

UNIVERSITETET I OSLO

Det matematisk-naturvitenskapelige fakultet

Exam in - INF5150
Day of exam: 5. December 2007
Exam hours: 14.30 – 17.30
This examination paper consists of 5 page(s).
Appendices:
Permitted materials: All written material.

Make sure that your copy of this examination paper is complete before answering.

NB: This exam text is only given in English since the course has been given in English this year. The candidate may, however, choose to answer in Bokmål or Nynorsk if he or she prefers.

A system for supporting spontaneous meetings

We are going to design a system that helps support spontaneous meetings. The idea is that those having subscribed to this concept will get offers for different kinds of meetings. They may also themselves initiate such spontaneous meetings. The participants will enter into a negotiation protocol given in Figure 1. We assume that there is only one group of participants even though in a real system there would have to be subgroups for scalability purposes.

This protocol is a variant of the FIPA Contract Net Interaction Protocol for negotiations between independent agents. (FIPA is Foundation for Intelligent Physical Agents, but this is not really important here).

You may consider the messages sent as SMS-es, and we apply positioning of GSM phones the way we are used to in the obligatory exercise #2 and the ICU examples. The idea is of course that spontaneous meetings most easily take place among participants that are near each other.

For simplicity we have omitted parameters to the signals, but in a real system there would have to be additional pieces of data giving the necessary information of the meetings. Such supplementary information would be the kind of meeting, its whereabouts, its purpose and duration. In this brief exam, we skip these data and the candidates may also skip parameters in their solutions.

1 Modeling (35%)

In Figure 1 there is a sequence diagram specifying the normal protocol for the meeting negotiations.

