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Foundation of Logical Thought
Assignment - 1

1) a) Not a proposition
b) Proposition (False)
c) Proposition (True)
d) Not a proposition
e) Not a proposition
f) Not a proposition
g) Not a proposition
h) Not a proposition
i) ~~Proposition (True)~~ Not a proposition

2) a) $7 \cdot 11 \cdot 13 \neq 999$
b) 125 is not a perfect cube.
c) $2 \times 10 \neq 20$

3) a) If I bought a lottery ticket this week then I would have won the million dollar jackpot.

b) If and only if I bought a lottery ticket this week, I won the million dollar jackpot.

c) If I didn't bought a lottery ticket this week, then I haven't won the million dollar jackpot.

d) I haven't bought a lottery ticket this week and I haven't won the million dollar jackpot.

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c) I haven't bought a lottery ticket this week or either I bought a lottery ticket this week and I won the million dollar jackpot.

4) a) $r \wedge \neg q$
b) $p \rightarrow r$
c) $(p \wedge q) \rightarrow r$

5) a) ~~False~~ True
b) False
c) False

6) a) Inclusive or (∨), as the statement intended experience with C++ or Java or having both would be much better.

b) Exclusive or, as the lunch gets to choose only one of these starter.

c) Inclusive or, as to enter the country you need a passport or a voter registration card or may be both.

7) a) If you wish to get promoted then you must wash the boss's car.
b) If willy cheats, then he gets caught.
c) If you keep your textbook, then it will be a useful reference in your future courses.

8. a) Converse - I will stay at home only if it snows tonight.
Contrapositive - If I don't stay at home, then it will not have snowed today.
inverse - If it does not snow today, then I will not stay at home.

b) Converse - If I go to the beach then it's a sunny summer day.
Contrapositive - If I don't go to the beach then it isn't a sunny summer day.
inverse - If it isn't a sunny summer day, then I don't go to the beach.

c) Converse - If I sleep untill noon, then I stay up late.
Contrapositive - If I don't sleep until noon, then I don't stay up late.
inverse - If I don't stay up late then I don't sleep until noon.

9) a) $11000 \wedge (01011 \vee 11011)$

Sol. $01011 \vee 11011 =$

$$\begin{array}{r} 01011 \\ \vee\ 11011 \\ \hline 11011 \end{array}$$

$11000 \wedge 11011$

$$= \begin{array}{r} 11000 \\ \wedge\ 11011 \\ \hline 11000 \end{array}$$

$\therefore 11000 \wedge (01011 \vee 11011) = \underline{11000}$

b) $(01010 \oplus 11011) \oplus 01000$

Sol $01010 \oplus 11011 =$

$$\begin{array}{r} 01010 \\ \oplus\ 11011 \\ \hline 10001 \end{array}$$

$10001 \oplus 01000 =$

$$\begin{array}{r} 10001 \\ \oplus\ 01000 \\ \hline 11001 \end{array}$$

$\therefore (01010 \oplus 11011) \oplus 01000 = \underline{\underline{11001}}$

c) $(11011 \vee 01010) \wedge (10001 \vee 11011)$

Sol

$$\begin{array}{r} 11011 \\ \vee\ 01010 \\ \hline 11011 \end{array} \quad \wedge \quad \begin{array}{r} 10001 \\ \vee\ 11011 \\ \hline 11011 \end{array}$$

$$\begin{array}{r} 11011 \\ \wedge\ 11011 \\ \hline 11011 \end{array}$$

$\therefore (11011 \vee 01010) \wedge (10001 \vee 11011) = \underline{\underline{11011}}$

10) a) $P \oplus P$

Sol-

P	P	$P \oplus P$
T	T	F
F	F	F

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b) $(p \leftrightarrow q) \leftrightarrow (r \leftrightarrow s)$

Sol.

p	q	r	s	$p \leftrightarrow q$	$r \leftrightarrow s$	$(p \leftrightarrow q) \leftrightarrow (r \leftrightarrow s)$
T	T	T	T	T	T	T
T	T	T	F	T	F	F
T	T	F	T	T	F	F
T	T	F	F	T	T	T
T	F	T	T	F	T	F
T	F	T	F	F	F	T
T	F	F	T	F	F	T
T	F	F	F	F	T	F
F	T	T	T	F	T	F
F	T	T	F	F	F	T
F	T	F	T	F	F	T
F	T	F	F	F	T	F
F	F	T	T	T	T	T
F	F	T	F	T	F	F
F	F	F	T	T	F	F
F	F	F	F	T	T	T

c) $(p \oplus q) \wedge (p \oplus \neg q)$

Sol.

p	q	$\neg q$	$p \oplus q$	$p \oplus \neg q$	$(p \oplus q) \wedge (p \oplus \neg q)$
T	T	F	F	T	F
T	F	T	T	F	F
F	T	F	T	F	F
F	F	T	F	T	F

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11) a) if $x+2=3$ then $x := x+1$

Sol. The condition $x+2=3$ is true for $(x=1)$

$\Rightarrow x = x+1 \Rightarrow x = 1+1 \Rightarrow x = 2$

Hence final value of x will be 2

b) if $(2x+3=5)$ AND $(3x+4=7)$ then $x := x+1$

Sol. The condition $2x+3=5$ is true for $(x=1)$

and also the condition $(3x+4=7)$ is true for $(x=1)$

$\Rightarrow x = x+1 \Rightarrow x = 1+1 \Rightarrow x = 2$

Hence final value of x will be 2

c) if $x<2$ then $x := x+1$

Sol. The condition $x<2$ is true, for $(x=1)$

$\Rightarrow x = x+1 \Rightarrow x = 1+1 \Rightarrow x = 2$

Hence final value of x will be 2

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