Oblig II: Refinement

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In this compulsory exercise we consider a service for mind-reading based on short videos. It is called the “Sherlock Holmes service” due to the famous detective’s abilities in this respect. The following excerpt has been taken from “The Adventure of the Cardboard Box” demonstrates Sherlock’s abilities:

Finding that Holmes was too absorbed for conversation I had tossed aside the barren paper, and leaning back in my chair I fell into a brown study. Suddenly my companion’s voice broke in upon my thoughts:

“You are right, Watson,” said he. “It does seem a most preposterous way of settling a dispute.”

“Most preposterous!” I exclaimed, and then suddenly realizing how he had echoed the inmost thought of my soul, I sat up in my chair and stared at him in blank amazement.

“What is this, Holmes?” I cried. “This is beyond anything which I could have imagined.”

He laughed heartily at my perplexity.

“You remember,” he said, “that some little time ago when I read you the passage in one of Poe’s sketches in which a close reasoner follows the unspoken thoughts of his companion, you were inclined to treat the matter as a mere tour-de-force of the author. On my remarking that I was constantly in the habit of doing the same thing you expressed incredulity.”

“Oh, no!”

“Perhaps not with your tongue, my dear Watson, but certainly with your eyebrows. So when I saw you throw down your paper and enter upon a train of thought, I was very happy to have the opportunity of reading it off, and eventually of breaking into it, as a proof that I had been in rapport with you.”

But I was still far from satisfied. “In the example which you read to me,” said I, “the reasoner drew his conclusions from the actions of the man whom he observed. If I remember right, he stumbled over a heap of stones, looked up at the stars, and so on. But I have been seated quietly in my chair, and what clues can I have given you?”

“You do yourself an injustice. The features are given to man as the means by which he shall express his emotions, and yours are faithful servants.”

“Do you mean to say that you read my train of thoughts from my features?”

“Your features and especially your eyes. Perhaps you cannot yourself recall how your reverie commenced?”

“No, I cannot.”

“Then I will tell you. After throwing down your paper, which was the action which drew my attention to you, you sat for half a minute with a vacant expression. Then your eyes fixed themselves upon your newly framed picture of General Gordon, and I saw by the alteration in your face that a train of thought had been started. But it did not lead very far. Your eyes flashed across to the unframed portrait of Henry Ward Beecher which stands upon the top of your books. Then you glanced up at the wall, and of course your meaning was obvious. You were thinking that if the portrait were framed it would just cover that bare space and correspond with Gordon’s picture over there.”

“You have followed me wonderfully!” I exclaimed.

“So far I could hardly have gone astray. But now your thoughts went back to Beecher, and you looked hard across as if you were studying the character in his features. Then your eyes ceased to pucker, but you continued to look across, and your face was thoughtful. You were recalling the incidents of Beecher’s career. I was well aware that you could not do this without thinking of the mission which he undertook on behalf of the North at the time of the Civil War, for I remember your expressing your passionate indignation at the way in which he was received by the more turbulent of our people. You felt so strongly about it that I knew you could not think of Beecher without thinking of that also. When a moment later I saw your eyes wander away from the picture, I suspected that your mind had now turned to the Civil War, and when I observed that your lips set, your eyes sparkled, and your hands clenched I was positive that you were indeed thinking of the gallantry which was shown by both sides in that desperate struggle.

