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CS161
HW5

1)
a. P => - Q

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

Q => -P

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

Proven equivalent

b. P ⇔ Q

P	Q	-Q	P => -Q	-Q => P	P ⇔ Q
F	F	T	T	F	F
F	T	F	T	T	T
T	F	T	T	T	T
T	T	F	F	T	F

((P ^ -Q) V (-P ^ Q))

| | | | | A | B | |
P	Q	-P	-Q	P ^ -Q	-P ^ Q	A V B
F	F	T	T	F	F	F
F	T	T	F	F	T	T
T	F	F	T	T	F	T
T	T	F	F	F	F	F

Proven equivalent

2)
a) (Smoke => Fire) => (- Smoke => -Fire)

| | | | | A | B | |
S	F	-S	-F	S = > F	-S => -F	A => B
F	F	T	T	T	T	T
F	T	T	F	T	F	F
T	F	F	T	F	T	T
T	T	F	F	T	T	T

- not valid
- not unsatisfiable
- it is satisfiable (neither)

b) (Smoke => Fire) => (Smoke v Heat) => Fire)

			A		B	
S	F	H	S => F	S v H	(S v H) => F	A => B
F	F	F	T	F	T	T
F	F	T	T	T	F	F
F	T	F	T	F	T	T
F	T	T	T	T	T	T
T	F	F	F	T	F	T
T	F	T	F	T	F	T
T	T	F	T	T	T	T
T	T	T	T	T	T	T

- not valid
- not unsatisfiable
- it is satisfiable (neither)

c) ((Smoke ^ Heat) => Fire) ⟺ ((Smoke => Fire) v (Heat => Fire))

				A			B	
S	H	F	S^H	S^H=>F	S=>F	H=>F	S=>F v H=>F	A⟺B
F	F	F	F	T	T	T	T	T
F	F	T	F	T	T	T	T	T
F	T	F	F	T	T	F	T	T
F	T	T	F	T	T	T	T	T
T	F	F	F	T	F	T	T	T
T	F	T	F	T	T	T	T	T
T	T	F	T	F	F	F	F	T
T	T	T	T	T	T	T	T	T

- it is valid

3)
a)
My = Mythical, I = Immortal, Ma = Mammal, H = Horned, Mg = Magical

1) My => I
2) –My => -I ^ Ma
3) (I v Ma) => H
4) H => Mg

b)
1) – My v I
2) My v (-I ^ Ma)
   (My v -I) ^ (My v Ma)
3) (-I ^ -Ma) v H
   (-I v H) ^ (-Ma v H)
4) –H v Mg

c)
5) I v (-I^ Ma)   (1 & 2)
   (I v Ma)
6) H   (3 & 5)
7) Mg   (4 & 6)

Unicorn is Horned and Magical. We can't find out if it is Mythical or not.