Patrick Tan
204158646
Disscussion 1C

PROBLEM 1

A. P ⇒ ¬Q, Q ⇒ ¬P

P => ¬Q

P	Q	P => Q
T	T	F
T	F	T
F	T	T
F	F	T

Q => ¬P

P	Q	Q => P
T	T	F
T	F	T
F	T	T
F	F	T

B. P ⇔ ¬Q, ((P ∧ ¬Q) ∨ (¬P ∧ Q))

P ⇔ ¬Q

P	Q	P ⇔ ¬Q
T	T	F
T	F	T
F	T	T
F	F	F

((P ∧ ¬Q) ∨ (¬P ∧ Q))

P	Q	P ∧ ¬Q	¬P ∧ Q	((P ∧ ¬Q) ∨ (¬P ∧ Q))
T	T	F	F	F
T	F	T	F	T
F	T	F	T	T
F	F	F	F	F

PROBLEM 2: Prove using truth table with all possible worlds.

A. (Smoke ⇒ Fire) ⇒ (¬Smoke ⇒ ¬Fire) is neither

Smoke	Fire	Smoke ⇒ Fire	¬Smoke ⇒ ¬Fire	(Smoke ⇒ Fire) ⇒ (¬Smoke ⇒ ¬Fire)
T	T	T	T	T
T	F	F	T	T
F	T	T	F	F
F	F	T	T	T

Patrick Tan
204158646
Disscussion 1C

B. (Smoke ⇒ Fire) ⇒ ((Smoke ∨ Heat) ⇒ Fire) is neither

Smoke	Fire	Heat	Smoke ⇒ Fire	Smoke ∨ Heat	(Smoke ∨ Heat) ⇒ Fire	(Smoke ⇒ Fire) ⇒ ((Smoke ∨ Heat) ⇒ Fire)
T	T	T	T	T	T	T
T	T	F	T	T	T	T
T	F	T	F	T	F	T
T	F	F	F	T	F	T
F	T	T	T	T	T	T
F	T	F	T	F	T	T
F	F	T	T	T	F	F
F	F	F	T	F	T	T

C. ((Smoke ∧ Heat) ⇒ Fire) ⇔ ((Smoke ⇒ Fire) ∨ (Heat ⇒ Fire)) is valid

Smoke	Fire	Heat	Smoke ∧ Heat	((Smoke ∧ Heat) ⇒ Fire)	Smoke ⇒ Fire	Heat ⇒ Fire	((Smoke ⇒ Fire) ∨ (Heat ⇒ Fire))	((Smoke ∧ Heat) ⇒ Fire) ⇔ ((Smoke ⇒ Fire) ∨ (Heat ⇒ Fire))
T	T	T	T	T	T	T	T	T
T	T	F	F	T	T	T	T	T
T	F	T	T	F	F	F	F	T
T	F	F	F	T	F	T	T	T
F	T	T	F	T	T	T	T	T
F	T	F	F	T	T	T	T	T
F	F	T	F	T	T	F	T	T
F	F	F	F	T	T	T	T	T

Note: A and B are satisfiable, meaning they were true in some models.

PROBLEM 3

If the unicorn is mythical, then it is immortal, but if it is not mythical, then it is a mortal mammal. If the unicorn is either immortal or a mammal, then it is horned. The unicorn is magical if it is horned.

Variable Names:

Mythical = Mythical

Mortal = Mortal

Mammal = Mammal

Horned = Horned

Magical = Magical

Patrick Tan
204158646
Disscussion 1C

a.

1. Mythical => ¬Mortal

2. ¬Mythical => Mortal ∧ Mammal

3. ¬Mortal ∨ Mammal => Horned

4. Horned => Magical

b.

1. ¬ Mythical ∨ ¬Mortal

2. Mythical ∨ (Mortal ∧ Mammal)

   (Mythical ∨ Mortal) ∧ (Mythical ∨ Mammal)

   Mythical ∨ Mortal, Mythical ∨ Mammal

3. ¬(¬Mortal ∨ Mammal) ∨ Horned

   (Mortal ∧ ¬Mammal) ∨ Horned

   (Mortal ∨ Horned) ∧ (¬Mammal ∨ Horned)

   Mortal ∨ Horned, ¬Mammal ∨ Horned

4. ¬Horned ∨ Magical

c.

Mythical

1. ¬ Mythical ∨ ¬Mortal

2. Mythical ∨ Mortal

3. Mythical ∨ Mammal

4. Mortal ∨ Horned

5. ¬Mammal ∨ Horned

6. ¬Horned ∨ Magical

7. ¬ Mythical

8. Mortal; 2, 7

9. Mammal; 3, 7

10. Horned; 5, 9

11. Magical; 6, 10

We cannot prove that the unicorn is mythical since there is no contradiction when we use resolution.

Patrick Tan
204158646
Disscussion 1C

Magical

1. ¬ Mythical ∨ ¬Mortal

2. Mythical ∨ Mortal

3. Mythical ∨ Mammal

4. Mortal ∨ Horned

5. ¬Mammal ∨ Horned

6. ¬Horned ∨ Magical

7. ¬ Magical

8. ¬Horned; 6, 7

9. Mortal; 4, 8

10. ¬Mammal; 5, 8

11. ¬ Mythical; 1, 9

12. Mythical; 3, 10

13. Contradiction; 11, 12

Since we find a contradiction, we prove that the unicorn must be magical.

Horned

1. ¬ Mythical ∨ ¬Mortal

2. Mythical ∨ Mortal

3. Mythical ∨ Mammal

4. Mortal ∨ Horned

5. ¬Mammal ∨ Horned

6. ¬Horned ∨ Magical

7. ¬ Horned

8. Mortal; 4, 7

9. ¬Mammal; 5, 7

10. ¬ Mythical; 1, 8

11. Mythical; 3, 9

12. Contradiction; 10, 11

Since we find a contradiction, we prove that the unicorn must be horned.