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.
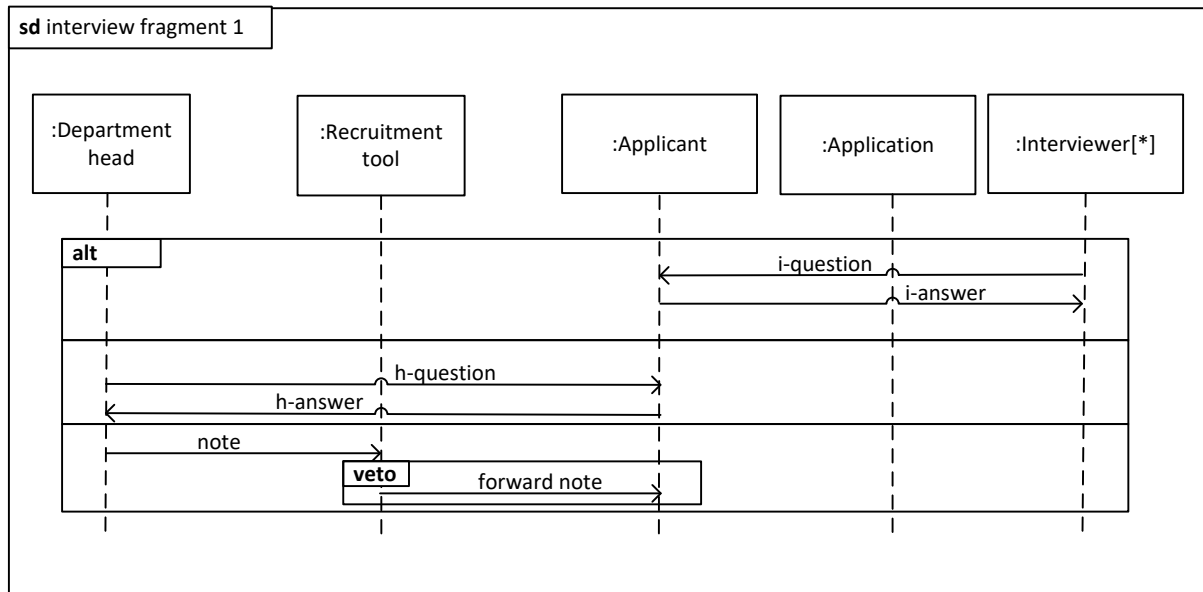

Figure 1

(weight 5%)

a) What is/are the potential initial event/events 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 **<e1,e2,...,en>** where **e1,e2,...,en** are events.

(weight 5%)

c) What is the shortest inconclusive trace with respect to the sequence diagram **sd** *interview fragment 1* in Figure 1?
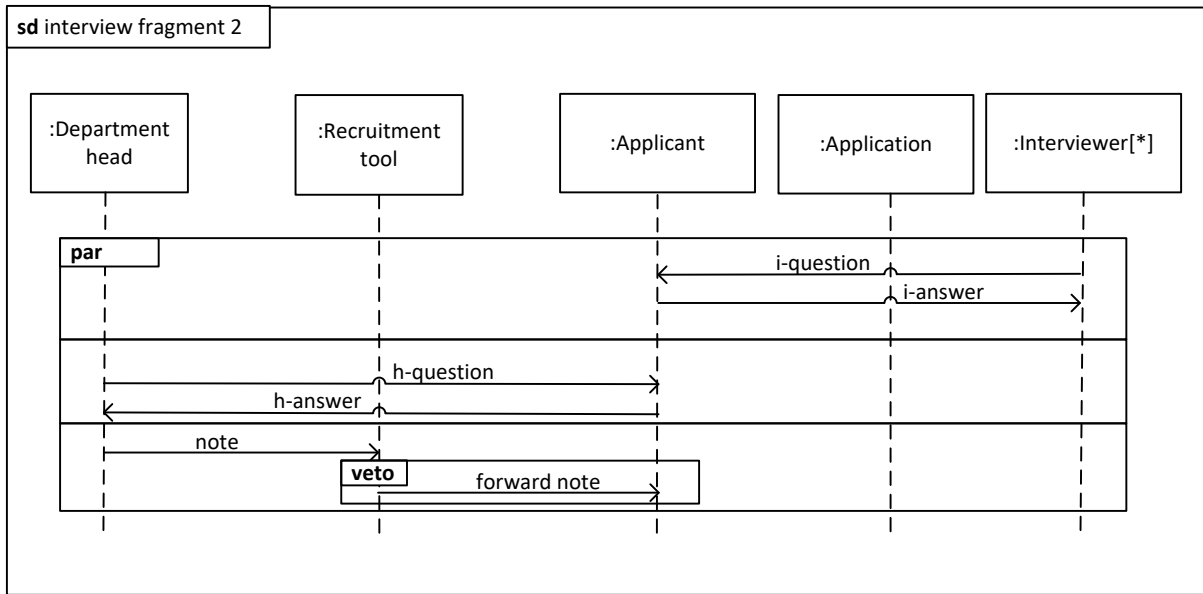
Figure 2

