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Homework 5

1.

a. (Smoke ⇒ Fire) ⇒ (¬Smoke ⇒ ¬Fire)

Smoke	Fire	¬Smoke	¬Fire	Smoke ⇒ Fire	¬Smoke ⇒ ¬Fire	(Smoke ⇒ Fire) ⇒ (¬Smoke ⇒ ¬Fire)
0	0	1	1	1	1	1
0	1	1	0	1	0	0
1	0	0	1	0	1	1
1	1	0	0	1	1	1

Neither

b. (Smoke ⇒ Fire) ⇒ ((Smoke ∨ Heat) ⇒ Fire)

Smoke	Fire	Heat	Smoke ⇒ Fire	(Smoke ∨ Heat) ⇒ Fire	(Smoke ⇒ Fire) ⇒ ((Smoke ∨ Heat) ⇒ Fire)
0	0	0	1	1	1
0	0	1	1	0	0
0	1	0	1	1	1
0	1	1	1	1	1
1	0	0	0	0	1
1	0	1	0	0	1
1	1	0	1	1	1
1	1	1	1	1	1

Neither

c. ((Smoke ∧ Heat) ⇒ Fire) ⇔ ((Smoke ⇒ Fire) ∨ (Heat ⇒ Fire))

Smoke	Heat	Fire	Smoke ∧ Heat	(Smoke ∧ Heat) ⇒ Fire	Smoke ⇒ Fire	Heat ⇒ Fire	(Smoke ⇒ Fire) ∨ (Heat ⇒ Fire)	((Smoke ∧ Heat) ⇒ Fire) ⇔ ((Smoke ⇒ Fire) ∨ (Heat ⇒ Fire))
0	0	0	0	1	1	1	1	1
0	0	1	0	1	1	1	1	1
0	1	0	0	1	1	0	1	1
0	1	1	0	1	1	1	1	1
1	0	0	0	1	0	1	1	1
1	0	1	0	1	1	1	1	1
1	1	0	1	0	0	0	0	1
1	1	1	1	1	1	1	1	1

Valid

2.

a.

Mythical ⇒ ¬Mortal

¬Mythical ⇒ (Mortal ^ Mammal)

(¬Mortal v Mammal) ⇒ Horned

Horned ⇒ Magical

b.

1. (Mythical ⇒ ¬Mortal) ≡ (¬Mythical v ¬Mortal)

2. (¬Mythical ⇒ (Mortal ^ Mammal)) ≡ ((Mythical v Mortal) ^ (Mythical v Mammal))

3. ((¬Mortal v Mammal) ⇒ Horned) ≡ ((Mortal v Horned) ^ (¬Mammal v Horned))

4. (Horned ⇒ Magical) ≡ (¬Horned v Magical)

c. We can't prove it's Mythical because Mythical can be T or F and still satisfy the KB:

Mythical = T, Mortal = F, Horned = T, Magical = T, Mammal = T

Mythical = F, Mortal = T, Horned = T, Magical = T, Mammal = T

To prove it's Horned:

5. ¬Mythical ⇒ Mammal	from 2
6. (¬Mythical v Mythical) ⇒ (Mammal v ¬Mortal)	from 1 and 5
7. Horned	from 3 and 6

To prove it's Magical:

8. Magical	from 4 and 7

3.

a. P(A, B, B), P(x, y, z)

P(A, B, B), P(A, y, z)

P(A, B, B), P(A, B, z)

P(A, B, B), P(A, B, B)

{x/A, y/B, z/B}

b. Q(y, G(A, B)), Q(G(x, x), y)

Q(G(x, x), G(A, B)), Q(G(x, x), G(x, x))

Q(G(A, A), G(A, B)), Q(G(A, A), G(A, A))

Can't unify A and B

c. Older(Father(y), y), Older(Father(x), John)

Older(Father(John), John), Older(Father(x), John)

Older(Father(John), John), Older(Father(John), John)

{x/John, y/John}

d. Knows(Father(y), y), Knows(x,x)

Knows(Father(y), y), Knows(Father(y), Father(y))

Can’t unify y and Father(y)

4.

a.

1. A x, food(x) -> likes(John, x)
2. food(Apples)
3. food(Chicken)
4. A x,y, (eats(x,y) ^ kills(y,x)) -> food(y)
5. A x,y, kills(x,y) -> ¬live(y)
6. eats(Bill, Peanuts) ^ live(Bill)
7. A x, eats(Bill, x) -> eats(Sue,x)

b.

1. ¬food(x) V likes(John, x)
2. food(Apples)
3. food(Chicken)
4. ¬eats(x,y) V ¬kills(y,x)) V food(y)
5. ¬kills(x,y) V ¬live(y)
6. eats(Bill, Peanuts)

    6.5. live(Bill)

7. ¬eats(Bill, x) V eats(Sue,x)

c.

8. eats(Bill, Peanuts) V ¬live(Bill)) V food(Peanuts)	from 4 and 5
9. ¬eats(Bill, Peanuts) V ¬live(Bill)) V food(Peanuts)	from 6, and 6.5
10. food(Peanuts)	from 9
11. likes(John, Peanuts)	from 1 and 10

d.

12. eats(Sue, Peanuts)	from 6 and 7

e.

new sentences:

1. ¬food(x) V likes(John, x)
2. food(Apples)
3. food(Chicken)
4. ¬eats(x,y) V ¬kills(y,x)) V food(y)
5. ¬kills(x,y) V ¬live(y)
6. eats(x,y) V dead(x)
7. ¬dead(x) V ¬live(x)
8. live(Bill)
9. ¬eats(Bill, x) V eats(Sue,x)

10. ¬dead(Bill)	from 7 and 8
11. eats(Bill, y)	from 6 and 10

We can’t go further than this. Can’t prove what Sue eats.