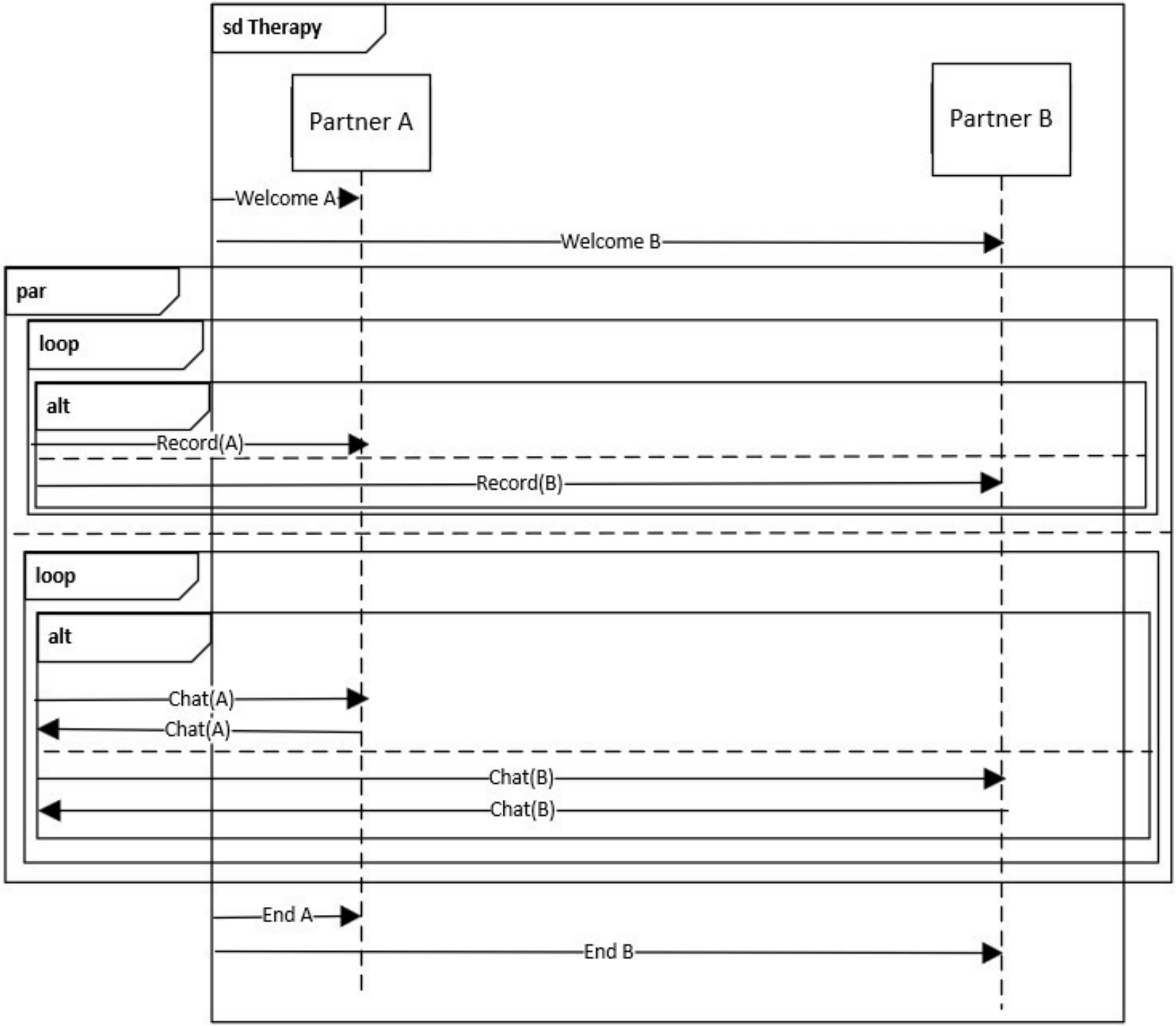
But then, again, your face grew sadder; you shook your head. You were dwelling upon the sadness and horror and useless waste of life. Your hand stole towards your own old wound and a smile quivered on your lips, which showed me that the ridiculous side of this method of settling international questions had forced itself upon your mind. At this point I agreed with you that it was preposterous and was glad to find that all my deductions had been correct."

"Absolutely!" said I. "And now that you have explained it, I confess that I am as amazed as before."

