

# HW1 (CSCI-C241)

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## 1. Question One

- (a) b, c, h, i, k, m, o, p

## 2. Question Two

- (a)  $P$  = I had good intentions  
 $Q$  = I had the highest hopes  
 $P \wedge Q$
- (b)  $P$  = The card has the same color as the previous card  
 $Q$  = The card has the same number as the previous card  
 $P \vee Q$
- (c)  $P$  = I will eat my tie  
 $Q$  = The bears win the world series  
 $Q \rightarrow P$
- (d)  $P$  = It smelt funny  
 $Q$  = He ate it anyway  
 $P \wedge Q$
- (e)  $P$  = All prizes will be awarded  
 $Q$  = Enough eligible entries are received  
 $Q \rightarrow P$
- (f)  $P$  = Participants were not timed on this task  
 $Q$  = Most finished in less than 8 minutes  
 $P \wedge Q$
- (g)  $P$  = The image is recovered  
 $Q$  = The receiver has an authenticated secret key  
 $P \leftrightarrow Q$
- (h)  $P$  = The printer can hold a black ink cartridge  
 $Q$  = The printer can hold a color cartridge  
 $P \oplus Q$

- (i) P = Changing batteries is a tedious task  
Q = The nodes are deployed in a remote environment  
R = The nodes are deployed in a hostile environment  
 $(Q \vee R) \rightarrow P$
- (j) P = The people will give up their arms  
Q = The tyrant resigns  
R = We get our money back  
 $(Q \wedge R) \rightarrow P$
- (k) P = The Lyapunov function exists  
Q = The system is stable  
 $P \rightarrow Q$
- (l) P = The Turing Test was passed  
Q = The individual is intelligent  
 $Q \rightarrow P$
- (m) REVIEW:  
P = There are no antibodies in the subject's body  
Q = The subject is not susceptible to an infection  
 $P \rightarrow Q$
- (n) P = Disciplinary knowledge is used  
Q = Organizational skills is used  
R = The teaching is considered effective  
 $(P \wedge Q) \rightarrow R$
- (o) P = Rice  
Q = Mashed Potatoes  
R = Fried Plantains  
 $P \oplus Q \oplus R$
- (p) P = I am ready  
C = Here I come  
 $(P \vee \neg P) \rightarrow C$
- (q) M = Someone makes a false move  
X = The whole thing explodes  
 $M \rightarrow X$

### 3. Question Three

- (a) The command returns an integer or displays a message.
- (b) The command returns an integer if and only if a message is displayed.
- (c) The command returns an integer if there is not an exception thrown.
- (d) The command does not throw an exception and does not display a message.

- (e) The command will end up displaying a message with a number returned or an exception will be thrown.

4. Question Four

- (a) This is not an accurate translation because the english statement is causation and the translation is implication.
- (b) This is not an accurate translation because it is still possible for one of the atomic propositions to be true even when the other is false.
- (c) I do not believe there is any way to translate this statement into propositional logic, due to the fact that I am not aware of any operators that show causation.

5. Question Five

- (a)  $A = \text{true}$

$B = \text{true}$

$$A \rightarrow \neg B = \text{true} \rightarrow \neg \text{false} = \text{true} \rightarrow \text{true} = \text{true}$$

- (b) The statement is not satisfiable as shown in the following truth table:

A	B	$(A \wedge \neg A) \vee (B \wedge \neg B)$
true	true	false
true	false	false
false	true	false
false	false	false

- (c)  $X = \text{false}$

$$X \rightarrow \neg X = \text{false} \rightarrow \neg \text{false} = \text{false} \rightarrow \text{true} = \text{true}$$

- (d)  $A = \text{false}$

$B = \text{true}$

$$\neg A \rightarrow \neg(A \vee B) = \neg \text{true} \rightarrow \neg(\text{true} \vee \text{false}) = \text{false} \rightarrow \text{true} = \text{false}$$

- (e) i.  $A = \text{true}$

$B = \text{true}$

$$\neg A \rightarrow \neg(A \vee B) = \neg \text{true} \rightarrow \neg(\text{true} \vee \text{true}) = \text{false} \rightarrow \text{false} = \text{true}$$

- ii.  $A = \text{false}$

$B = \text{true}$

$$\neg A \rightarrow \neg(A \vee B) = \neg \text{false} \rightarrow \neg(\text{false} \vee \text{true}) = \text{true} \rightarrow \text{false} = \text{false}$$

- (f) The statement is a tautology as shown in the following truth table:

A	B	C	$((A \rightarrow B) \wedge (C \vee \neg B)) \rightarrow (A \rightarrow C)$
true	true	true	true
true	true	false	true
true	false	true	true
true	false	false	true
false	true	true	true
false	true	false	true
false	false	true	true
false	false	false	true

(g) A = true

B = true

C = true

$((A \rightarrow B) \wedge (C \vee \neg B)) \rightarrow (A \rightarrow C) = ((\text{true} \rightarrow \text{true}) \wedge (\text{true} \vee \text{false})) \rightarrow (\text{true} \rightarrow \text{true}) = (\text{true} \wedge \text{true}) \rightarrow \text{true} = \text{true} \rightarrow \text{true} = \text{true}$

(h) The statement is not a contingency as shown in the following truth table:

A	B	C	$((A \rightarrow B) \wedge (C \vee \neg B)) \rightarrow (A \rightarrow C)$
true	true	true	true
true	true	false	true
true	false	true	true
true	false	false	true
false	true	true	true
false	true	false	true
false	false	true	true
false	false	false	true

(i) A = true

B = true

$(A \rightarrow B) \rightarrow (\neg A \rightarrow \neg B) = (\text{true} \rightarrow \text{true}) = \text{true}$

(j) A = false

B = true

$(A \rightarrow B) \rightarrow (\neg A \rightarrow \neg B) = (\text{false} \rightarrow \text{true}) \rightarrow (\text{true} \rightarrow \text{false}) = \text{true} \rightarrow \text{false} = \text{false}$

(k) A = false

B = true

C = false

D = true

$\neg A \vee ((D \vee \neg D) \rightarrow ((B \wedge \neg B) \leftrightarrow (C \rightarrow C))) = \neg \text{false} \vee ((\text{true} \vee \neg \text{true}) \rightarrow ((\text{true} \wedge \neg \text{true}) \leftrightarrow (\text{false} \rightarrow \text{false}))) = \text{true} \vee (\text{true} \rightarrow (\text{false} \leftrightarrow \text{true})) = \text{true}$

## 6. Question Six

(a)  $A = \text{true}$

$B = \text{false}$

i.  $A \wedge \neg B = \text{true} \wedge \neg \text{false} = \text{true} \wedge \text{true} = \text{true}$

ii.  $A \vee B = \text{true} \vee \text{false} = \text{true}$

(b) The statement is inconsistent as shown in the following truth table:

P	Q	$P \rightarrow Q$	P	$\neg Q$
true	true	true	true	false
true	false	false	true	true
false	true	true	false	false
false	false	true	false	true

(c)  $H = \text{false}$

$E = \text{false}$

$G = \text{true}$

i.  $H \rightarrow E = \text{false} \rightarrow \text{false} = \text{true}$

ii.  $\neg G \leftrightarrow H = \neg \text{true} \leftrightarrow \text{false} = \text{false} \leftrightarrow \text{false} = \text{true}$

iii.  $G = \text{true}$