CSE 2321 Homework 1

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AU17

1. (a) Contingency, not a logical equivalence.

P	Q	¬P	∨	¬Q	⇐	⇔	⇒	¬	(P ∨ Q)
T	T	F	F	F	T	T	T	F	T
T	F	F	T	T	T	F	F	F	T
F	T	T	T	F	T	F	F	F	T
F	F	T	T	T	T	T	T	T	F

(b) Tautology, logical equivalence.

P	Q	(P	∧	¬Q	⇐	⇔	⇒	¬	(P ⇒ Q)
T	T		F	F	T	T	T	F	T
T	F		T	T	T	T	T	T	F
F	T		F	F	T	T	T	F	T
F	F		F	T	T	T	T	F	T

(c) Contingency, not a logical equivalence.

P	Q	¬	(P ∨ Q)	∧	(¬	((P ∨ Q))	∧	(¬P)	LEFT ∧ MIDDLE ∧ RIGHT
T	T	F	T	F	F	T	F	F	F
T	F	F	T	F	F	T	F	F	F
F	T	F	T	F	F	T	F	T	F
F	F	T	F	T	T	F	T	T	T

(d) Contingency, not a logical equivalence.

P	Q	R	(P ⇒	(Q ⇒ R))	⇐	⇔	⇒	((P ⇒ Q)	∨	¬	(Q ⇒ R))
T	T	T	T	T	T	T	T	T	T	F	T
T	T	F	F	F	F	F	T	T	T	T	F
T	F	T	T	T	T	F	F	F	F	F	T
T	F	F	T	T	T	F	F	F	F	F	T
F	T	T	T	T	T	T	T	T	T	F	T
F	T	F	T	F	T	T	T	T	T	T	F
F	F	T	T	T	T	T	T	T	T	F	T
F	F	F	T	T	T	T	T	T	T	F	T

(e) Contingency, not a logical equivalence.

P	Q	R	(P ⇒	(Q ⇒ R))	⇐	⇔	⇒	((P ⇒ Q)	⇒	R)
T	T	T	T	T	T	T	T	T	T	
T	T	F	F	F	T	T	T	T	F	
T	F	T	T	T	T	T	T	F	T	
T	F	F	T	T	T	T	T	F	T	
F	T	T	T	T	T	T	T	T	T	
F	T	F	T	F	T	F	F	T	F	
F	F	T	T	T	T	T	T	T	T	
F	F	F	T	T	T	F	F	T	F	

(f) Contingency, not a logical equivalence.

P	Q	R	S	P ∨ R	Q ∨ S	(P ∨ R) ⇒ (Q ∨ S)	¬(P ∨ R ⇒ Q ∨ S)	P ⇒ Q	R ⇒ S	(P ⇒ Q) ∧ (R ⇒ S)	LHS ⇒ RHS
T	T	T	T	T	T	T	F	T	T	T	T
T	T	T	F	T	T	T	F	T	F	F	T
T	T	F	T	T	T	T	F	T	T	T	T
T	T	F	F	T	T	T	F	T	T	T	T
T	F	T	T	T	T	T	F	F	T	F	T
T	F	T	F	T	F	F	T	F	F	F	F
T	F	F	T	T	T	T	F	F	T	F	T
T	F	F	F	T	F	F	T	F	T	F	F
F	T	T	T	T	T	T	F	T	T	T	T
F	T	T	F	T	T	T	F	T	F	F	T
F	T	F	T	F	T	T	F	T	T	T	T
F	T	F	F	F	T	T	F	T	T	T	T
F	F	T	T	T	T	T	F	T	T	T	T
F	F	T	F	T	F	F	T	T	F	F	F
F	F	F	T	F	T	T	F	T	T	T	T
F	F	F	F	F	F	T	F	T	T	T	T

2. (a) $\neg S \wedge \neg Q$.

   (b) $\neg Q \wedge P$.

   (c) $Q \Rightarrow R$.

   (d) $\neg R \Leftarrow Q$.

   (e) $P \vee (\neg S \wedge \neg R)$.

   (f) $(S \wedge \neg R) \Rightarrow \neg P$.

   (g) Ann went to the park and Ann got ice cream but Ann's family didn't play tennis.

   (h) If Ann didn't go to the park or Ann's family went to the park on Saturday, then Ann got ice cream but Ann's family didn't play tennis.

   (i) If Ann got ice cream , then Ann went to the park.

   (j) If Ann's family didn't go to the park on Saturday and Ann's family didn't play tennis, then Ann got ice cream.

3. (a) **Inverse:** If it rains, then I'm not going.
   Contrapositive: If I don't go, then it will rain.

   (b) **Inverse:** If he won't be king, then Arthur won't pull the sword from the stone.
   Contrapositive: If he doesn't pull the sword from the stone, then he won't be king.

   (c) **Inverse:** If you aren't a CSE major, then you don't study computers.
   Contrapositive: If you don't study computers, then you aren't a CSE major.

   (d) **Inverse:** If you play, then you'll win.
   Contrapositive: If you win, then you played.

   (e) **Inverse:** If I don't take my umbrella, then it won't rain.
   Contrapositive: If it doesn't rain, then I won't take my umbrella.