

Propositional Logic Practice

Q1. Symbolize the following statements by propositional formulas:

- (a) A relation is an equivalence relation if and only if it is reflexive, symmetric, and transitive
- (b) It requires courage and skills to climb that mountain
- (c) If he is a man who campaigns so hard, he probably will be elected.

Q2. Let

$P \equiv$ He needs a doctor

$Q \equiv$ He needs a lawyer

$R \equiv$ He has an accident

$S \equiv$ He is sick

$U \equiv$ He is injured

Translate the following formulas to English

(a) $(S \Rightarrow P) \wedge (R \Rightarrow Q)$

(b) $(P \wedge Q) \iff (S \wedge U)$

(c) $\sim(S \vee U) \Rightarrow \sim P$

3. Consider the statement:

If the congress refuses to enact new laws, then the strike will no be over unless it lasts more than one year and the president of the firm resigns, and if either the congress enacts new laws or the strike is not over then the strike lasts more than one year.

Is the above statement contradictory? Find out by encoding this statement in logic and checking if it is valid, inconsistent or satisfiable.

4. If the congress refuses to enact new laws, then the strike will not be over unless it lasts more than one year and the president of the firm resigns. Suppose the congress refuses to act, the strike is over, and the president of the firm does not resign. Has the strike lasted more than one year?

5. Consider the following statements:

$F1 \equiv$ Tom cannot be a good student unless he is smart and his father supports him.

$F2 \equiv$ Tom is a good student only if his father supports him.

Show that $F2$ is a logical consequence of $F1$.