Exam Behavioural Dynamics 2008 (February 6, 2008, 18.30-21.15).   (NEW STYLE!)

Part 1 (45 pts)

In this assignment the case of *motivation-based behaviour* is analysed:

> Person A has the following typical pattern of mental activity and behaviour. Every week he receives the weekend weather forecast on Wednesday. If this predicts nice weekend weather, then he desires to do a sailing trip on Saturday. Moreover, given the desire to sail, he calls his friends to invite them for a sailing trip for Saturday. Then, if he also believes his friends are available (because they told him), he intends to do the sailing trip with them. If he intends to sail, and on Saturday morning he observes that the weather turns out to be OK, A will actually do the sailing trip.

Assume the following relevant state properties for the example:

<u>External state properties</u>

weather_forecast_OK	the weather forecast (on Wednesday) predicts nice weekend weather
weather_OK	the weather (on Saturday morning) is nice
friends_available	A's friends are available for the trip on Saturday
sailing_trip	the sailing trip is going on

<u>Input state properties</u>

obs(weather_forecast_OK)	A observes that the forecast predicts nice weekend weather
obs(weather_OK)	A observes that the weather on Saturday morning is nice
obs(friends_available)	A observes that his friends are available for the trip on Saturday

<u>Output state properties</u>

call_friends	A calls his friends to invite them for a sailing trip
go_sailing	A does the sailing trip

<u>Internal state properties</u>

b	A believes that his friends are available
d	A desires to go for the sailing trip
i	A intends to go for the sailing trip

a) Give two example traces (showing external, input, output and internal state properties), one leading to the sailing trip and one not leading to the sailing trip. **(5)**

b) Show the dynamics of the example in graphical form. Do not forget to indicate which state properties are persistent. **(5)**

c) Write down a list of *executable dynamic properties* that characterise these dynamics. **(5)**

d) For the properties you defined in c), indicate which ones are *step properties* and which ones are *persistence properties*? **(5)**

e) For one of the internal state properties, indicate by which of the dynamic properties its *functional role* is defined. **(5)**

f) Give a set of dynamic properties that specifies the input-output correlation from an **external** perspective. **(5)**

g) Suppose A indeed does a sailing trip on Saturday. Give an (iterated) explanation from a functionalist perspective of the following form. **(5)**

        Why does A sail on Saturday?

                A sails on Saturday, because ....

        Why .....?

                ...., because ...

        et cetera.

The following two questions are independent from the case study:

h) In design of agent systems, two cases can be distinguished: *agent behaviour design* and *interaction protocol design*. Explain the difference between both cases. **(5)**

i) Give an example of *reasoning by assumption*. Explicitly indicate different steps in the reasoning process. **(5)**

Part 2 (45 pts)

The organization of a naval vessel is very hierarchically structured. The Captain is the one that is in charge of commanding the ship. He takes place in the Command Group, together with several senior officers. In this case it is assumed that two such officers are present: Senior Officer Offensive Forces (SOOF), and Senior Officer Defensive Forces (SODF). Each of these senior officers also heads the specific group which they represent in the Command Group. The SOOF is in charge of the Offensive Forces group, and the SODF of the Defensive Forces group. Furthermore, both the Offensive Forces group and the Defensive Forces group contain one additional (non-senior) officer.

As already stated, the Captain is in charge of the ship. In case the captain outputs a command within the Command Group, this is received by the senior officers within the same group (i.e. SOOF and SODF). In case the command concerns an offensive command, the SOOF outputs this command in the Offensive Forces group. If the command is a defensive command, the SODF outputs the command in the Defensive Forces group. The functioning of the Defensive and Offensive group is quite similar. In both the Offensive as well as the Defensive Forces group the outputs of the Senior Officers (SOOF and SODF respectively) become input of the non-senior officer in the group. As a consequence of such an input, a non-senior officer generates an output with the result of the execution of the command, which is received by the senior officer in the group (i.e. either SOOF or SODF). The senior officer outputs this information to the Captain within the Command Group. This information is then received by the Captain.

a) Express the AGR-specification of this organization in **graphical** format **(15)**

b) Express the behavior of the organization in terms of semi-formal dynamic properties. Try to limit yourself to the behavior described in the text above. **(15)**

c) Provide a proof tree for the organizational property " *if the Captain outputs a command, then he will eventually receive the result of the execution of that command"* **(15)**