

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.

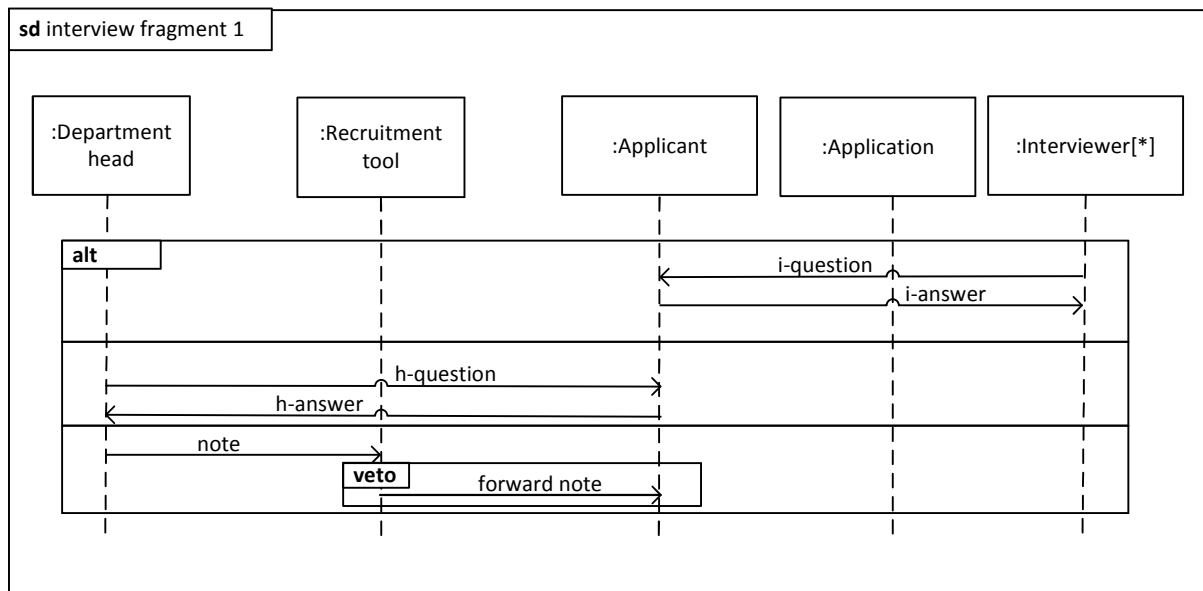


Figure 1

(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.

There are three possible initial events:

!i-question, !h-question, !note

The alt allows us to select freely between the three operands. Each operand has only one first event due to weak sequencing.

(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.

There is only one such trace:

<!note,?note,!forward note,?forward note>

Only one of the operands can produce a negative trace and it obtained weak sequencing with the first message.

(weight 5%)

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

The empty trace <>, since this trace is neither positive nor negative in the diagram.

