

## Question 1: Modeling (35%)

We consider again the recruitment system that you know from the three obligatory exercises, although some of the specifications are slightly changed.

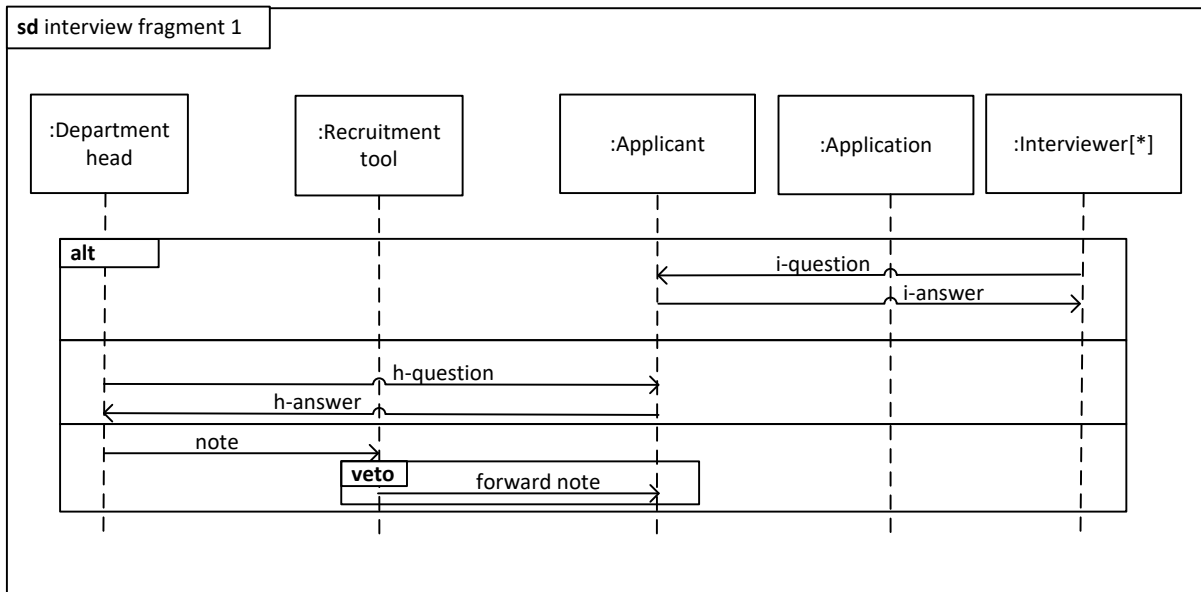


Figure 1

(weight 5%)

a) What is/are the potential initial event/event(s) in the sequence diagram *sd interview fragment 1* in Figure 1? Explain your answer.

(weight 5%)

b) Describe the negative trace/traces of the sequence diagram *sd interview fragment 1* in Figure 1. Describe each trace on the form  $\langle e_1, e_2, \dots, e_n \rangle$  where  $e_1, e_2, \dots, e_n$  are events.

(weight 5%)

c) What is the shortest inconclusive trace with respect to the sequence diagram *sd interview fragment 1* in Figure 1?