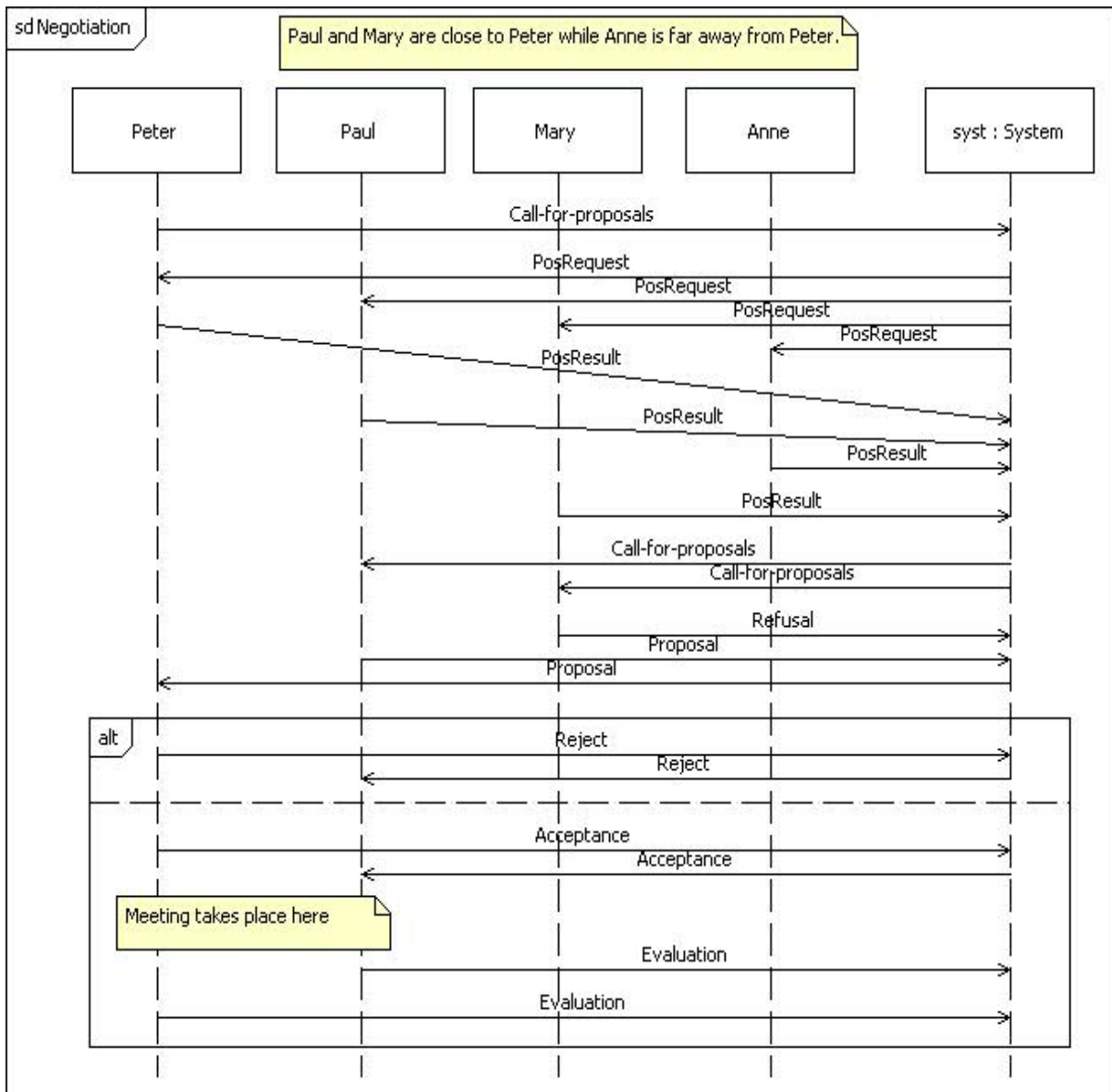


Figure 1 The negotiation for a spontaneous meeting

1 a) Composite structure

Define a composite structure for *System* where *Peter*, *Paul*, *Mary* and *Anne* are handled by instantiations of the same part. Remember that a part is a property of the enclosing classifier and a part may represent a set of objects. Please be aware that we are asking you to provide the composite structure for the system that you are going to design and which is represented by the lifeline *syst* in Figure 1.

1 b) Decomposition

Define a decomposition of lifeline *syst:System* for sequence diagram *Negotiation*.

1 c) State machine

In 1a) above you were asked to define a composite structure in which *Peter*, *Paul*, *Mary* and *Anne* were represented by one part inside *System*. Define a state machine for the type of that part.

2 STAIRS (35%)

The exercises below refer to the sequence diagram of Figure 1, but do not depend on what you have answered on exercise 1 above.

2 a) Events

The STAIRS Tutorial associates two events with each message, a transmission event and a reception event.

I. What is (are) the first event(s) of Figure 1. (If there is more than one possibility, list all the possibilities.) Explain your answer.

II. What is (are) the last event(s)? Again explain your answer and if necessary list more than one event.

2 b) Traces

I: How many traces are there in the **alt**-construct (combined fragment) inside *Negotiation* (Figure 1.)

II: How many traces are negative with respect to *Negotiation* (Figure 1.) Explain your answer.

2 c) Refinement

I: Assume that Bob has joined the meeting group. We augment our *Negotiation* with one more lifeline representing Bob. He behaves like Mary and refuses the meeting call-for-proposals e.g. as represented in Figure 2. Explain whether the augmented *Negotiation2* is a supplementing of the original *Negotiation* (Figure 1) or not.

