Homework 2

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1 Knowledge Representation

1. Let p = It is cloudy, and let q = It is raining, then q $\rightarrow$ p.
2. Let p = I like to eat apples, and let q = I like to eat bananas, then p $\wedge$ q.
3. Let p = Behind the clouds, and let q = The sun is shining, then q $\rightarrow$ p.
4. Let p = The function is differentiable, and let q = The function is continuous, then p $\rightarrow$ q.
5. Let p = I will study for the final, and let q = I will fail the final, then $\neg$p $\rightarrow$ q.

2 Equivilance in Propositional Logic

1.

p	q	$\neg q$	$p \wedge q$	$p \vee \neg q$	$(p \wedge q) \leftrightarrow (p \vee \neg q)$
0	0	1	0	1	0
0	1	0	0	0	1
1	0	1	0	1	0
1	1	0	1	1	1

The statements p $\wedge$ q and p $\vee$ $\neg$q are not equivilant because not all cases of the final column are true in the truth table.

2.

p	q	$\neg p$	$\neg q$	$p \vee q$	$\neg p \vee \neg q$	$(p \vee q) \leftrightarrow (\neg p \vee \neg q)$
0	0	1	1	0	1	0
0	1	1	0	1	1	1
1	0	0	1	1	1	1
1	1	0	0	1	0	0

The statements p $\vee$ q and $\neg$p $\vee$ $\neg$q are not equivilant because not all cases of the final column are true in the truth table.

3.

p	q	$\neg p$	$\neg q$	$p \rightarrow q$	$\neg q \rightarrow \neg p$	$(p \rightarrow q) \leftrightarrow (\neg q \rightarrow \neg p)$
0	0	1	1	1	1	1
0	1	1	0	1	1	1
1	0	0	1	0	0	1
1	1	0	0	1	1	1

The statements p $\rightarrow$ q and $\neg$q $\rightarrow$ $\neg$p are equivilant because all cases of the final column are true in the truth table.

4.

p	q	$\neg p$	$p \to q$	$\neg p \vee q$	$(p \to q) \leftrightarrow (\neg p \vee q)$
0	0	1	1	1	1
0	1	1	1	1	1
1	0	0	0	0	1
1	1	0	1	1	1

The statements p $\to$ q and $\neg$p $\vee$ q are equivilant because all cases of the final column are true in the truth table.

5.

p	q	$\neg p$	$\neg q$	$\neg(p \wedge q)$	$\neg p \vee \neg q$	$\neg(p \wedge q) \leftrightarrow (\neg p \vee \neg q)$
0	0	1	1	1	1	1
0	1	1	0	1	1	1
1	0	0	1	1	1	1
1	1	0	0	0	0	1

The statements $\neg$(p $\wedge$ q) and $\neg$p $\vee$ $\neg$q are equivilant because all cases of the final column are true in the truth table.