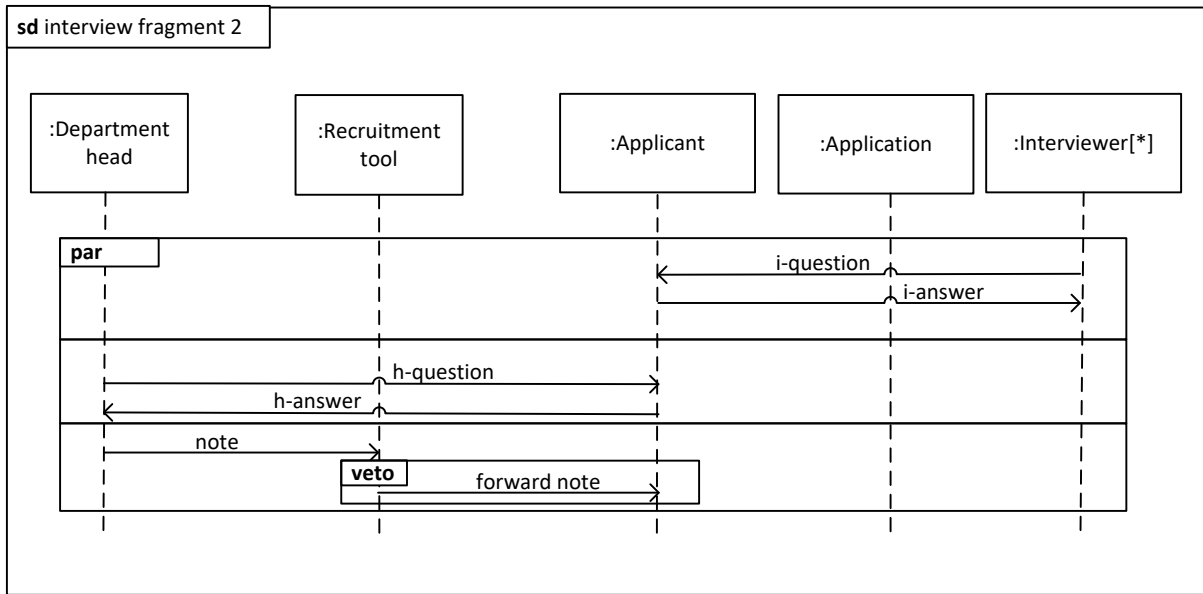


Figure 2

(weight 6%)

d) What is the length of a negative trace of *sd interview fragment 2* in Figure 2? Explain your answer. (Note that in *sd interview fragment 2*, the *alt* in *sd interview fragment 1* has been replaced by *par*.)

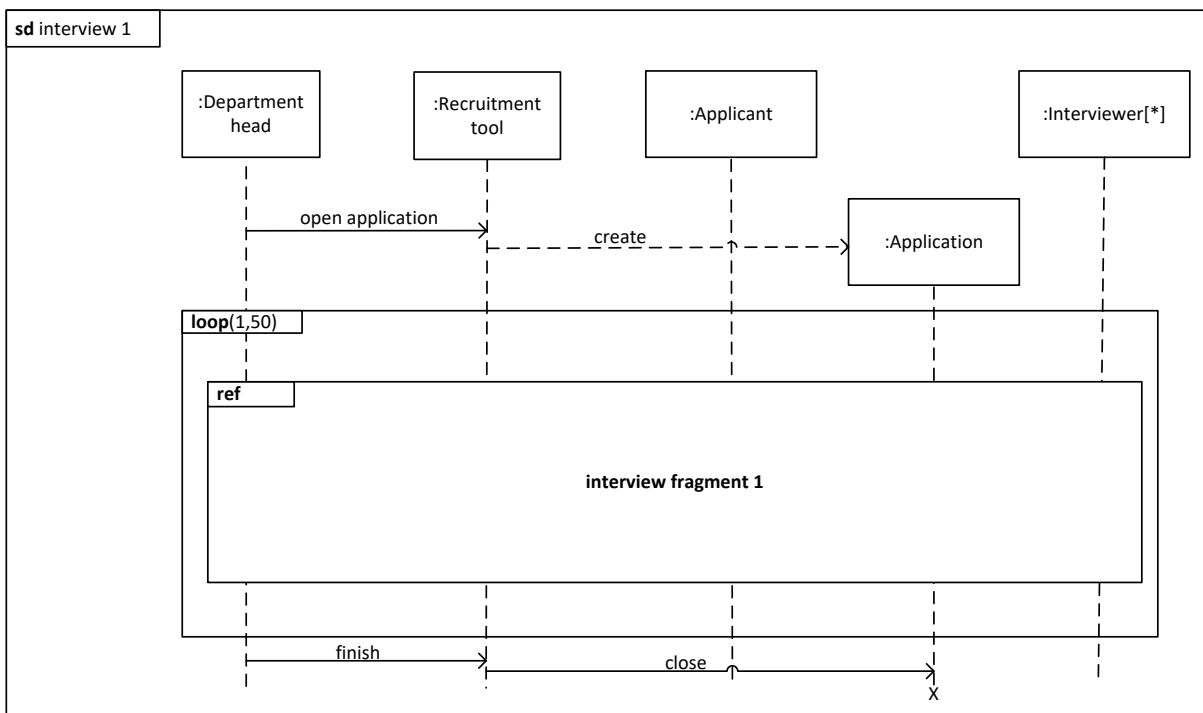


Figure 3

(weight 6%)

e) What is the minimal length of a positive trace of *sd interview 1* in Figure 3? Explain your answer.