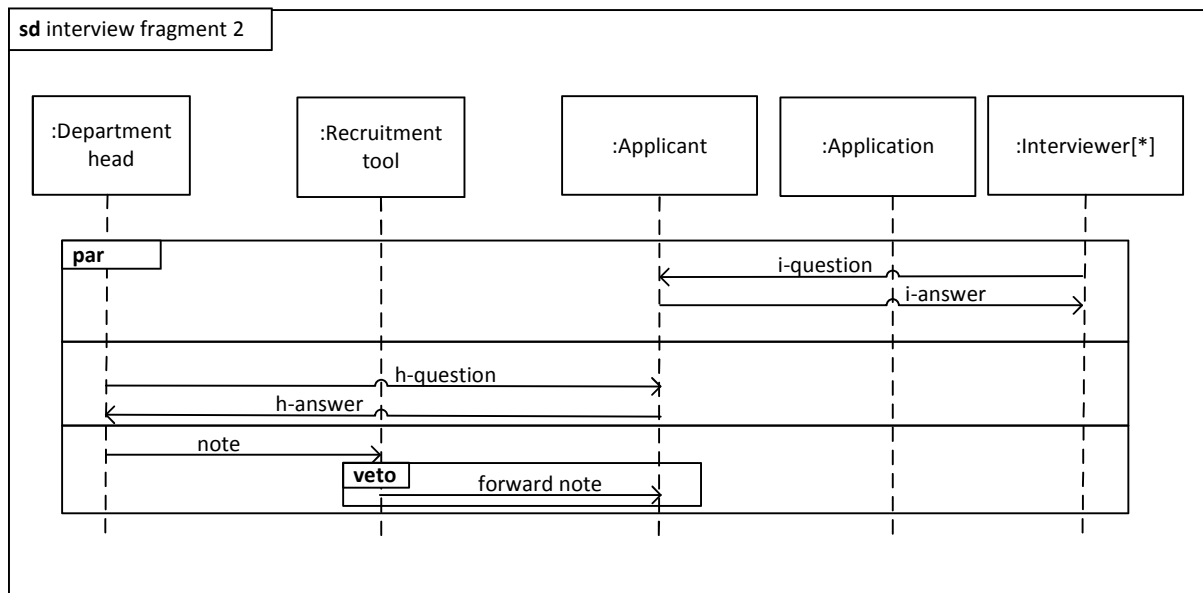


Figure 2

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 (Note that in **sd interview fragment 2**, the **alt** in **sd interview fragment 1** has been replaced by **par**.)

The length is 12. We get two events per message, and positive traces of the first two operands are interleaved with the negative one of the last.

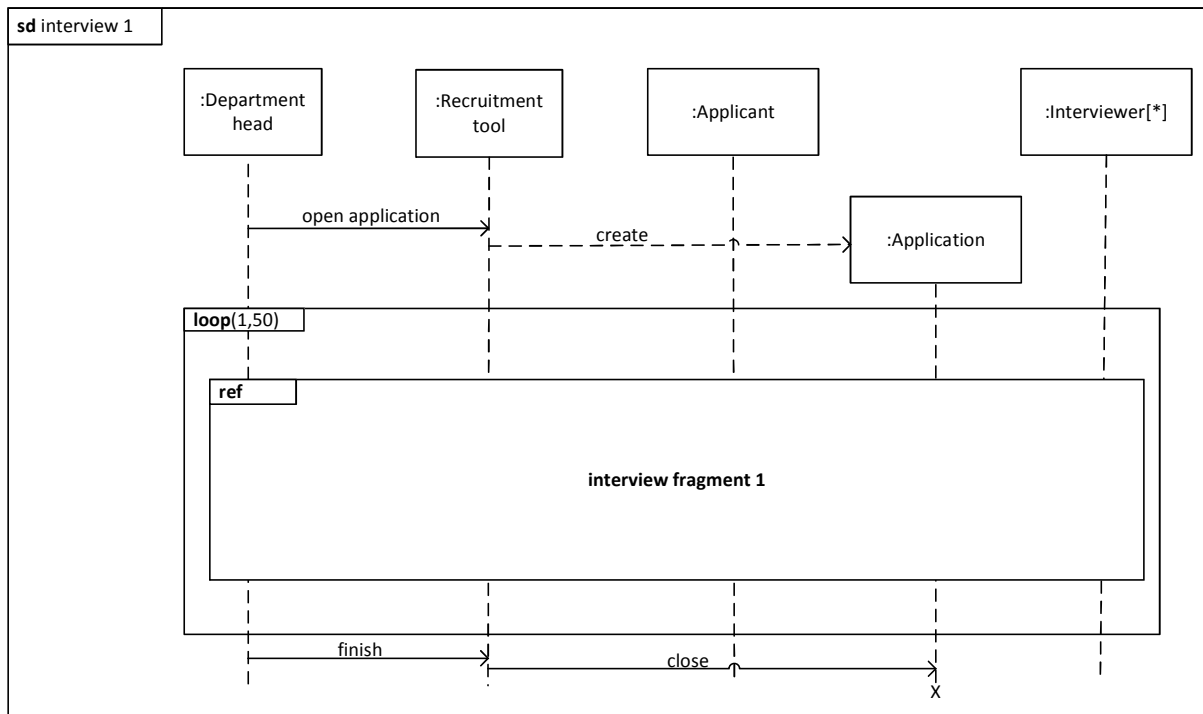


Figure 3

(weight 6%)

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

10, since we may loop only once and choose the alt-operand with positive trace of length 2. If they answer 8, because they do not count create, then that is also ok.