- We cannot hope to mirror the abilities of the famous detective, but it is nevertheless possible to make some deductions. For example, most of us can deduce with some certainty whether a person we are observing is surprised, angry, depressed, etc.
- Assume that we have developed such a service with the help of deep learning and that we are now supposed to test it out in different kinds of situations. We will in the following focus on the use of this service to assist therapists in couples' therapy. We consider the case where we have a one video recorder, a therapist, a couple, and the service.
- The service performs emotion analysis on recorded video segments. The therapist has a controller that may steer the video recorder. During the conversation the therapist make short recordings that are inputted to the service to get a second opinion about what the individual partners (of the couple) really think. The partners are both sitting in front of the therapist. The controller directs the video recorder to switch its focus between partners during the session, controlled by the therapist.

Question I

Consider the following sequence diagram representing a Therapy session


sd Therapy
Partner A
Partner B
Welcome A
Welcome B
par
loop
alt
Record(A)
Record(B)
loop
alt
Chat(A)
Chat(A)
Chat(B)
Chat(B)
End A
End B

Answer the following

a: Which events may occur as the first event in a positive trace of sd Therapy? Explain your answer.

b: Which events may occur as the last event in a negative trace of sd Therapy? Explain your answer.

c: Which events may occur as the second event in a positive trace of sd Therapy? Explain your answer.

d: Which events may occur as the first event in an inconclusive trace of sd Therapy? Explain your answer.

e: What is the length of the shortest positive trace of sd Therapy? Explain your answer.

Answers Question 1

a: ?Welcome A, ?Welcome B

b: None. There are no negative traces.

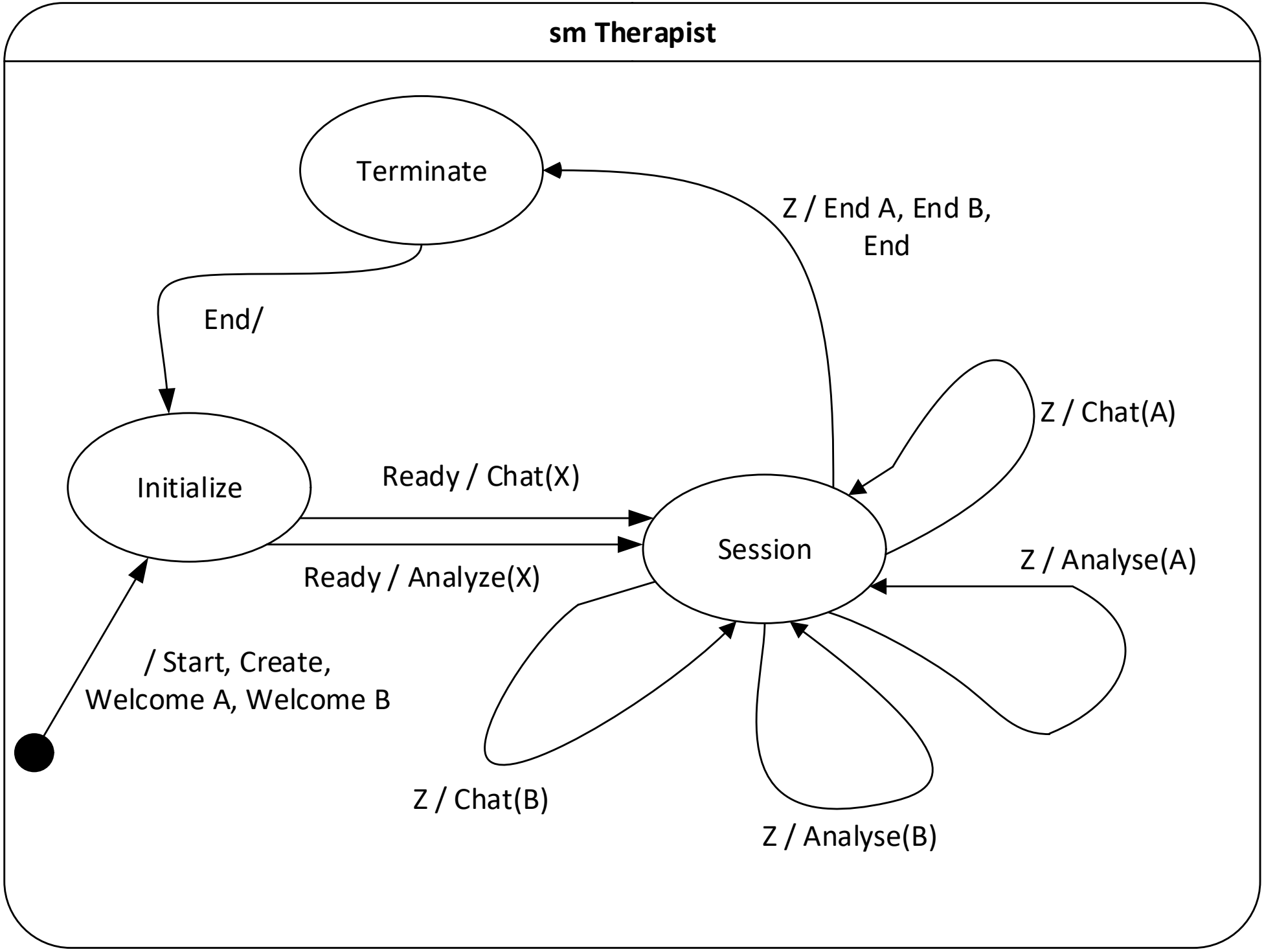
c: ?Welcome A, ?Welcome B, ?Record A, ?Record B, ?Chat A, ?Chat B, ?End A, ?End B

