CSE 015: Discrete Mathematics
Fall 2020
Homework #01
Solution

Tony Doan
Lab CSE-015-11L

September 7, 2020

1. **Question 1:**

   (a) It is not the case that XYZ is a CSE major.

   (b) It is not the case that XYZ scored at least 90% in the labs.

   (c) XYZ scored 100% in the CSE015 final or XYZ scored at least 90% in the labs which implies XYZ receives an A+ in CSE015.

   (d) XYZ scored 100% in the CSE015 final and XYZ scored at least 90% in the labs which implies XYZ recieves an A+ in CSE015.

   (e) It is not the case that XYZ is not a CSE major which implies it is not the case that XYZ receives an A+ in CSE015.

2. **Question 2:**

   (a) $\mathbf{p} \oplus (\mathbf{q} \vee \neg \mathbf{r})$

p q r	$\mathbf{q} \vee \neg \mathbf{r}$	$\mathbf{p} \oplus (\mathbf{q} \vee \neg \mathbf{r})$
F F F	T	T
F F T	F	F
F T F	T	T
F T T	T	T
T F F	T	F
T F T	F	T
T T F	T	F
T T T	T	F

(b) $(\mathbf{p} \vee \mathbf{q}) \rightarrow (\neg \mathbf{r} \vee \mathbf{p})$

p q r	$\mathbf{p} \vee \mathbf{q}$	$\neg \mathbf{r} \vee \mathbf{p}$	$(\mathbf{p} \vee \mathbf{q}) \rightarrow (\neg \mathbf{r} \vee \mathbf{p})$
F F F	F	T	T
F F T	F	F	T
F T F	T	T	T
F T T	T	F	F
T F T	T	T	T
T F T	T	T	T
T T F	T	T	T
T T T	T	T	T

(c) $((\mathbf{p} \rightarrow \mathbf{q}) \wedge \mathbf{p}) \rightarrow \mathbf{q}$

p q	$\mathbf{p} \rightarrow \mathbf{q}$	$(\mathbf{p} \rightarrow \mathbf{q}) \wedge \mathbf{p})$	$((\mathbf{p} \rightarrow \mathbf{q}) \wedge \mathbf{p}) \rightarrow \mathbf{q}$
F F	T	F	T
F T	T	F	T
T F	F	F	T
T T	T	T	T

3. **Question 3:**

(a) $\mathbf{p} \vee (\mathbf{q} \wedge \mathbf{r}) \equiv (\mathbf{p} \vee \mathbf{q}) \wedge (\mathbf{p} \vee \mathbf{r})$

p q r	$\mathbf{q} \wedge \mathbf{r}$	$\mathbf{p} \vee (\mathbf{q} \wedge \mathbf{r})$	p q r	$\mathbf{p} \vee \mathbf{q}$	$\mathbf{p} \vee \mathbf{r}$	$(\mathbf{p} \vee \mathbf{q}) \wedge (\mathbf{p} \vee \mathbf{r})$
F F F	F	F	F F F	F	F	F
F F T	F	F	F F T	F	T	F
F T F	F	F	F T F	T	F	F
F T T	T	T	F T T	T	T	T
T F F	F	T	T F F	T	T	T
T F T	F	T	T F T	T	T	T
T T F	F	T	T T F	T	T	T
T T T	T	T	T T T	T	T	T

(b) $(\mathbf{p} \rightarrow \mathbf{q}) \wedge (\mathbf{p} \rightarrow \mathbf{r}) \equiv \mathbf{p} \rightarrow (\mathbf{q} \wedge \mathbf{r})$

p q r	$\mathbf{p} \rightarrow \mathbf{q}$	$\mathbf{p} \rightarrow \mathbf{r}$	$(\mathbf{p} \rightarrow \mathbf{q}) \wedge (\mathbf{p} \rightarrow \mathbf{r})$	p q r	$\mathbf{q} \wedge \mathbf{r}$	$\mathbf{p} \rightarrow (\mathbf{q} \wedge \mathbf{r})$
F F F	T	T	T	F F F	F	T
F F T	T	T	T	F F T	F	T
F T F	T	T	T	F T F	F	T
F T T	T	T	T	F T T	T	T
T F F	F	F	F	T F F	F	F
T F T	F	T	F	T F T	F	F
T T F	T	F	F	T T F	F	F
T T T	T	T	T	T T T	T	T

4. **Question 4:**

(a) $\mathbf{p} \rightarrow (\mathbf{p} \vee \mathbf{q})$

p q	$\mathbf{p} \vee \mathbf{q}$	$\mathbf{p} \rightarrow (\mathbf{p} \vee \mathbf{q})$
F F	F	T
F T	T	T
T F	T	T
T T	T	T

Tautology

(b) $(p \wedge q) \rightarrow \neg p$

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

Contingency

(c) $(p \rightarrow (q \vee r) \rightarrow (\neg q \vee p)$

p	q	r	$q \vee r$	$(p \rightarrow (q \vee r)$	$\neg q \vee p$	$(p \rightarrow (q \vee r) \rightarrow (\neg q \vee p)$
F	F	F	F	T	T	T
F	F	T	T	T	T	T
F	T	F	T	T	F	F
F	T	T	T	T	F	F
T	F	F	F	F	T	T
T	F	T	T	T	T	T
T	T	F	T	T	T	T
T	T	T	T	T	T	T

Contingency

5. **Question 5:**

(a) You cannot be late and you cannot smoke.
p: You cannot be late
q: You cannot smoke
$\neg(p \wedge q) \equiv \neg p \vee \neg q$

It is not the case that you cannot be late or it is not the case that you cannot smoke.

(b) It is not the case that you can take an annuity and you can take a lump sum.
n: you can take an annuity
r: you can take a lump sum
$\neg(\neg n \wedge r) \equiv n \vee \neg r$

You can take an annuity or it is not the case that you can take a lump sum.