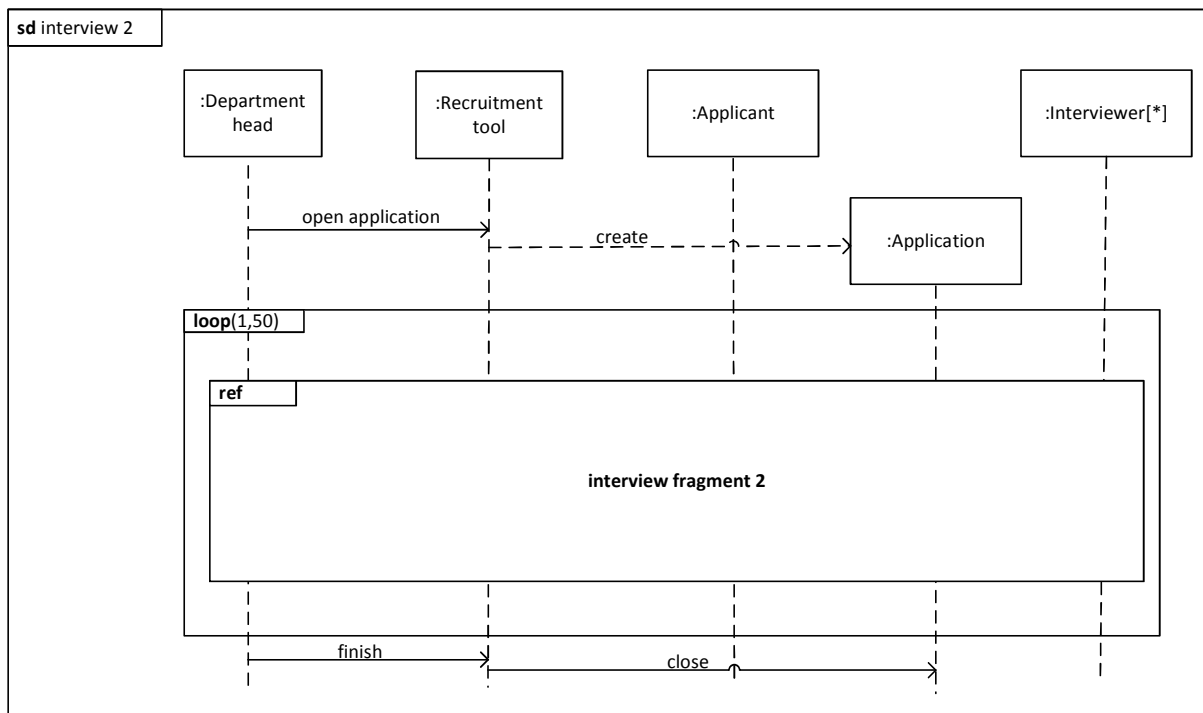


Figure 4

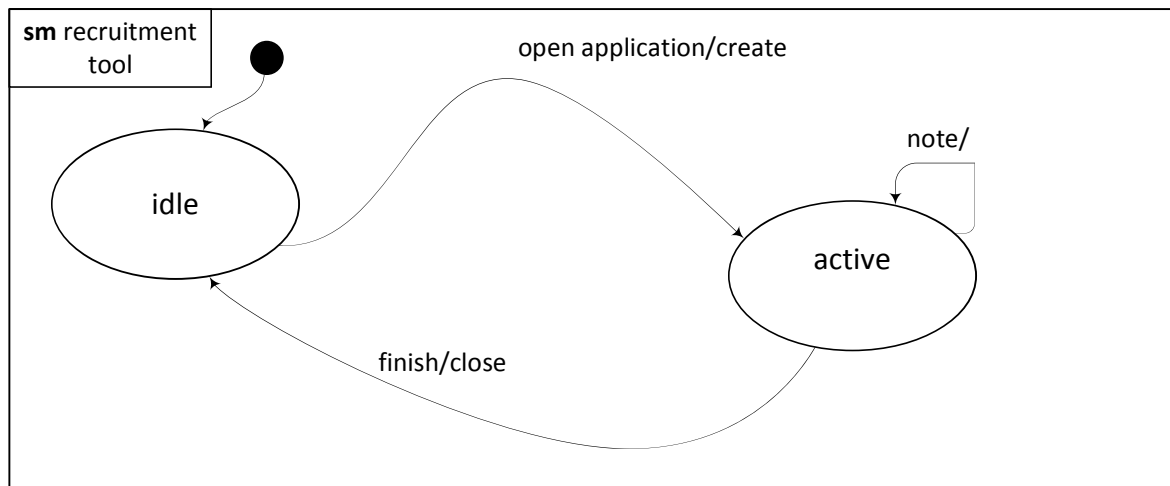


Figure 5

(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.