d: Any event

e: 4

Question II

Consider the following state machine representing the Therapist



Z is either Chat(A), Chat(B), Judgement(A) or Judgement(B)

Answer the following:

a: What is the length of the shortest positive trace of sm Therapist? Explain your answer.

b: What is the length of the shortest inconclusive trace of sm Therapist? Explain your answer.

c: What is the length of the shortest negative trace of sm Therapist? Explain your answer.

d: Is the trace <!Start, !Create, !Welcome A, !Welcome B, ?Not Ready> positive, negative or inconclusive with respect to sm Therapist? Explain your answer.

e: Is the trace <!Start, !Create, !Welcome A, !Welcome B, ?Ready> positive, negative or inconclusive with respect to sm Therapist? Explain your answer.

Answers Question 2

a: 4

b: There are no inconclusive traces

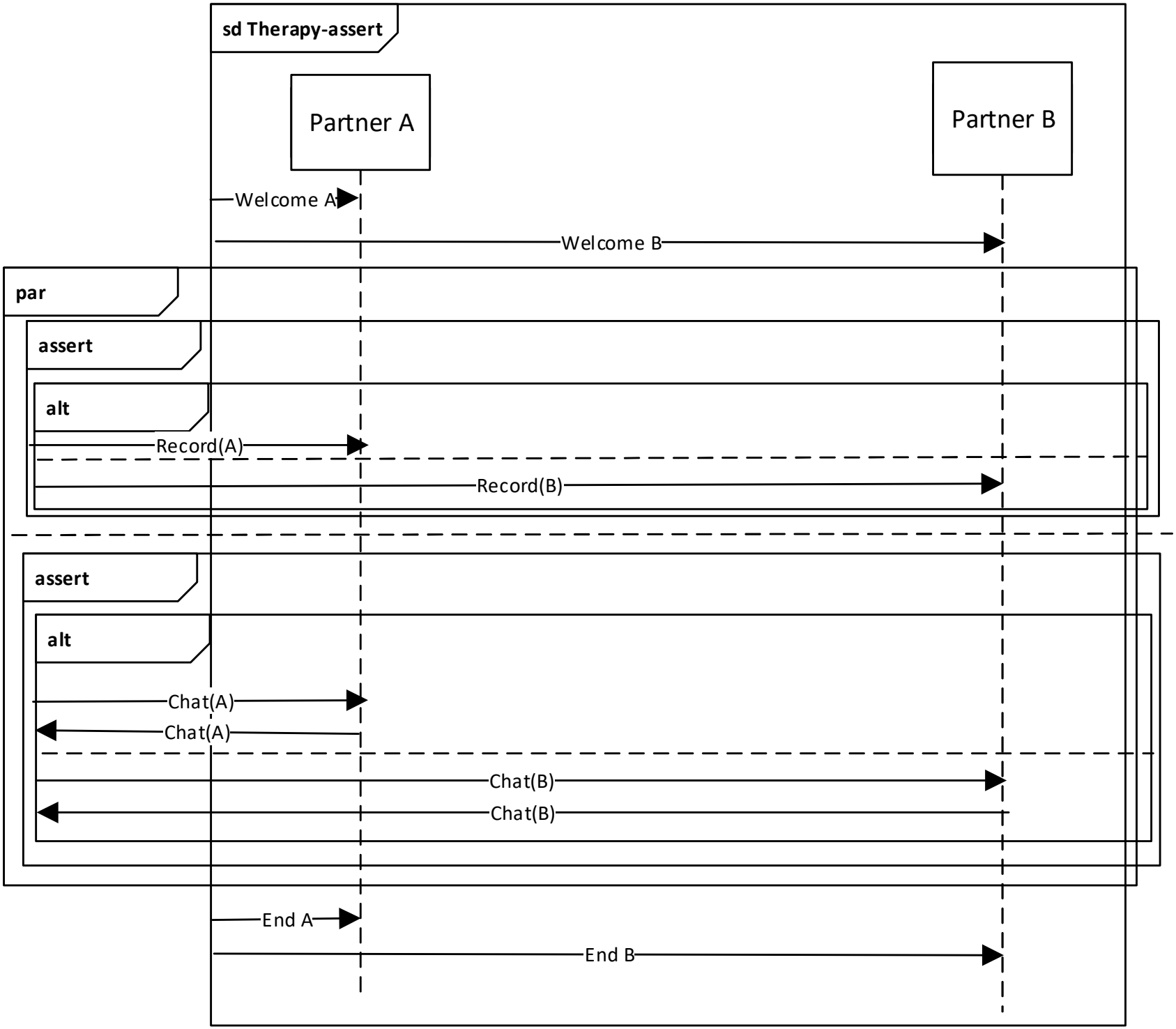
c: 0

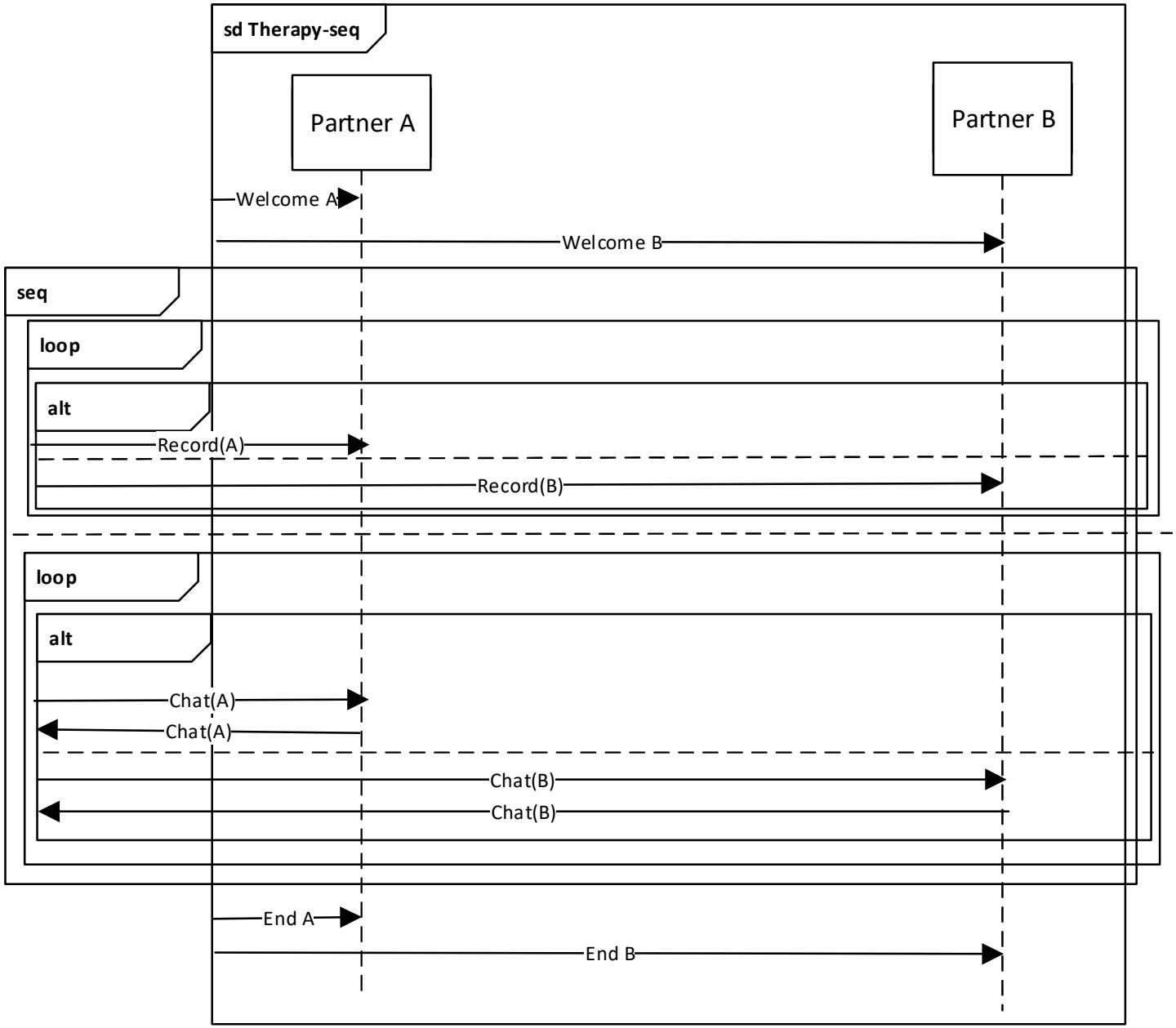
d: Positive

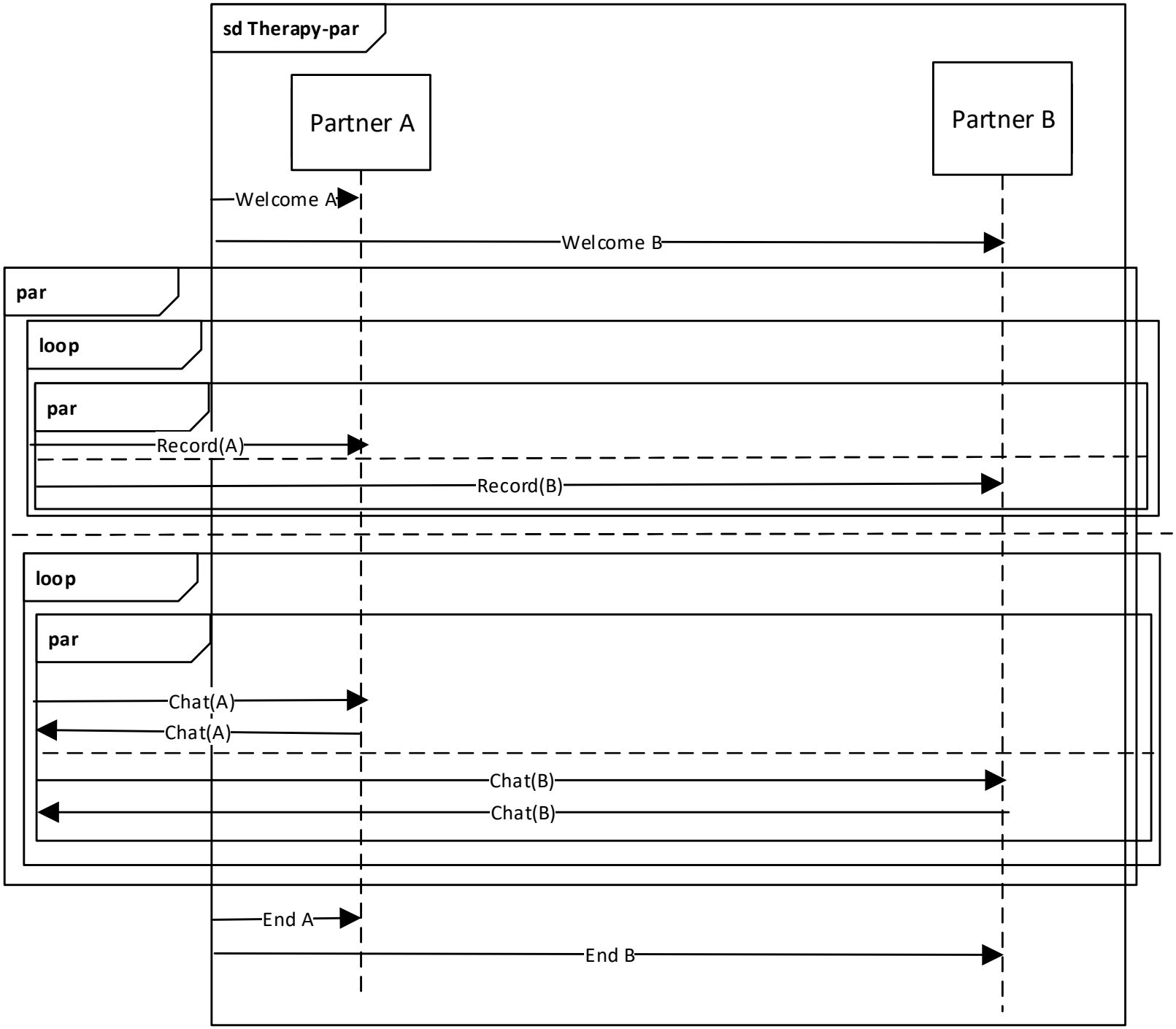
e: Negative

Question III

Consider the following adaptation of the initial sequence diagram


sd Therapy-assert
Partner A
Partner B
Welcome A
Welcome B
par
assert
alt
Record(A)
Record(B)
assert
alt
Chat(A)
Chat(A)
Chat(B)
Chat(B)
End A
End B


sd Therapy-seq
Partner A
Partner B
Welcome A
Welcome B
seq
loop
alt
Record(A)
Record(B)
loop
alt
Chat(A)