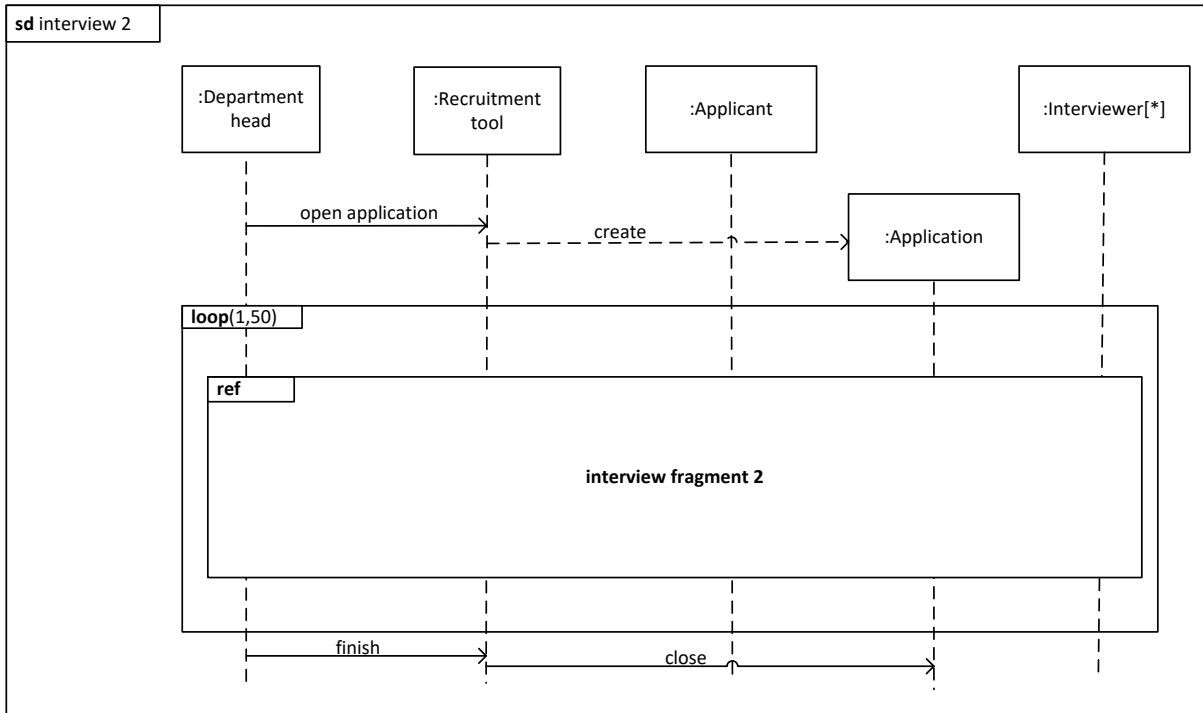


Figure 4

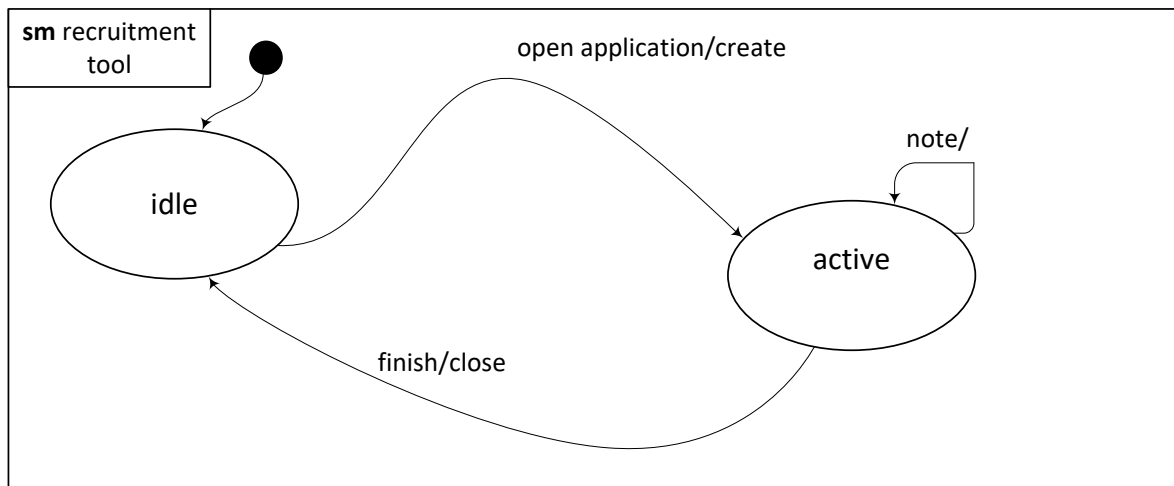


Figure 5

(weight 8%)

f) Explain how **sm recruitment tool** can be updated so that it describes all possible positive traces of **sd interview 2** with respect to the lifeline **:Recruitment tool**, but not all positive traces of **sd interview 1** with respect to the same lifeline.

Question 2: Refinement (35%)

We consider the recruitment system as specified above.

(weight 5%)

a) Explain how the sequence diagram *sd interview fragment 1* in Figure 1 can be modified into a sequence diagram *sd interview fragment 1'* so that *sd interview fragment 1'* is a (pure) narrowing of *sd interview fragment 1*.

(weight 5%)

b) Explain how the sequence diagram *sd interview fragment 1* in Figure 1 can be modified into a sequence diagram *sd interview fragment 1''* so that *sd interview fragment 1''* is a (pure) supplementing of *sd interview fragment 1*.

(weight 5%)

c) Explain how the sequence diagram *sd interview fragment 1* in Figure 1 can be modified into a sequence diagram *sd interview fragment 1'''* so that *sd interview fragment 1'''* is a refinement of *sd interview fragment 1* without being a (pure) supplementing or a (pure) narrowing.

(weight 6%)

d) Is *sd interview 2* in Figure 4 a refinement of *sd interview 1* in Figure 3? Explain your answer.