(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(Note that in **sd** *interview fragment 2,* the **alt** in **sd** *interview fragment 1* has been replaced by **par**.)
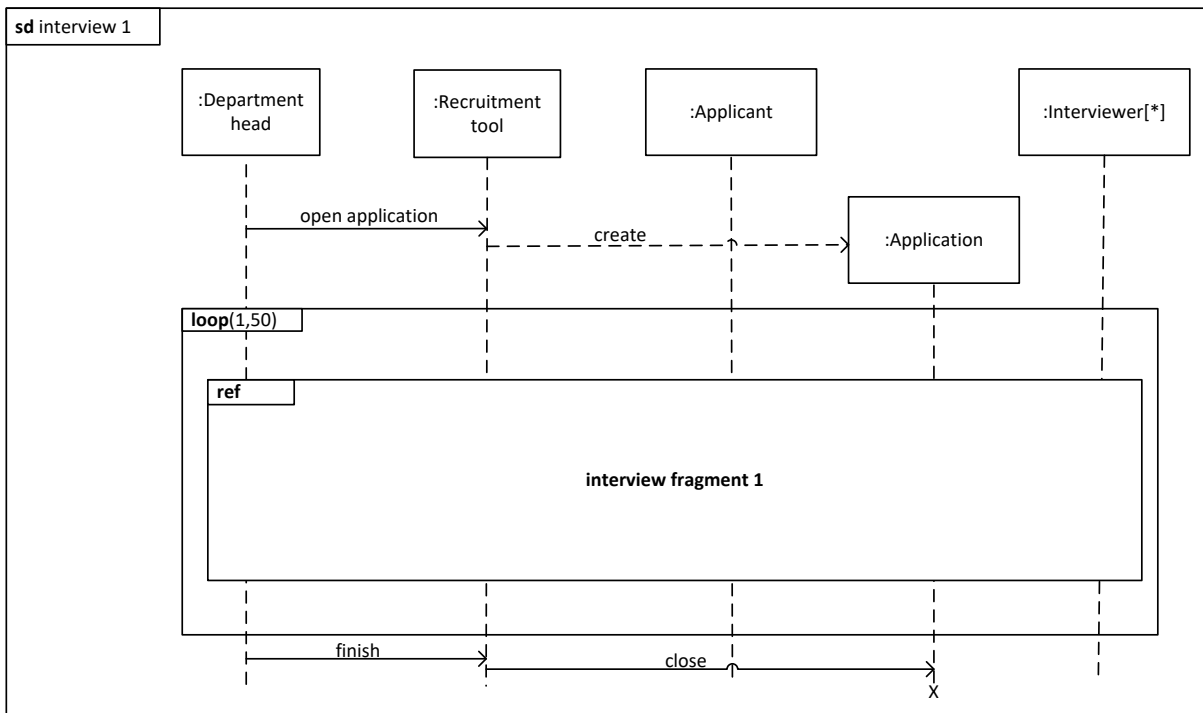

