

Tutorial 4

Foundations of Computing Science

Pallab Dasgupta
Professor,
Dept. of Computer Sc & Engg



Questions

1. Express the following statements as propositional logic formulae.

- (a) Fido is always either sleeping or barking.
- (b) When Fido is hungry Fido barks, but Fido's barking does not necessarily mean that Fido is hungry.

2. According to political experts "A person who is a radical(R) is elected (E) if (s)he is conservative (C), but otherwise is not elected. Which of the following are correct representations of this assertion and why?

(a) $(R \wedge E) \Leftrightarrow C$

(b) $R \Rightarrow (E \Leftrightarrow C)$

(c) $R \Rightarrow ((C \Rightarrow E) \vee \neg E)$

Questions

3. Which of the following sentences are valid, unsatisfiable, or neither.

- (a) $\text{Smoke} \Rightarrow \text{Smoke}$
- (b) $\text{Smoke} \Rightarrow \text{Fire}$
- (c) $\text{Smoke} \vee \text{Fire} \vee \neg \text{Fire}$
- (d) $(\text{Smoke} \Rightarrow \text{Fire}) \Rightarrow (\neg \text{Smoke} \Rightarrow \neg \text{Fire})$
- (e) $(\text{Smoke} \Rightarrow \text{Fire}) \Rightarrow (\text{Smoke} \wedge \text{Heat} \Rightarrow \text{Fire})$

4. Prove whether or not the following rule of inference is sound: $(P \Rightarrow Q, \neg Q) / \neg P$

5. Convert the sentence $A \Leftrightarrow (B \vee E)$ to CNF, where your answer will be one or more “clauses”. Using the clauses obtained, and the clauses: $(\neg E \vee D)$, $(\neg C \vee \neg F \vee \neg B)$, $(\neg E \vee B)$, $(\neg B \vee F)$, $(\neg B \vee C)$, determine if $\neg B$ is true using resolution refutation. Show the proof tree.

Questions

6. Consider the following hypotheses:

- (a) If it rains, Joe brings his umbrella
- (b) If Joe has an umbrella, he doesn't get wet.
- (c) If it doesn't rain, Joe doesn't get wet.

Prove that Joe never gets wet.

Questions

7. Let the propositions have intuitive meanings as given here:
Encode the following ideas as *clauses* or *product of clauses*:

- (a) If test T is positive, then that person has blood type A or AB.
- (b) If test S is positive, then that person has blood type B or AB.
- (c) If a person has type A, then test T will be positive.
- (d) If a person has type B, then test S will be positive.
- (e) If a person has type AB, then both tests T and S will be positive.
- (f) A person has type A, B, AB, or O blood.

Props.	Meaning
a	A person has blood type A.
b	A person has blood type B.
c	A person has blood type AB.
o	A person has blood type O.
t	Test T is positive on a person's blood sample.
s	Test S is positive on a person's blood sample.