MAT 2440 - HW2 Solutions

September 2016

Section 1.4

Exercise 6

d

There is a student that hasn't visited North Dakota.

e

Not every student has visited North Dakota.

f

All students have not visited North Dakota.

Exercise 8

c

There is an animal x such that if x is a rabbit, then it hops.

d

There is an animal x such that it is a rabbit and it hops.

Exercise 10

b

$\forall x\,(C(x) \lor D(x) \lor F(x))$

c

$\exists x\,(C(x) \land F(x) \land \neg D(x))$

d

$\neg\exists x\,(C(x) \wedge F(x) \wedge D(x))$ **or** $\forall x \neg\,(C(x) \wedge F(x) \wedge D(x))$

Exercise 36

a

If $x = 1$ then $x^2 = x$

b

If $x = 0$ then $|x| = 0$

Section 1.5

Exercise 10

b

$\forall y F(\text{Evelyn}, y)$

c

$\forall x \exists y F(x, y)$

d

$\neg\exists x \forall y F(x, y)$

Exercise 32

a

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

b

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

Section 1.6

Exercise 16

a

Let $E(x)$ denote "x is enrolled in the university" and let $D(x)$ denote "x has lived in a dormitory".

Step	Reason
1. $\forall x\,(E(x) \to D(x))$	Premise
2. $E(\text{Mia}) \to D(\text{Mia})$	Universal instantiation
3. $\neg D(\text{Mia}$	Premise
4. $\neg E(\text{Mia})$	Modus tollens using steps 2 and 3

b

Let $P(x)$ be "x is a convertible car" and $Q(x)$ be "x is fun to drive". The premises are $\forall x\,(C(x) \to D(x))$. By applying universal instantiation, we get $C(\text{Isaac's car}) \to D(\text{Issac's car})$. Given the premise "$\neg C(\text{Isaac's car})$", this argument is of the form: $((p \to q) \vee \neg p) \to \neg q$. This uses the fallacy of denying the hypothesis.

c

Let $A(x)$ denote "x is an action movie" and let $Q(x)$ denote "Quincy likes movie x". Then the premise is $\forall x\,(A(x) \to Q(x))$. By applying universal instantiation, we get $A(\text{Eight Men Out}) \to Q(\text{Eight Men Out})$. Given the premise "$Q(\text{Eight Men Out})$", this argument is of the form $((p \to q) \wedge q) \to p$. This uses the fallacy of affirming the conclusion.