Figure 3

(weight 6%)

e) What is the minimal length of a positive trace of **sd** *interview 1* in Figure 3? Explain your answer.
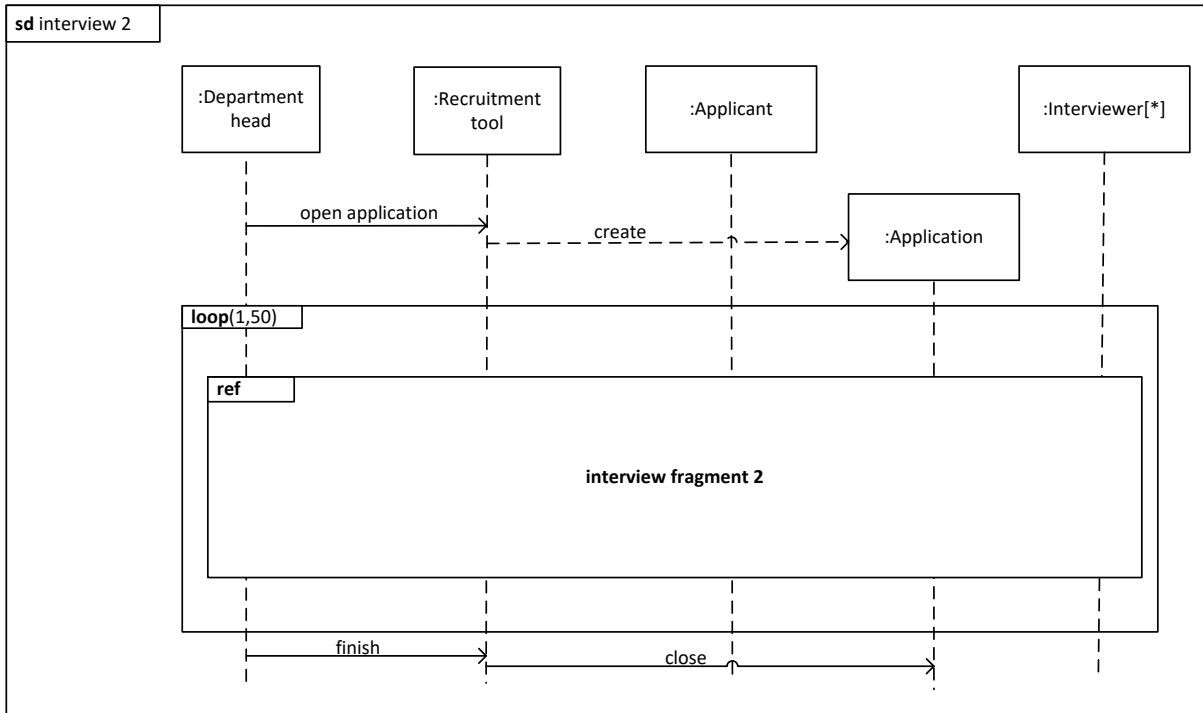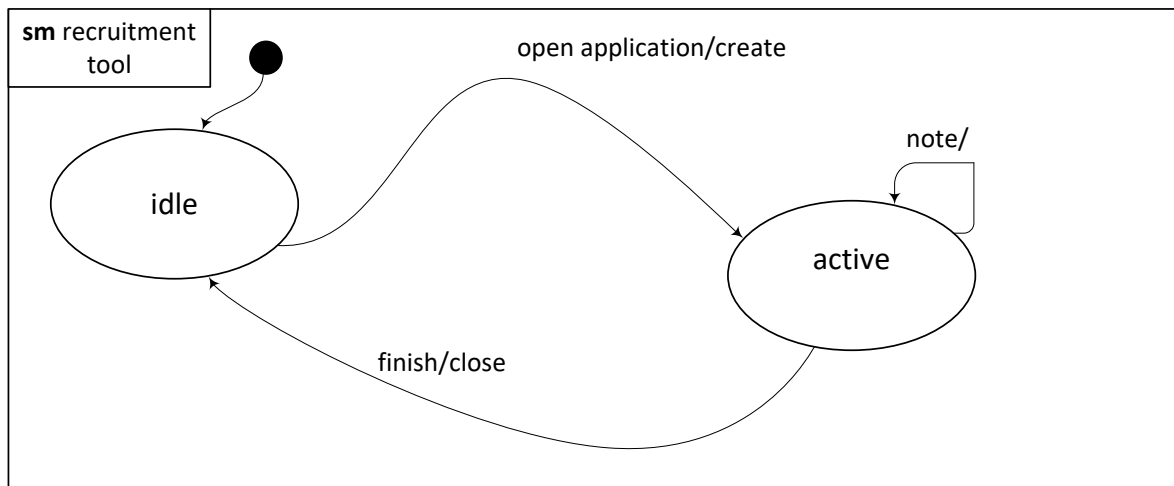
Figure 4