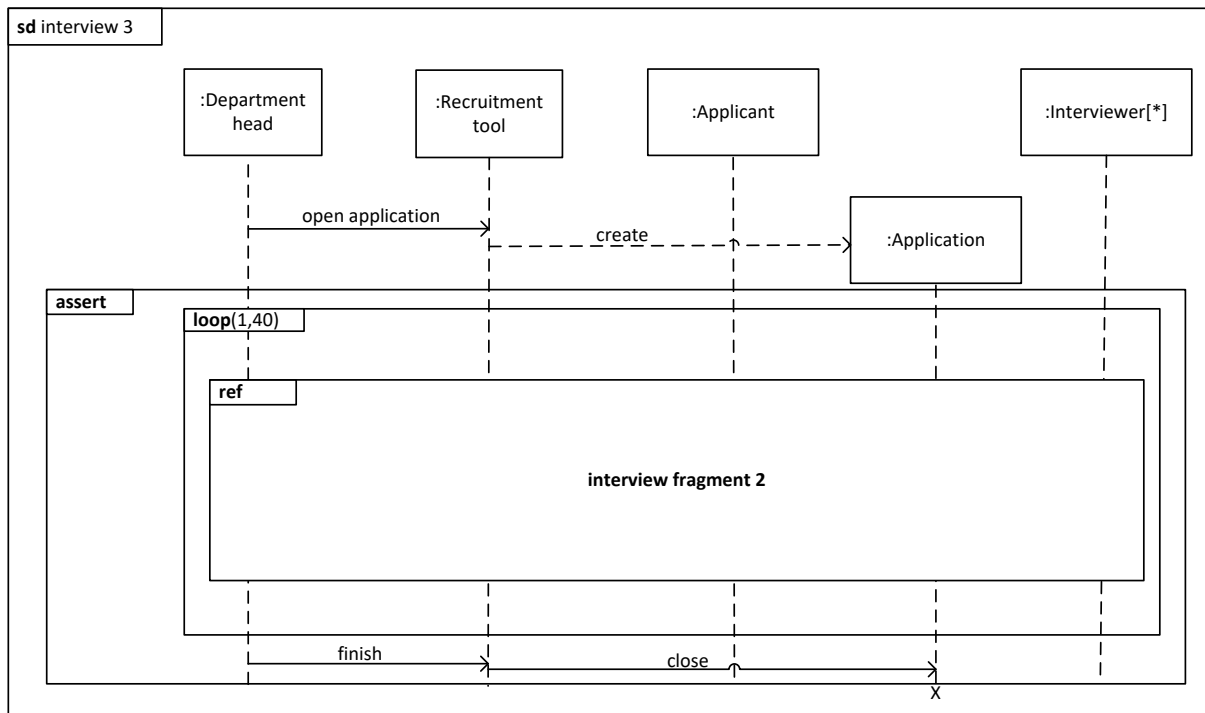


Figure 6

(weight 7%)

e) Is *sd interview 3* in Figure 6 a refinement of *sd interview 2* in Figure 4? Explain your answer. (Note that *sd interview 3* contains two modifications wrt *sd interview 2* – the **loop** construct is restricted