CS1231–Midterm 1, 2017

Name: **Matric Number:**

Tutorial Group: **Seat Number:**

1.

Yes.

p	q	r	$\neg(p \vee q \vee \neg r)$	$r \to p$	$r \to q$	$\neg(p \vee q \vee \neg r) \wedge ((r \to p) \vee (r \to q))$
T	T	T	F	T	T	F
T	T	F	F	T	T	F
T	F	T	F	T	F	F
T	F	F	F	T	T	F
F	T	T	F	F	T	F
F	T	F	F	T	T	F
F	F	T	T	F	F	F
F	F	F	F	T	T	F

2. $(\neg p \vee \neg q) \wedge (\neg p \vee \neg r) \equiv \neg p \vee (\neg q \wedge \neg r) \equiv \neg p \vee \neg(q \vee r) \equiv \neg(p \wedge (q \vee r))$.

3. $\neg p \to q \equiv p \vee q$.

4. (a)(i) $\exists x, G(x) \wedge F(x)$

(a)(ii) $\exists x, C(x) \wedge (G(x) \wedge F(x))$

(b)(i) $\forall x, \neg G(x) \vee \neg F(x)$

(b)(ii) $\forall x, C(x) \to (\neg G(x) \vee \neg F(x))$

5. False. For $x = 0$, one cannot find y so that $xy = 1$.

6. (i) $\forall s \in Y \exists p \in X, B(p, s)$

(ii) $\forall s \in Y \forall p \in X \forall q \in X, B(p, s) \wedge B(q, s) \rightarrow p = q$

7. $\forall s \in C \exists k \in H \forall n \in H, E(s) \rightarrow R(s, k) \wedge W(k) \wedge (R(s, n) \rightarrow n = k)$

8.

1. $f \rightarrow q,$ (from (ii)) Specialization.
2. f (iv)
3. $\therefore q$ (from 1, 2) Modus Ponens.
4. $a \wedge q \rightarrow m$ (i)
5. $\neg m$ (iii)
6. $\therefore \neg(a \wedge q) \equiv \neg a \vee \neg q$ (from 4, 5) Modus Tollen.
7. $\therefore \neg a$ (from 3,6) Elimination.
8. $\neg p \rightarrow a$ (from (ii)) Specialization.
9. $\therefore p$ (from 7, 8) Modus Tollen.