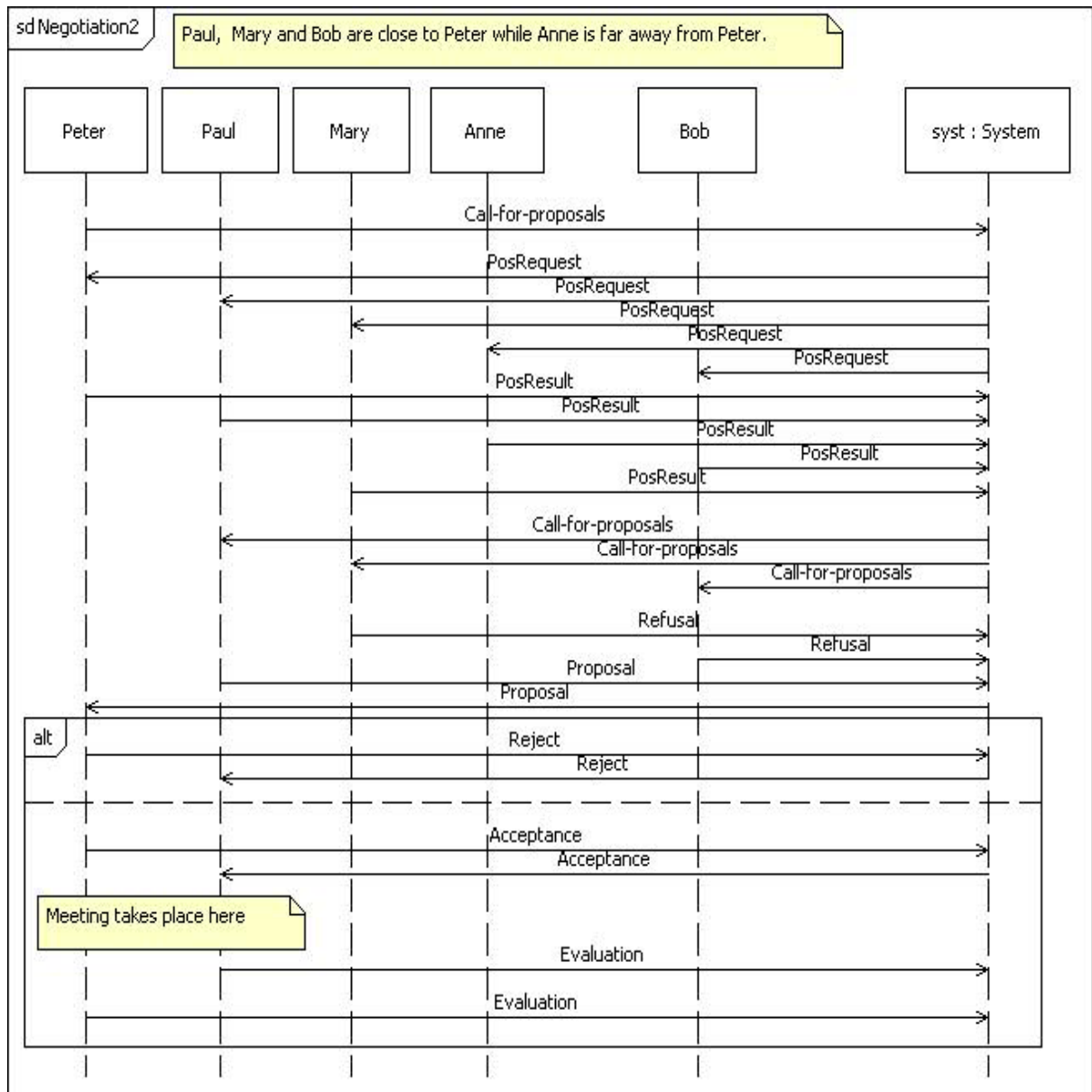


Figure 2 Augmented Negotiation2 where Bob has been added

II: It turns out that *Peter* is a very easy-going fellow that would not dream of rejecting meeting proposals. How would you modify the *Negotiation* (Figure 1) to accommodate for Peter's attitude such that the modified behavior is a narrowing of the original?

You can explain this in words or through a diagram detail. If you use a diagram, we accept that you only sketch those parts of the original diagram that you think are not relevant for this question.

3. Risk Analysis (30%)

The exercises below refer to the sequence diagram of Figure 1, but do not depend on what you have answered on exercises 1 and 2 above.

Assume the meeting service becomes popular and that someone managed to embed malicious software that may trigger *sys* to transmit position requests to certain individuals to trace their position at any time.

3 a) Terminology

- I. With respect to the above scenario, what would be a threat? Explain your answer.
- II. With respect to the above scenario, what would be the vulnerability? Explain your answer.
- III. With respect to the above scenario and the diagram *Negotiation* (Figure 1), what are the assets? Explain your answer.
- IV. With respect to the above scenario, how many of the events in the diagram *Negotiation* (Figure 1) may potentially represent unwanted incidents? Explain your answer.

3 b) Risk modeling

- I. Draw a threat diagram capturing the scenario outlined in the introduction to exercise 3a). Explain your diagram.
- II. Draw a sequence diagram that may be understood as a specialization of the threat diagram. Explain your drawing and why it can be understood as a specialization of the threat diagram.

3 c) Likelihoods

- I. Assign likelihoods to the threat diagram that you drew in exercise 3b) in such a way that the diagram becomes inconsistent. Explain your choices.
- II. Assign likelihoods to the threat diagram that you drew in exercise 3b) in such a way that the diagram is consistent. Explain your choices.
- III. Assign likelihoods to the threat diagram that you drew in exercise 3b) in such a way that the diagram is consistent only under the assumption that the diagram is incomplete. By incomplete we mean that the diagram contains vertexes that may be triggered by threat scenarios that are not represented. Explain your choices.