CSE - 015: Homework 2: Propositional Logic and Variables

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February 10, 2019

1 Knowledge Representation:

- It is not cloudy and it is not raining.
  - Solution: Let p = It is not cloudy, and let q = it is not raining, then $-p \wedge -q$
- I like to eat apples and bananas.
  - Solution: Let p = I like to eat apples, and q = I like to eat bananas, then $p \wedge q$
- Behind the clouds the sun is shining.
  - Solution: Let p = Behind the clouds the sun is shinning, then p
- If a function is differentiable then the function is continuous.
  - Solution: Let p = If a function is differentiable, and q = the function is continuous, then $p \rightarrow q$
- I will study for the final otherwise I will fail.
  - Solution: Let p = I will study for the final, and q = I will fail, then $p \rightarrow q$

2 Equivalence in Propositional Logic:

- 1. $p \wedge q$ and $p \vee \neg q$
  - Solution: They are not equivalent, because For p = T and q = F, $T \wedge F$ = F and $T \vee \neg F$ = T, which makes them not equivalent.

p	q	$p \wedge q$	$p \vee \neg q$
0	0	0	1
0	1	0	0
1	0	0	1
1	1	1	1

- 2. $p \vee q$ and $\neg p \vee \neg q$
  - Solution: They are not equivalent, because for p = F and q = F, $F \vee F$ = F and $\neg F \vee \neg F$= T, which makes them not equivalent.

p	q	$p \vee q$	$\neg p \vee \neg q$
0	0	0	1
0	1	1	1
1	0	1	1
1	1	1	0

- 3. $p \rightarrow q$ and $\neg q \rightarrow \neg p$
  - Solution: They are equivalent. Proof: Contra Positive, TruthTable rows Match.

p	q	$p \rightarrow q$	$\neg q \rightarrow \neg p$
0	0	1	1
0	1	1	1
1	0	0	0
1	1	1	1

- 4. $p \rightarrow q$ and $\neg p \vee q$
  - Solution: They are equivalent. Proof The TruthTable, the rows match.

p	q	$p \rightarrow q$	$\neg p \vee q$
0	0	1	1
0	1	1	1
1	0	0	0
1	1	1	1

- 5. $\neg(p \wedge q)$ and $\neg p \vee \neg q$
  - Solution: They are equivalent. Proof: De Morgan's Law, TruthTable rows Match

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