Task6 Who first (*3 points in total*)

The solution should be submitted through UPLOAD by 9:00 am of Monday 16.5.2016

Task6a Could the modality be defined as a boolean function? (*1 point*)

Let us consider for simplicity only Kripke structures with a single agent whose knowledge is described by the modal operator **K**. We know that in all the corresponding Kripke structures where **K** is interpreted by equivalence there holds for any formula α

a) the formula **K** $\alpha \rightarrow \alpha$ (Knowledge Axiom) is valid ,

b) but the formulas $\alpha \rightarrow$ **K** α and $\neg$ **K** α are not valid.

Utilize these facts to show that such a behaviour of the modal operator **K** cannot be encoded by any boolean function (ie. Truth values defined by a table).

Hint: Suppose the truth value of **K** α can be calculated from the truth value of α using a truth table for **K** (in the same way as $\neg \alpha$ is calculated form α). Consider all possible truth tables for **K** and show that none of them grants the properties a) and b) mentioned above.

Task 6b Ann and Bob (*2 points*)

Ann and **B**ob take part in a quizz. First, the organizer selects from an urn a natural number $n < 10$, that he writes on the forehead of one of the players and continues by writing the neighboring number (either $n+1$ or $n-1$) on the forhead of the second player. Neither **A**nn nor **B**ob knows her/his number – each sees only the other´s forehead. They can take turns in announcing nothing but „*I do not know my number*.“ or „*I know my number*.“ Suppose Ann starts and she can see the symbol **5**.

1. Who will be the first to identify her/his number?
2. Demonstrate your conclusion about the winner using the corresponding Kripke structure and its modification during information exchange between **A** and **B**.