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CS135 Problem Set 2 1/30

1) a) • $(p \to q) \vee (q \to p)$ Conditional Identities ↴

$(\neg p \vee q) \vee (\neg q \vee p)$ Associative Laws ↳ Commutative Laws ↴

$\neg p \vee p \vee \neg q \vee q$ Complement Laws ↴

$T \vee T \equiv T$

$\therefore (p \to q) \vee (q \to p) \equiv T$

b) • $(p \wedge (p \to q)) \vee \neg((\neg p \vee q) \wedge p)$ Conditional Identities ↴

$(p \wedge (\neg p \vee q)) \vee \neg((\neg p \vee q) \wedge p)$ Complement Laws ↴

T

$\therefore (p \wedge (p \to q)) \vee \neg((\neg p \vee q) \wedge p) \equiv T$

c) • $(p \to \neg p) \to \neg p$ Conditional Identities ↴

$\neg(p \to \neg p) \vee \neg p$

$\neg(\neg p \vee \neg p) \vee \neg p$ De Morgan's

$p \wedge p \vee \neg p$ Idempotent

$p \vee \neg p$ Complement

T

$\therefore (p \to \neg p) \to \neg p$ is a tautology

d) • $((p \to R) \wedge (Q \to \neg R)) \to \neg(p \to Q)$ ∴ if $P = Q = R = F$, the proposition is false.

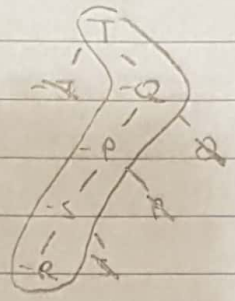
* Implications are true if the left side (implies) is false or right side (implied) is true.
$P \rightarrow Q \equiv \neg P \vee Q$

2) 1) P = someone has special power
Q = someone is a werewolf
R = someone can kill others
S = someone is dangerous
T = someone is a villager

① $P \rightarrow Q$
② $R \rightarrow S$
③ $S \rightarrow P$
④ $T \rightarrow \neg Q$
⑤ $\therefore T \rightarrow R$ negate → $\neg(T \rightarrow R) \equiv T \wedge \neg R$

→ Assume that the conclusion is false by negating. If there is a counterexample to the false conclusion, the argument / original case is true. Otherwise false.

• If T = True ∴
Q = P = S = R = False,
T → R is false
and therefore
invalid

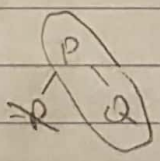


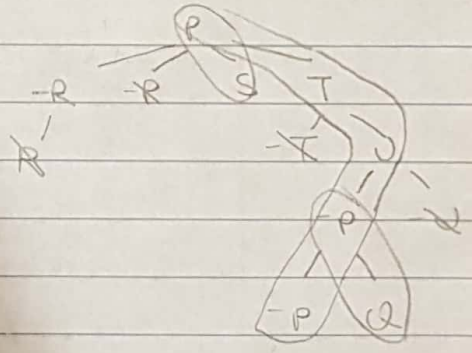
∴ $T \wedge \neg R$ is true; the argument $T \rightarrow R$ is invalid.

2) P = someone gets an oatmeal raisin cookie
Q = someone is Zoey
R = there are leftover orc's
S = someone is Elmo
T = someone is Rocco
U = someone is a rock

$P \rightarrow Q$
$R \rightarrow (P \rightarrow (S \vee T))$
$P \rightarrow \neg U$
R
$T \rightarrow U$
$\therefore S \rightarrow \neg P$ → $\neg(S \rightarrow \neg P) \equiv S \wedge P$

$\neg R \vee (\neg P \vee (S \vee T))$
$\rightarrow \neg R \vee \neg P \vee S \vee T$





• If P & Q are true, S → ¬P is false and therefore invalid.

Issac Zheng CS135 Problem Set 2

Aparna Bella 3) 1) If someone is a ghost, Franklin is a ghost.
~~Colleen~~ Ella 2) If Saoirse and Franklin are ghosts, Everyone is a ghost.
Danielle ~~Hamis~~ 3) Danielle and colleen are not both ghosts.
~~Franklin~~ Isabel 4) If Franklin is a ghost, Sanjana is not a ghost. Hamis is not a ghost.
~~Jakob~~ Jessica 5) If Colleen is a ghost, Danielle is a ghost.
~~M.K.~~ ~~M.T.~~ 6) If Colleen & Matthew T. are ghosts, Harris is not a ghost.
~~Sanjana~~ ~~Saoirse~~ 7) If Matthew T. is a ghost, Harris is a ghost.
Sandeep 8) Neither Bella nor Ella are ghosts.
9) If Isabel is a ghost, Aparna is not a ghost. Jessica is not a ghost.
10) If Matthew K. or Jakob is a ghost, Colleen is a ghost.
11) If Sandeep is not a ghost, Either Jessica is not a ghost or Ella is a ghost.

Deduction

There are 5 ghosts. So someone is a ghost, implying that Franklin is a ghost (4 left). Since Franklin is a ghost, Sanjana and Hamis aren't ghosts, and Saoirse cannot be a ghost since not everyone is a ghost. If Colleen is a ghost implies that Danielle is a ghost, and they cannot both be ghosts, Colleen is not a ghost. Since Colleen is not a ghost, neither MK nor Jacob can be ghosts. Since M.T. being a ghost implies that Hamis is a ghost, Colleen is not a ghost, and if both Colleen & MT are ghosts, then Hamis is not a ghost, neither M.T. nor Hamis are ghosts.

ignore the crossout. Also, if Jessica being a ghost eliminates two from being a ghost, but there are 5 ghosts and only 6 available people left, Jessica cannot be a ghost. Therefore, the ghosts are Aparna, Danielle, Isabel, Sandeep, and Franklin. Jessica is not a ghost.

EC) • One of the not hungry statements is false
• If 6 is false, then the not hungry person stole the cookie
• If Jo or Sam stole the cookie, their statement is false and the other's is true.
• If Sam stole the cookie, 2 is false.
↳ If 1 is true, then 6 is false, 3 is true, 5 is false, and 4 is true, which is one too many true statements.
↳ If 1 is false, 6 is true, 3 & 5 both are either true or false, and 4 is true.
=> 1 = F, 6 = T, 3 = 5 = F, 4 = T, 2 = F
↳ 2 true statements!!
∴ Sam stole the cookies.