Exercise 1

Question 1

a) "An agent is a computer system that is situated in some environment, and that is capable of autonomous action in this environment in order to meet its delegated objectives" [WJ, 95]

1, Objective/goal to affect the environment
2, Autonomy is the only general requirement
3, On behalf of someone
4, The intelligent agent is also proactive (as well as reactive), goal directed on its own

- "Multiagent systems are systems composed of multiple interacting computing elements, known as agents" [W4), 55]
  - Agents engage in social activities like cooperation, coordination and negotiations
  - Research goal is to connect micro scale behaviour with macro scale (often emergent) properties/effects, and vice versa.

Question 2

a) This is a DM problem since it does not involve multiple agents, one must ad

Static environment.

Definition of expected utility

$$u(Ag, Env) = \sum_{r \in R(Ag, Env)} P(r \mid Ag, Env) \cdot u(r)$$

where

$$\sum_{r \in R(Ag, Env)} P(r \mid Ag, Env) = 1$$

we have two stakeholders/strategies, Ag1 and Ag2
and their corresponding available states,
with outcome and probability of outcome

where $Env = \langle E, e_0, \tau \rangle$ is environment

$E = \{e_0, e_1, e_2, e_3\}$ set of possible states,

e_0 is initial state

$\tau(e_0 \xrightarrow{\alpha_0}) = \{e_1\}$ state transform for α_0

$\tau(e_0 \xrightarrow{\alpha_1}) = \{e_2, e_3\}$ state transform for α_1

- we have two agents

  $Ag_1(e_0) = \alpha_0$ use action 0

  $Ag_2(e_0) = \alpha_1$ use action 1

- We also have the probability of ending up in another state

  $P(e_0 \xrightarrow{\alpha_0} e_1 \mid Ag, Env) = 1$

  meaning that the probability of ending up in state e_1 given agent Ag_1 in environment using action α_0 is 1

- The utility of ending up in e_1

$$u(e_0 \xrightarrow{\alpha_0} e_1) = 8$$

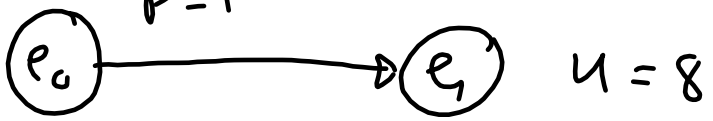
- Let's check if $\sum p(r) = 1$ as required

$$\left.\begin{aligned} P(e_0 \xrightarrow{\alpha_1} e_1)\, Ag_2, Env) &= 0,2 \\ P(e_0 \xrightarrow{\alpha_1} e_3)\, Ag_2, Env) &= 0,8 \end{aligned}\right\} = 1 \quad \text{for agent } Ag_2$$

b) Calculate expected utility of LoM agents

Ag_1:

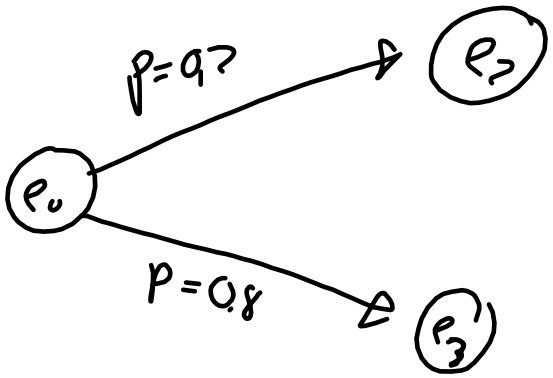
x_c



$U_1 = 1 \cdot 8 = \underline{8}$

Alg 2 :

α_1



$\hat{u}_2 = 0,7 \cdot 7 + 0,8 \cdot 9 = 1,4 + 7,2 = 8,6$

$\Rightarrow$ Alg 2 is optimal in this environment using α_0 and α_1 $\hat{u}_1 < \hat{u}_2$

Question 3

a) "Endow" agents with mental states:
Desires & Beliefs
1) Desires modelled by max exp utility
2) Beliefs from information processes
3) Inspired from biology & sociology, social sciences which do manage complexity somehow
4) Key component of agent-based systems.

b) Agents share common goals to

1) improve on overall goal
2) Simplify the design task
3) In contrast to self-interested agents of different goals

1) Communication = the process of sharing data / information / meaning

1, Communicating data "bit and bytes"

2, Ontologies for meaning

d) Result scoring (eg in robot MAS)

1. Confidence
   Multiple observations (assumed independent)
   Strengthens statistical overall conclusion
2. Completeness
   Broader or larger area to sample
3. Precision
   Closeness to observation objects

4) Timeliness
Faster sampling of large area.