1.1 Deductive Reasoning and Logical Connectives Problems

Wednesday, April 2, 2025 8:21 PM

1 Analyze logical forms of following sentences

a) We'll have either a reading or homework problems, but we won't have both homework problems and a test.

H: We have homework problems
T: We have a test

$(H \vee T) \wedge \neg(H \wedge T)$

b) You won't go skiing, or you will and there won't be snow.

S: You go skiing
N: It will snow

$\neg S \vee (S \wedge \neg N)$

c) $\sqrt{5} \nleq 2$

$(\sqrt{5} < 2) \wedge (\sqrt{5} = 2)$

3. a) Alice and Bob are not both in the room.

A: Alice is in the room
B: Bob is in the room

$\neg(A \wedge B)$

b) Alice and Bob are both not in the room.

$\neg A \wedge \neg B$

c) Either Alice or B is not in the room.

$\neg A \vee \neg B$

d) Neither Alice or Bob is in the room.

$\neg A \wedge \neg B$

skipped 2.1.1

2.1.a) J: John is telling the truth

2.a) J: John is telling the truth

B: Bill is telling the truth

$(J \vee B) \vee \neg(J \vee B)$

b) C: I'll have chicken

F: I'll have fish

M: I'll have mashed potatoes

$(C \vee F) \wedge \neg(F \wedge M)$

c) A: 3 is a common divisor of 6

B: 3 is a common divisor of 9

C: 3 is a common divisor of 15

$A \wedge B \wedge C$

4. a) R: Ralph is tall

E: Ed is tall

A: Ralph is handsome

B: Ed is handsome

$(R \wedge E) \vee (A \wedge B)$

b) $(R \vee A) \wedge (E \vee B)$

c) $\neg(R \vee E) \wedge \neg(E \vee B)$

d) $\neg(R \wedge E) \wedge \neg(E \wedge B)$

5. a) well formed

b) not well formed

c) well formed

d) not well formed

6. a) I will not both buy the pants

6. a) I will not both buy the pants and not buy the shirt,

b) I will not by the pants and I will not by the shirt,

c) I will not by the pants or I will not by the shirt,

7. a) Steve or George is happy but either Steve or George is not happy

b) Steve is happy or George is happy and Steve is not happy or George is not happy

c). Steve is happy or George is happy and steve is not happy or George is not happy.

8. a) Taxes will go up or the deficit will go up.

b) neither taxes or the deficit will go up or both will go up.

c). taxes will go up and deficit will not or the deficit will go up and taxes will not.

9. a) premises:

June and Pete won't Both win the math prize

Pete will win either the math chemistry prize.

June will win the math prize.

conclusion: $\neg(J_m \wedge P_m) \wedge (P_m \vee P_c) \wedge J_m \therefore P_c$

conclusion: $\neg(J_m \wedge P_m) \wedge (P_m \vee P_c) \wedge J_m \therefore P_c$

Pete will win the chemistry prize.

That is valid.

b) Promises:

The main course will be either fish or beef.

The vegetable will be either peas or corn.

We will not have both fish as a main course and corn as a vegetable.

Conclusion: $(F \vee B) \wedge (P \vee C) \wedge \neg(F \wedge C) \therefore \neg(B \wedge V)$

We will not have both beef as a main course and peas a a vegetable,

Does not follows logically

c Promises:

Either John or Bill is telling the truth

Either Sam or Bill is lying

Conclusion: $(J \vee B) \wedge (S \vee \neg B) \therefore J \vee \neg S$

Either John is telling the truth or Sam is lying.

Does logically follow

d Promises

Either Sale will go up and the Boss will be happy or expenses will go up and the boss will not be happy

Conclusion. $(S \wedge B) \vee (E \wedge \neg B) \therefore \neg(S \wedge E)$

Sales and expenses can't both go up

conclusion, correlation: sales and expenses can't both go up does logically follow