Quiz 12/11 Answers

COGS 526

1. **[2pts*]** Take the rule `Kapiyi calmadan odaya girilmez.` and assume everyone obeys it. Which inferences are valid?

   (1) If the door is not knocked, then the room is not entered.

   (2) If the room is entered, then the door is knocked.

   (3) If the door is knocked, then the room is entered.

   (4) If the room is not entered, then the door is not knocked.

   Atomic logical propositions:

   - E: The room is entered.
   - K: The door is knocked.

   `Kapiyi calmadan odaya girilmez` can be formally stated as:

   $$E \rightarrow K$$

   (1) If the door is not knocked, then the room is not entered.

   $$\neg K \rightarrow \neg E$$

   It is the contrapositive of the original rule. If it is true that the door is knocked in cases where the room is entered, then it must be true that in cases where the room is not entered the door is not knocked. Hence, it is valid.

   (2) If the room is entered, then the door is knocked.

   $$E \rightarrow K$$

   This is the same as the original rule. Thus, it is valid as well.

(3) If the door is knocked, then the room is entered.

$$K \to E$$

The converse of the original rule is not equivalent to the original rule. According to the original rule, $(E \to K)$, knocking the door (K) is a necessary condition for entering the room (E). The above formula expresses that knocking the door (K) is a sufficient condition for entering the room (E). However, one can knock the door and choose not to enter. Thus, it is invalid.

(4) If the room is not entered, then the door is not knocked.

$$\neg E \to \neg K$$

For the same reason as (3), it is invalid. The door can be knocked, and the room can be still not entered. It is the contrapositive of (3) and logically equivalent to (3).

The valid inferences are (1) and (2).