Figure 5

(weight 8%)

f) Explain how **sm** *recruitement tool* can be updated so that it describes all possible positive traces of **sd** *interview 2* with respect to the lifeline *:Recruitement 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%)

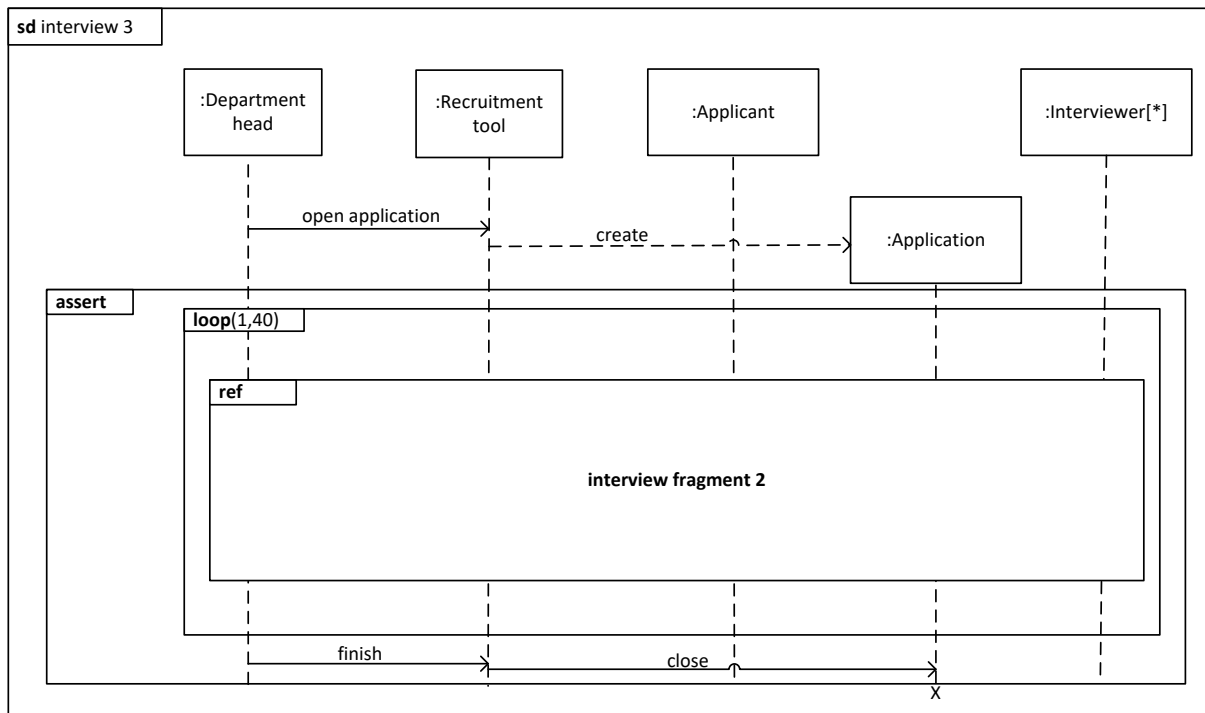d) Is **sd** *interview 2* in Figure 4 a refinement of **sd** *interview 1* in Figure 3? Explain your answer.