to 40 iterations and we have introduced an **assert**.)

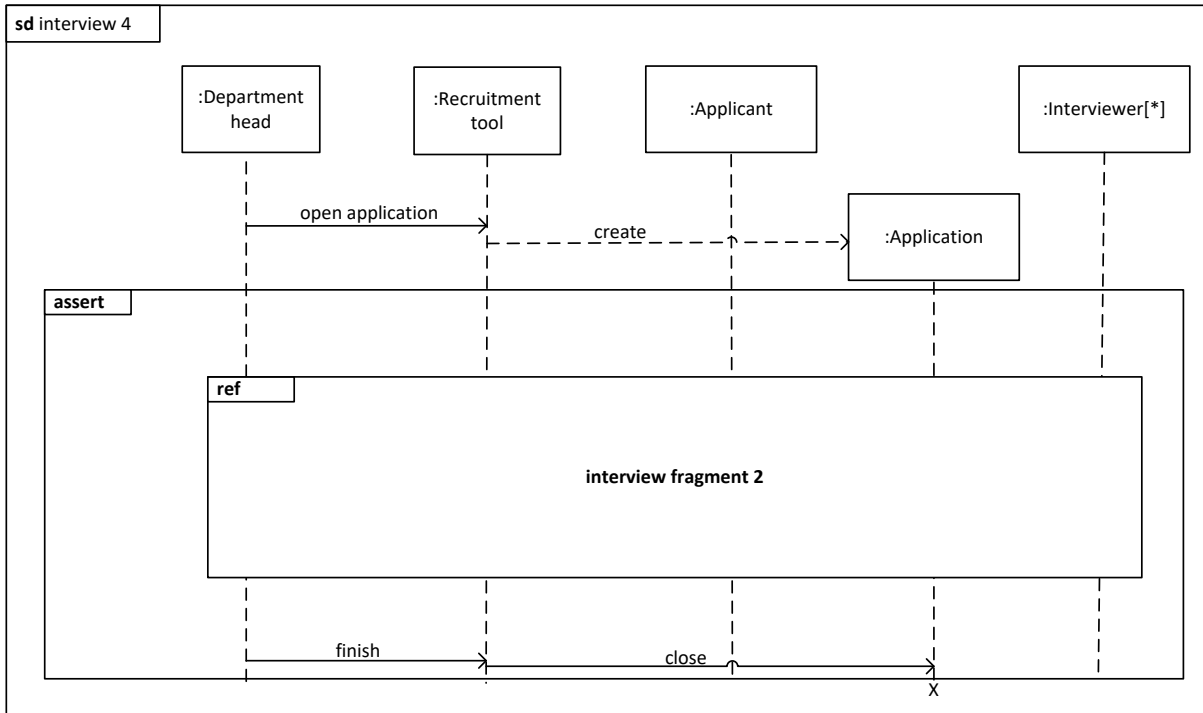


Figure 7

(weight 7%)

f) Is *sd interview 4* in Figure 7 a refinement of *sd interview 3* in Figure 6? Explain your answer. (Note that *sd interview 4* has no **loop** construct)

