

Quiz 5/11 Answers

COGS 526

1. [4pt] Translate the following into symbolic argument form and check their validity:

- (a) Either blockchain adoption increases or data breaches continue. If blockchain adoption increases, then security improves. Security does not improve. Therefore, data breaches will continue.
- B : Blockchain adoption increases
 - D : Data breaches continue
 - S : Security improves

The argument is translated as follows:

$$\begin{array}{c} B \vee D \\ B \rightarrow S \\ \neg S \\ \hline \therefore D \end{array}$$

The conclusion (D) can be derived from the premises using standard rules of inference (Modus Tollens and Disjunctive Syllogism).

- i. $B \rightarrow S$ (Premise 2)
- ii. $\neg S$ (Premise 3)
- iii. $\neg B$ (From i, ii by Modus Tollens)
- iv. $B \vee D$ (Premise 1)
- v. D (From iii, iv by Disjunctive Syllogism)

The argument is valid.

- (b) We will play both tennis and football only if it is sunny. It is not sunny. Therefore, we will not play tennis and we will not play football.

- T : Blockchain adoption increases
- J : Data breaches continue
- S : Security improves

The argument is translated as follows:

$$\begin{array}{c} (T \wedge J) \rightarrow S \\ \neg S \\ \hline \therefore \neg T \wedge \neg J \end{array}$$

- i. The intermediate conclusion of the premises is found using Modus Tollens:

$$(T \wedge J) \rightarrow S \quad \text{and} \quad \neg S \quad \Rightarrow \quad \neg(T \wedge J)$$

- ii. By De Morgan's Laws, $\neg(T \wedge J)$ is equivalent to $(\neg T \vee \neg J)$. The argument requires the truth of $(\neg T \vee \neg J)$ to guarantee the truth of the conclusion, $(\neg T \wedge \neg J)$. This is not guaranteed.

- iii. Counterexample:

- Let T be False.
- Let J be True.
- Let S be False.

Then,

- Premise 1: $(T \wedge J) \rightarrow S$ is True, since $(T \wedge J)$ is False.
- Premise 2: $\neg S$ is True
- Conclusion: $\neg T \wedge \neg J$ is False

Since both premises are True, but the conclusion is False, the argument is invalid.

NOTE: Validity testing can be done by constructing a truth table as well.