Math 210 – solutions to HW 1.5

1.5) 4, 6adf, 8, 32, 36ad

4) a) There is someone in my class who has taken a CS course.

b) There is someone in my class who has taken all of the CS courses.

c) Everyone in my class has taken a CS course.

d) There is a CS course that everyone in my class has taken.

e) Every CS course has been taken by at least one person in my class.

f) Every person in my class has taken every CS course.

6 a) Randy Goldberg is enrolled in CS 252.

d) There is someone at MSUM who is enrolled in both CS 222 and CS 252.

f) There are two different people who are enrolled in exactly the same classes

8) a) $\exists x \exists y\, Q(x,y)$

b) $\forall x \forall y\, (\neg Q(x,y))$

c) $\exists x\, (Q(x, \text{wheel of Fortune}) \wedge Q(x, \text{Jeopardy}))$

d) $\forall y \exists x\, Q(x,y)$

e) $\exists x \exists y\, (x \neq y) \wedge Q(x, \text{Jco}) \wedge Q(y, \text{Jco}))$

32) a) $\neg(\exists z \forall y \forall x\, T(x,y,z))$

$\equiv \forall z \exists y \exists x\, (\neg T(x,y,z))$

b) $\neg[\exists x \exists y\, P(x,y) \wedge \forall x \forall y\, Q(x,y)]$

$\equiv \forall x \forall y\, (\neg P(x,y)) \vee \exists x \exists y\, (\neg Q(x,y))$

c) $\neg(\exists x \exists y\, [Q(x,y) \leftrightarrow Q(y,x)])$

$\equiv \forall x \forall y\, (Q(x,y) \leftrightarrow \neg Q(y,x))$

d) $\neg(\forall x \exists x \exists z\, (T(x,y,z) \vee Q(x,y)))$

$\equiv \exists y \forall x \forall z\, (\neg T(x,y,z) \wedge \neg Q(x,y))$

36a) i) dom of x: all people
$L(x)$ = "x have lost $\geq \$1000$ in lottery"
$\forall x\, (\neg L(x))$

ii) neg is $\exists x\, L(x)$

iii) Someone has lost more than $1000 playing the lottery.

d) i) dom: all ppl's, $S(x)$ = "x solved every ex in this bk"
$\exists x\, S(x)$

ii) neg is $\forall x (\neg S(x))$

iii) NO student has solved every exercise in this bk.