Question 3: Security Risk Assessment (30%)

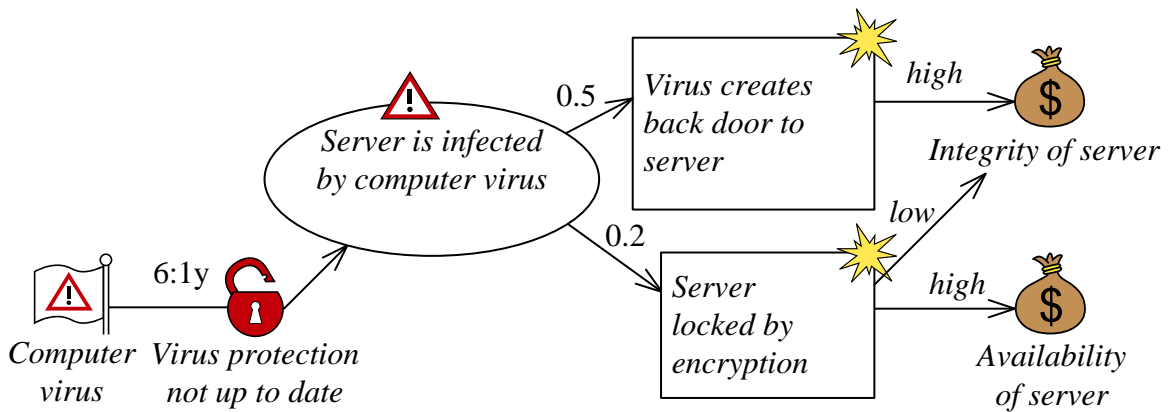


Figure 8

(weight 5%)

a) Determine frequencies for the threat scenario and the two unwanted incidents in Figure 8 in such a way the threat diagram is consistent under the assumption that it is complete.

(weight 5%)

b) Determine frequencies for the threat scenario and the two unwanted incidents in Figure 8 in such a way the threat diagram is inconsistent under the assumption that it is complete, but consistent under the assumption that it is not incomplete.

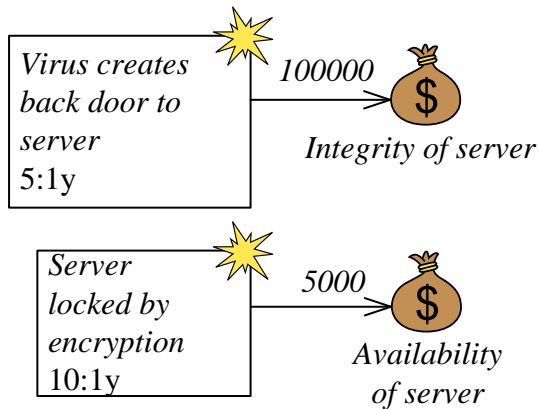


Figure 9

(weight 5%)

c) Calculate the frequency of the aggregated risk corresponding to the two unwanted incidents in Figure 9.

(weight 5%)

d) Assume consequence values in Figure 9 represent the average loss in EURO per occurrence. What is then the average loss in EURO per occurrence of the aggregated risk corresponding to the two unwanted incidents?

(weight 5%)

e) The party of the security risk assessment in Oblig-III was the company Bang!. It could also have been the applicant. Consider the asset "trust of applicant". In the setting of a security risk assessment would "trust of applicant" be a suitable asset for the company Bang!, the applicant, for both or for neither? Explain your answer.

(weight 5%)

f) Define a good qualitative scale with 6 values to measure trust (in the general case).