Chat(A)
Chat(B)
Chat(B)
End A
End B


sd Therapy-par
Partner A
Partner B
Welcome A
Welcome B
par
loop
par
Record(A)
Record(B)
loop
par
Chat(A)
Chat(A)
Chat(B)
Chat(B)
End A
End B

Answer the following questions:

a: Is sd Therapy-assert a refinement of sd Therapy? If so, what kind (narrowing/supplementing/both). Explain your answer.

b: Can sd Therapy-seq and sd Therapy be related by refinement in one way or another? If so, what kind (narrowing/supplementing/both). Explain your answer.

c: Is sd Therapy-par a refinement of sd Therapy? If so, what kind (narrowing/supplementing/both)? Explain your answer.

d: Explain how sd Therapy can be changed into sd Therapy-general so that sd Therapy-general is a general refinement of sd Therapy but not a limited refinement.

Answers Question 3

a: Yes, one iteration remains positive, the rest becomes negative. That's narrowing, but also other traces become negative and that's supplementing.

b: sd Therapy is a pure supplementing sd Therapy-seq since seq represents one interleaving option.

c: No. Traces corresponding to looping once and executing one alt option have for example become inconclusive.

d: Make a diagram with xalt as main construct and put sd Therapy inside the first option. Make sure that the content of the second option is not a refinement of Therapy.