Exercises from lecture 2 (agents, communication and cooperation) TEK5010 Multiagent systems 2021

Question 1

a) Could you give a definition of an agent?
b) How would you define a multiagent system?

Question 2

Consider the environment $Env_1 = \langle E, e_0, \tau \rangle$ defined as follows:

$$E = \{e_0, e_1, e_2, e_3, e_4, e_5, e_6\}$$
$$\tau\left(e_0 \xrightarrow{\alpha_0}\right) = \{e_1, e_2, e_3\}$$
$$\tau\left(e_0 \xrightarrow{\alpha_1}\right) = \{e_4, e_5, e_6\}$$

There are two agents possible with respect to this environment, which we shall refer to as:

$$Ag_1(e_0) = \alpha_0 \text{ and } Ag_2(e_0) = \alpha_1$$

Assume the probabilities and the utility function is defined as follows:

$$P\left(e_0 \xrightarrow{\alpha_0} e_1 \middle| Ag_1, Env_1\right) = 0.7$$
$$P\left(e_0 \xrightarrow{\alpha_0} e_2 \middle| Ag_1, Env_1\right) = 0.2$$
$$P\left(e_0 \xrightarrow{\alpha_0} e_3 \middle| Ag_1, Env_1\right) = 0.1$$
$$P\left(e_0 \xrightarrow{\alpha_1} e_4 \middle| Ag_2, Env_1\right) = 0.6$$
$$P\left(e_0 \xrightarrow{\alpha_1} e_5 \middle| Ag_2, Env_1\right) = 0.3$$
$$P\left(e_0 \xrightarrow{\alpha_1} e_6 \middle| Ag_2, Env_1\right) = 0.1$$

$$u_1\left(e_0 \xrightarrow{\alpha_0} e_1\right) = 10$$
$$u_1\left(e_0 \xrightarrow{\alpha_0} e_2\right) = 6$$
$$u_1\left(e_0 \xrightarrow{\alpha_0} e_3\right) = 5$$
$$u_1\left(e_0 \xrightarrow{\alpha_1} e_4\right) = 12$$
$$u_1\left(e_0 \xrightarrow{\alpha_1} e_5\right) = 3$$
$$u_1\left(e_0 \xrightarrow{\alpha_1} e_6\right) = 4$$

a) Is this a decision-making problem or a problem of strategic interaction? Explain the variables used. What are the requirements for maximizing expected utility?
b) Given these definitions, calculate the expected utility of agent Ag_1 and Ag_2 with respect to Env_1 and u_1. Which agent is optimal with respect to Env_1 and u_1?