Exam Behavioural Dynamics 2007 (December 20, 2007, 12.00-14.45).

Part 1 (45 pts)

In this assignment the following case is analyzed:

Freelancer Bill develops software products on request from external clients. Since Bill's income is not secured and fixed, he has the permanent desire to earn money. When a new job proposal (an order) arrives, Bill considers whether to accept it. Bill intends to perform a new order, when he believes that the requirements of that order match the skills he possesses. When Bill has the intention to perform a job and believes that no better proposal is available, he starts executing the order. Unfortunately, after the successful accomplishment of one of the orders, Bill receives a payment that is lower than the promised amount. As a result, next time Bill will intend to perform a job only when - in addition to the already mentioned condition - one more condition is satisfied: Bill believes that a contract between him and the client has been made.

Assume the following relevant state properties for the example:

External state properties

successfully_accomplished(new_order)	A new order has been successfully accomplished

Input state properties

obs(income_unstable)	Bill observes that his income is unstable
obs(arrived(new_order))	Bill observes that a new order has arrived
obs(reqs_match_skills_for(new_order))	Bill observes that the requirements for a new order match his capabilities
obs(no_better_orders)	Bill observes that no better orders are currently available
obs(less_payment_than_promised)	Bill observes that he got less payment than promised
obs(contract_made(new_order))	Bill observes that the contract with a client has been made

Output state properties

performs_order(new_order_without_contract)	Bill performs a new order without a contract
performs_order(new_order_with_contract)	Bill performs a new order with a contract

Internal state properties

belief(income_unstable)	Bill believes that his income is unstable
belief(arrived(new_order))	Bill believes that a new order has arrived
belief(reqs_match_skills_for(new_order))	Bill believes that the requirements for a new order match his capabilities
belief(no_better_orders)	Bill believes that no better orders are currently available
belief(less_payment_than_promised)	Bill believes that he got less payment than promised (* HINT: *this state should be made persistent* *)
belief(contract_made(new_order))	Bill believes that the contract with a client has been made
d	Bill desires to earn money
i1	Bill intends to perform a new order without a contract
i2	Bill intends to perform a new order with a contract

a) Give an example of a trace (showing external, input, output and internal state properties), which reflects the change of the Bill's intention generation before and after receiving less payment than promised. **(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 at least 4 *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 Bill has successfully accomplished an order. Give an (iterated) explanation from a functionalist perspective of the following form. **(5)**

Why has Bill accomplished a new order successfully?

Bill has successfully accomplished a new order, 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)

Incident management organizations in the Netherlands are quite predefined in their structure as well as their behavior. In such an organization, there are basically three teams active namely the strategic team, the team called command disaster area, and finally, the team called command surroundings disaster area. In such teams it is the case that if a role communicates something to another role, this communication is received by this other role.

The command disaster area team consists of three members, namely the commander disaster area, and two fire fighters. The behavior of these members is as follows: In case one of the fire fighters receives on its input a situation which requires a high-level strategic decision, then the fire fighters ask the commander disaster area what strategy to follow in this situation. The commander disaster area is also represented in the strategic team. In case the commander receives a question for what strategy to follow in a particular situation, the commander outputs this question in the strategic team.

The command surroundings disaster area basically follows the same structure and behavior as the command disaster area team, except that there are not two fire fighter roles, but two policeman roles. Furthermore, the leader is now called commander surrounding disaster area. In this group, in case one of the policeman roles receives an input on a situation which requires a strategic decision, the policeman asks the commander what strategy to follow in this situation. The commander surroundings disaster area is also represented in the strategic team. If the commander gets input on which strategy to follow in a situation from a policeman role, then the commander outputs this request in the strategic group.

In the strategic group, besides the representative of the command disaster area and the command surrounding disaster area, a third member is present, namely the mayor, the one in charge of defining a strategy. In case the mayor receives as an input a request for a strategy in a particular situation, the mayor outputs such a strategy to the originator of this request in the group. In case one of the two representatives receives such information as input, they output this information to the other roles in the group which they represent.

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 either a policeman or a firefighter requests a strategy to follow in a certain situation, then eventually this role will receive this strategy as an input"* **(15)**