My idea is to insert another state in-between **idle** and **active** and require **note** as an input signal in order to get from the new state to **active**. Then any trace ending with **!close** must have at least one **!note**.

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%)

My idea is **refuse** within one of the **alt** operands.

- 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%)

My idea is to add another operand to **alt**.

- 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%)

My idea is to combine the two steps corresponding to the two first questions.

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

No, because positive traces become inconclusive.

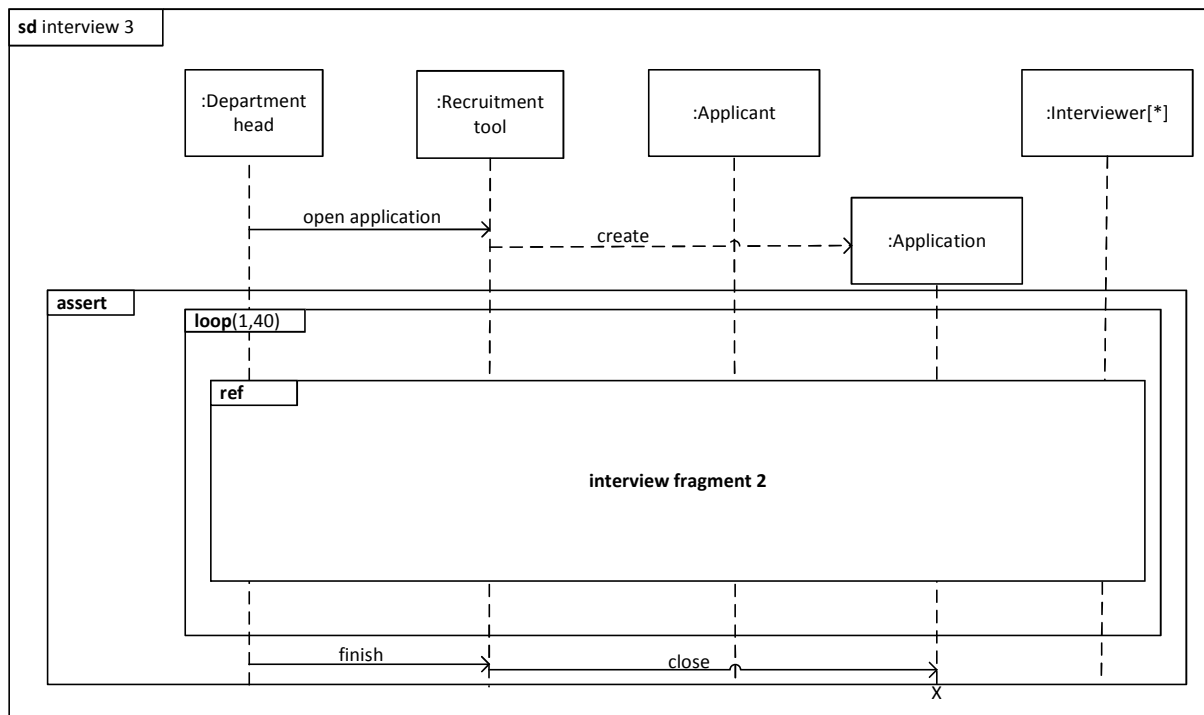


Figure 6

(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 maximum 40 iterations and we have introduced an **assert**.)

Yes. The positive traces of the new diagram are positive also in the old. The positive traces of the old diagram that are not positive in the new have become negative.

