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CS131 - Fall 2019, Assignment 1

Ques 1. - Analyze the logical form of the following statements

(a) Mary and kevin are not both in CAS B12

(b) Mary and kevin are both not in CAS B12

(c) Either Mary or kevin is not in CAS B12

(d) Neither Mary nor kevin is in CAS B12

M = Mary is in CAS B12

K = kevin is in CAS B12

Q a. $\neg(M \wedge K)$

Q b. $\neg M \wedge \neg K$

Q c $(\neg M) \vee (\neg K) = \neg(M \wedge K)$

M	K	$(\neg M) \vee (\neg K)$
F	F	T
F	T	T
T	F	T
T	T	F

Q.d $(\neg M) \wedge (\neg K)$, or $\neg(M \vee K)$

M	K	$(\neg M) \wedge (\neg K)$
F	F	T
F	T	F
T	F	F
T	T	F

M	K	a	b	c	d
F	F	T	T	T	T
F	T	T	F	T	F
T	F	T	F	T	F
T	T	F	F	F	F

Ques 2.

(a) - 1. Jane and pete won't both win the math prize

-2. pete will win either the math prize or the chemistry prize.

-3. Jane will win the math prize

-4 Therefore, pete will win the chemistry prize.

J: Jane'll win the math prize
P: Pete'll win the math prize
M: Pete'll win the chemstry prize

premises
(a) 1 - $\neg(J \wedge P)$
(a) 2 - $P \vee M$
(a) 3 - J
conclusion - M

J	P	M	(1) $\neg(J \wedge P)$	(2) $P \vee M$	(3) J	$[\neg(J \wedge P)] \wedge (P \vee M) \wedge J$
F	F	F	T	F	F	F
F	F	T	T	T	F	F
F	T	F	T	T	F	F
F	T	T	T	T	F	F
T	F	F	T	F	T	F
T	F	T	T	T	T	T
T	T	F	F	T	T	F
T	T	T	F	T	T	F

Conclusion is valid because Through out all the premises, one is True when the clusion M is True at the same time.

Question 2

(b) -1. Either John or Bill is telling the truth

-2 Either Sam or Bill is lying

Conclusion: Therefore, either John is telling the truth or Sam is lying

J = John is telling the Truth
B = Bill is telling the truth
S = Sam is telling the truth.

Premises: -1 $J \vee B$

-2 $\neg S \vee \neg B$

$\neg(S \vee B)$

S	B	$\neg S \vee \neg B$
F	F	T
F	T	T
T	F	T
T	T	F

S	B	$\neg(S \vee B)$
F	F	T
F	T	F
T	F	F
T	T	F

Conclusion: $J \vee \neg S$

J	B	S	① $J \vee B$	② $\neg S \vee \neg B$	$(J \vee B) \wedge (\neg S \vee \neg B)$	$J \vee \neg S$
F	F	F	F	T	F	T
F	F	T	F	T	F	F
F	T	F	T	T	T	T
F	T	T	T	F	F	F
T	F	F	T	T	T	T
T	F	T	T	T	T	T
T	T	F	T	T	T	T
T	T	T	T	F	F	T

The conclusion is valid because every time the premises $(J \vee B) \wedge (\neg S \vee \neg B)$ is true, the conclusion $J \vee \neg S$ is True

Question 2.

(c.) premises - 1. If Sales go up then the boss will be happy

- 2 If expenses go up then the boss won't be happy

conclusion: Therefore, Sales and expenses will not both go up.

S = Sales go up
b = boss will be happy
E = expenses go up.

premises: 1 $S \rightarrow b$
2. $E \rightarrow \neg b$
Conclusion: $\neg(S \wedge E)$

S	b	E	① $S \rightarrow b$	② $E \rightarrow \neg b$	$(S \rightarrow b) \wedge (E \rightarrow \neg b)$	$\neg(S \wedge E)$
F	F	F	T	T	T	T
F	F	T	T	T	T	T
F	T	F	T	T	T	T
F	T	T	T	F	F	T
T	F	F	F	T	F	T
T	F	T	F	T	F	T
T	T	F	T	T	T	T
T	T	T	T	F	F	F

The conclusion is valid because when the premises $(S \rightarrow b) \wedge (E \rightarrow \neg b)$ are true, the conclusion is true.

Question 3.

