COMP310 Multi Agent Systems - Tutorial 3.1

2020-02-20

Questions taken from 2012/13 Exam.

Q1b Consider the environment $Env_1 = \langle E, e_0, \tau \rangle$ defined as follows:

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

There are just two agents with respect to this environment, which we shall refer to as Ag_1 and Ag_2:

$$Ag_1(e_0) = \alpha_0$$
$$Ag_2(e_0) = \alpha_1$$

Assume the probabilities of the various runs are as follows:

$$P(e_0 \xrightarrow{\alpha_0} e_1 \mid Ag_1, Env_1) = 0.4$$
$$P(e_0 \xrightarrow{\alpha_0} e_2 \mid Ag_1, Env_1) = 0.5$$
$$P(e_0 \xrightarrow{\alpha_0} e_3 \mid Ag_1, Env_1) = 0.1$$
$$P(e_0 \xrightarrow{\alpha_1} e_4 \mid Ag_2, Env_1) = 0.3$$
$$P(e_0 \xrightarrow{\alpha_1} e_5 \mid Ag_2, Env_1) = 0.7$$

Assume the utility function u_1 is defined as follows:

$$u_1(e_0 \xrightarrow{\alpha_0} e_1) = 8$$
$$u_1(e_0 \xrightarrow{\alpha_0} e_2) = 7$$
$$u_1(e_0 \xrightarrow{\alpha_0} e_3) = 6$$
$$u_1(e_0 \xrightarrow{\alpha_1} e_4) = 9$$
$$u_1(e_0 \xrightarrow{\alpha_1} e_5) = 7$$

Given these definitions, determine the expected utility of the agents Ag_1 and Ag_2 with respect to Env_1 and u_1, and explain which agent is optimal with respect to Env_1 and u_1. Include an explanation of your calculations in your solution. **(13 marks)**

Q2f The Blocksworld scenario is represented by an ontology with the following formulae:

$On(x, y)$	obj x on top of obj y
$OnTable(x)$	obj x is on the table
$Clear(x)$	nothing is on top of obj x
$Holding(x)$	arm is holding x

An agent has a set of actions Ac , such that $Ac = \{Stack, UnStack, Pickup, PutDown\}$:

	$Stack(x, y)$
pre	$Clear(y)$ & $Holding(x)$
del	$Clear(y)$ & $Holding(x)$
add	$ArmEmpty$ & $On(x, y)$

	$UnStack(x, y)$
pre	$On(x, y)$ & $Clear(x)$ & $ArmEmpty$
del	$On(x, y)$ & $ArmEmpty$
add	$Holding(x)$ & $Clear(y)$

	$Pickup(x)$
pre	$Clear(x)$ & $OnTable(x)$ & $ArmEmpty$
del	$OnTable(x)$ & $ArmEmpty$
add	$Holding(x)$

	$PutDown(x)$
pre	$Holding(x)$
del	$Holding(x)$
add	$OnTable(x)$ & $ArmEmpty$ & $Clear(x)$

It also has the following beliefs B_0 regarding the four bricks $\{A, B, C, D\}$, and the intention i:

$Beliefs\ B_0$	$Intention\ i$
$Clear(C)$	$Clear(A)$
$Clear(D)$	$On(A, B)$
$On(C, A)$	$On(B, C)$
$On(D, B)$	$On(C, D)$
$OnTable(A)$	$OnTable(D)$
$OnTable(B)$	

Calculate a plan π that would achieve i, given the beliefs B_0. Draw the environment and current beliefs at the beginning of the plan, and after every action is performed. You should then verify that the intention i is achieved with the final set of beliefs. **(15 marks)**