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**.)
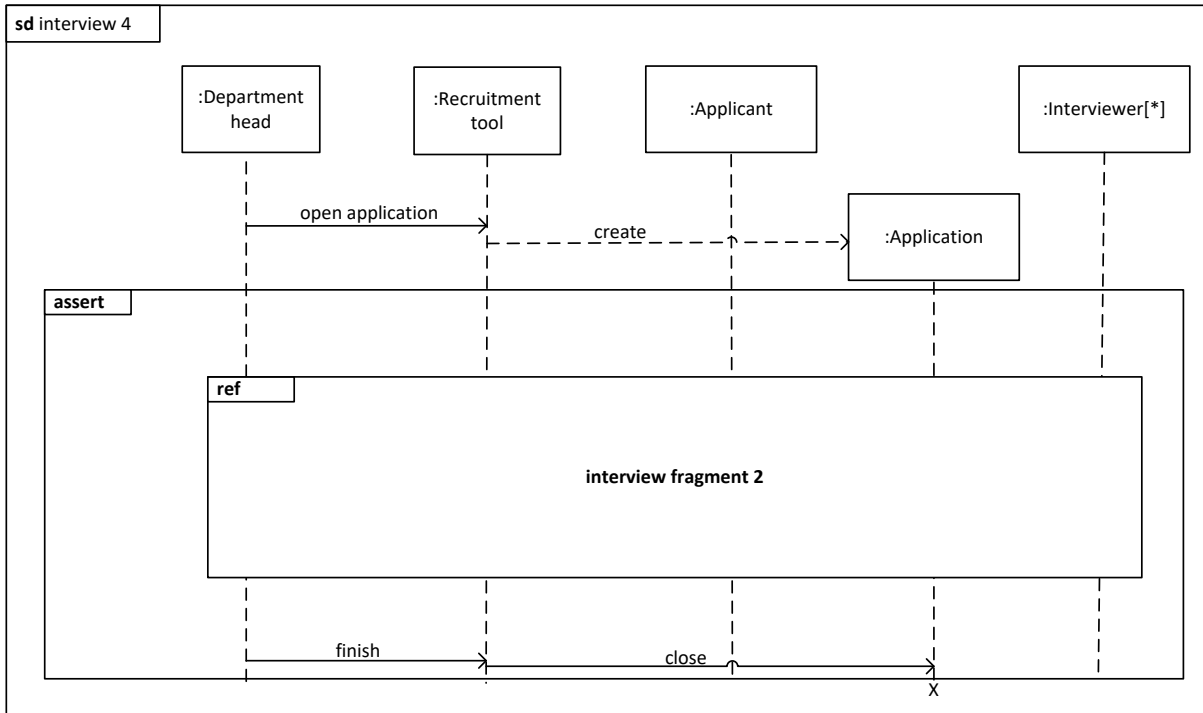
Figure 7

(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)

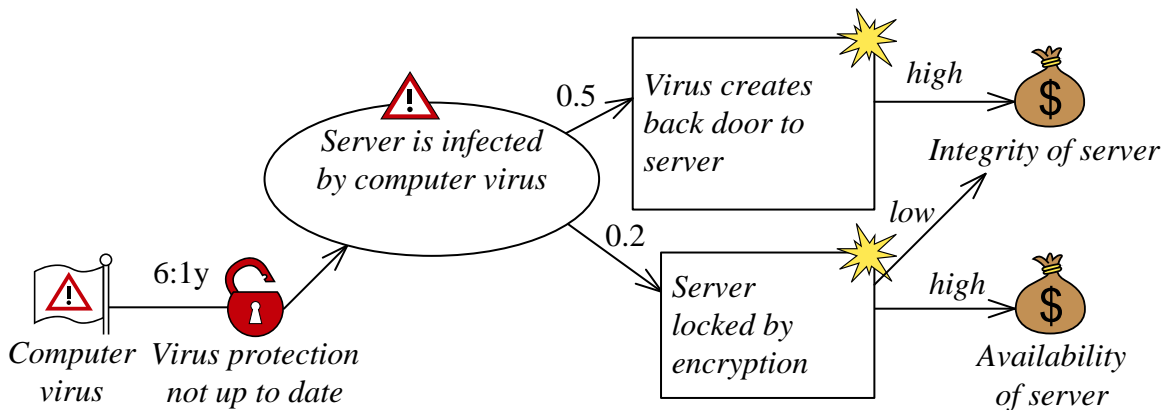## Question 3: Security Risk Assessment (30%)

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.

Virus creates back door to server 5:1y — *100000* → Integrity of server

Server locked by encryption 10:1y — *5000* → Availability of server
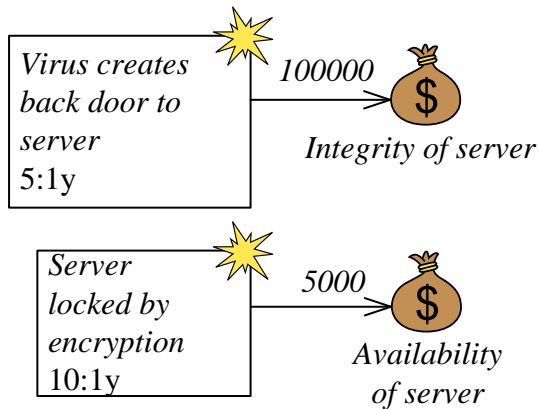
Figure 9

(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).