 - (e) Not the same.
- A3.
- (a) Could be true. $(\forall p)(\exists q)(\exists t)[W(p, q, t)]$ means for all tennis players, there exists a player that they win a game against. If there were two tennis players, then one could beat the other one time, and the other could win another time.
 - (b) Not true. $(\forall p)(\forall q)(\exists t)[W(p, q, t)]$ means for all pairs of tennis players p and q , there exists a game where p beats q . This must mean p beats themselves, which is not possible (I think?).
 - (c) Could be true. $(\forall q)(\exists p)(\exists t)[W(p, q, t)]$ means for all tennis players, there exists a player that beats them in a game.
- A4. (a). $(\forall x)(\forall y)[(\exists z)(L(x, z) \wedge L(z, x)) \implies L(y, x)]$ means for everyone who is a lover, they are loved by everyone.
- A5.
- (a) True.
 - (b) True.

(c) True. One can choose one such $y = x$.

(d) False. Suppose $y = x$, then $\neg[(y < x) \vee (x < y)]$.

A6. 20 pts. Logical Correctness (4 pts) + Clarity (4 pts) + Opening (2 pts) + Stating the conclusion (4 pts) + Reasons (2 pts) + Overall valuation (4 pts).