Exercises Social Software, Lecture 3

Exercise 1 *Imagine the following situation. There is a fact p with the following properties: p is true, Alice knows that p is true, Bob does not know that p is true, Alice knows that Bob does not know that p is true. Can you give a Kripke model of this situation?*

Exercise 2 *Now the situation is similar, but with a slight difference. There is a fact p with the following properties: p is true, Alice knows that p is true, Bob does not know that p is true, Alice does not know whether Bob knows whether p is true. Can you give a Kripke model of this situation?*

Exercise 3 *This final exercise is a challenge to design a piece of social software, in order to solve a riddle.*

A group of 100 prisoners, all together in the prison dining area, are told that they will be all put in isolation cells and then will be interrogated one by one in a room containing a light with an on/off switch. The prisoners may communicate with one another by toggling the light-switch (and in no other way). The light is initially switched off. There is no fixed order of interrogation. Every day one prisoner will get interrogated. At any stage every prisoner will be interrogated again sometime.

When interrogated, a prisoner can either do nothing, or toggle the light-switch, or announce that all prisoners have been interrogated. If that announcement is true, the prisoners will (all) be set free, but if it is false, they will all be executed. Can the prisoners agree on a protocol that will set them free?