(a) $P \leftrightarrow Q$ and $(P \wedge Q) \vee (\neg P \wedge \neg Q)$

P	Q	$P \leftrightarrow Q$	$P \wedge Q$	$\neg P \wedge \neg Q$	$(P \wedge Q) \vee (\neg P \wedge \neg Q)$
F	F	T	F	T	T
F	T	F	F	F	F
T	F	F	F	F	F
T	T	T	T	F	T

$P \leftrightarrow Q$ and $(P \wedge Q) \vee (\neg P \wedge \neg Q)$ are logically the same (equivalent.) $P \leftrightarrow Q \equiv (P \wedge Q) \vee (\neg P \wedge \neg Q)$

(b) $(P \rightarrow Q) \vee (P \rightarrow R)$ $P \rightarrow (Q \vee R)$

1. $(P \rightarrow Q) \vee (P \rightarrow R)$ $P \rightarrow q \equiv \neg P \vee q$ Law
$= (\neg P \vee Q) \vee (\neg P \vee R)$ (distributive Law)
$= \neg P \vee (Q \vee R)$
$\equiv P \rightarrow (Q \vee R)$ $\neg P \vee q \equiv P \rightarrow q$ Law

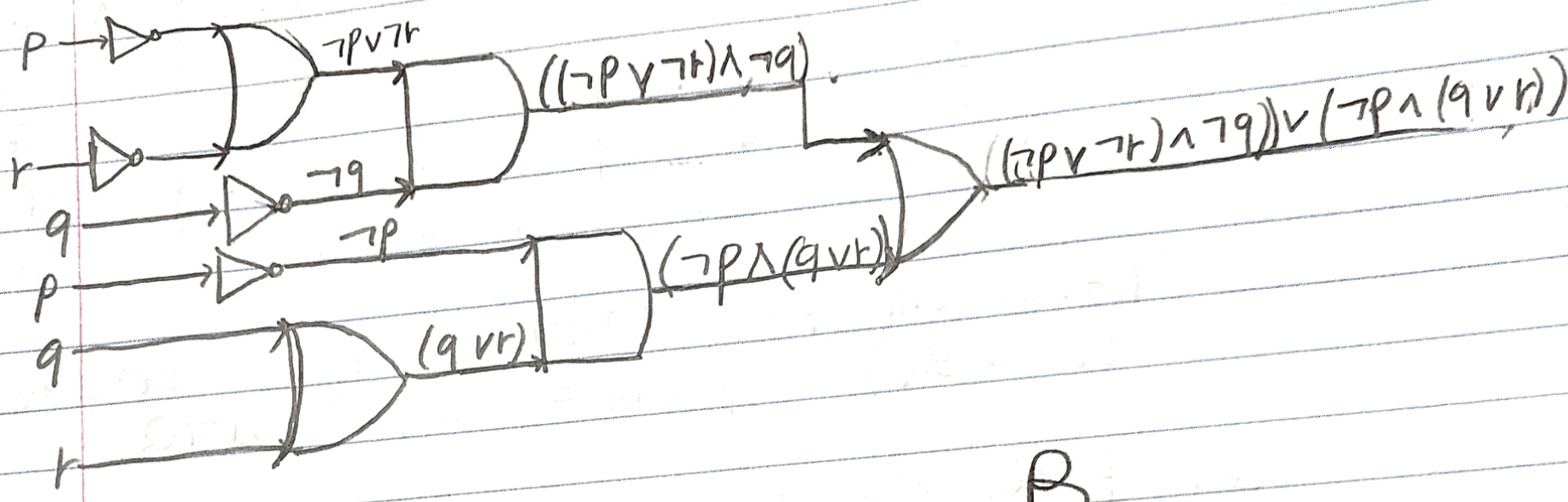
(c) $(P \rightarrow Q) \vee (Q \rightarrow R)$ is tautology

P	Q	R	$P \rightarrow Q$	$Q \rightarrow R$	$(P \rightarrow Q) \vee (Q \rightarrow R)$
F	F	F	T	T	T
F	F	T	T	T	T
F	T	F	T	F	T
F	T	T	T	T	T
T	F	F	F	T	T
T	F	T	F	T	T
T	T	F	T	F	T
T	T	T	T	T	T

Since all of $(P \rightarrow Q) \vee (Q \rightarrow R)$ in Truth table is True, it is tautology

Ques 4

(a) $((\neg p \vee \neg r) \wedge \neg q) \vee (\neg p \wedge (q \vee r))$.



Ques 5

(a)

A

(1) In this room, there is a lady, and in the other one there is a tiger.

B

In one of these rooms, there is a lady, and in one of them, there is a tiger.

A: first door is true
B: second door is true

since

if A the B so when A is true B is true

$\neg A \wedge B$

If the first answer is true then first and second door both have to be true we cannot have two true sign, so the second sign is true, and the first sign is false.