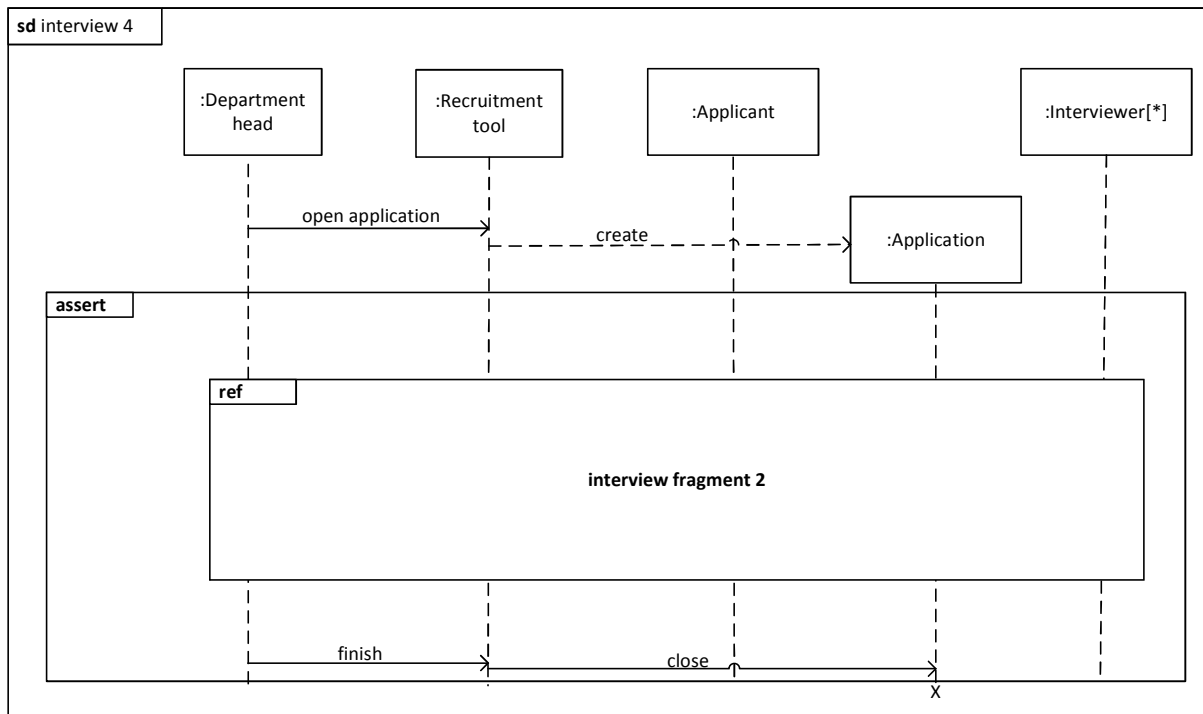


Figure 7

(weight 7%)

- g) 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)

Yes. The argument is basically the same as above since we basically loop once in interview 4.

Question 3: Security Risk Assessment (30%)

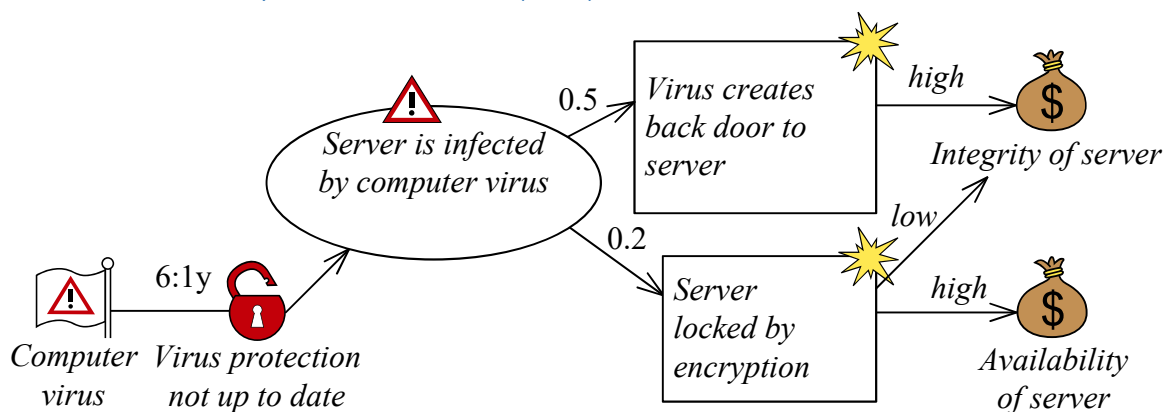


Figure 8

(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.