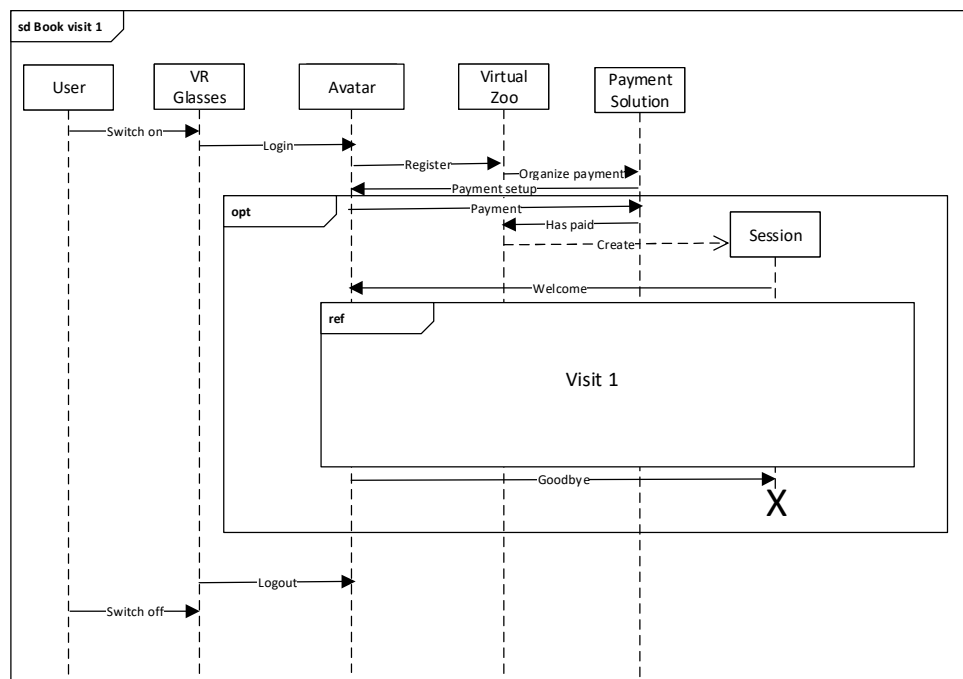


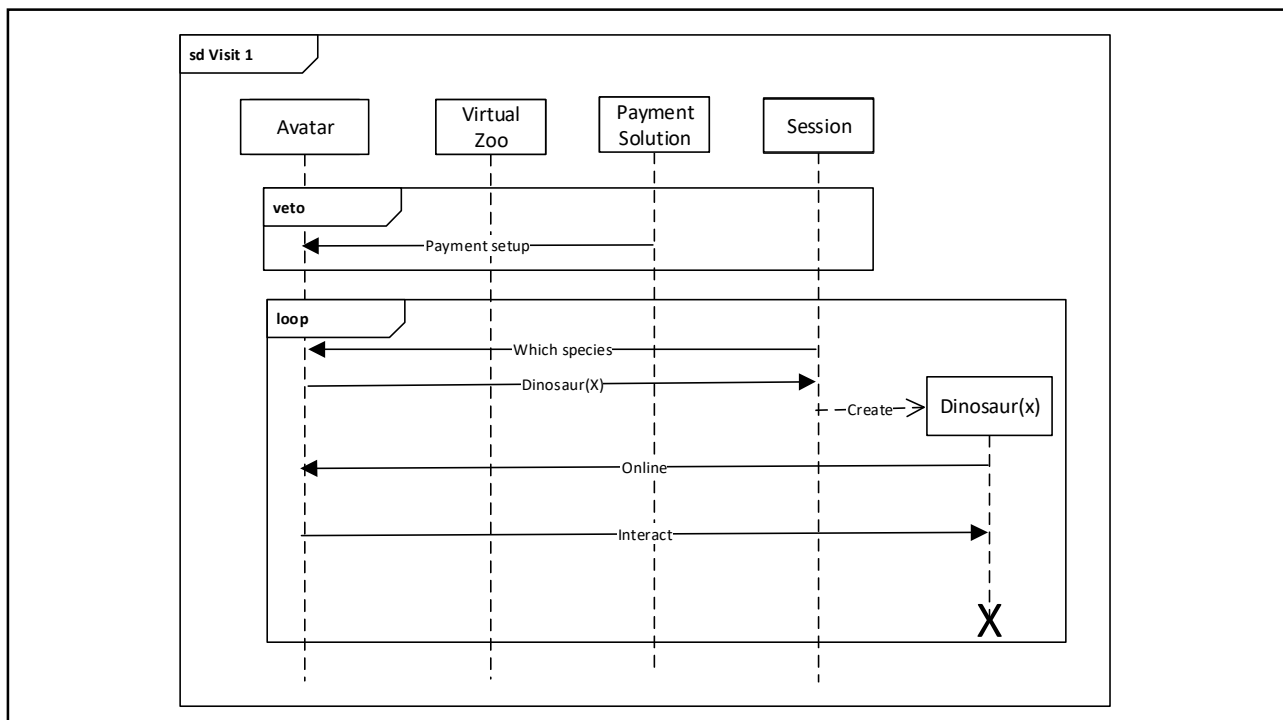


Exam 2022

1



2



3

Question 1

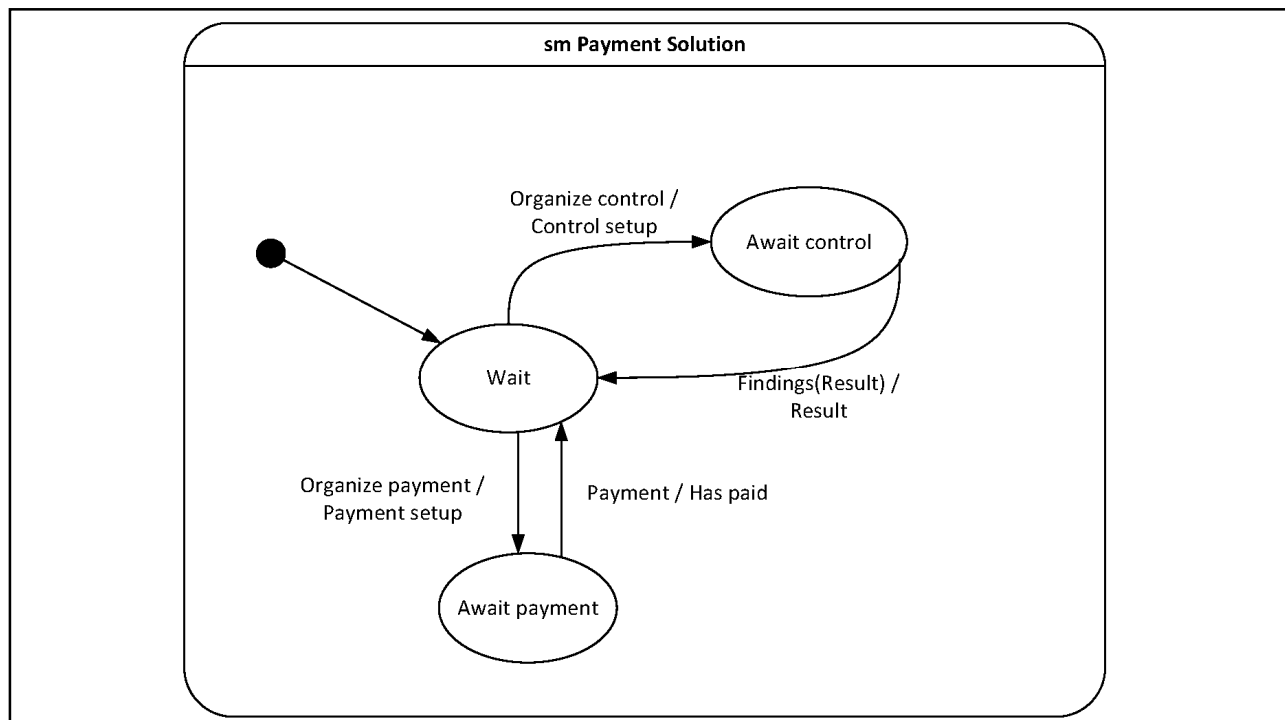
- Which events may occur as the first event in a positive trace of sd Book visit 1? Explain your answer.
- Which events may occur as the first event in a negative trace of sd Book visit 1? Explain your answer.
- Which events may occur as the last event in a positive trace of sd Book visit 1? Explain your answer.
- What is the length of the shortest negative trace of sd Book visit 1? Explain your answer.

4

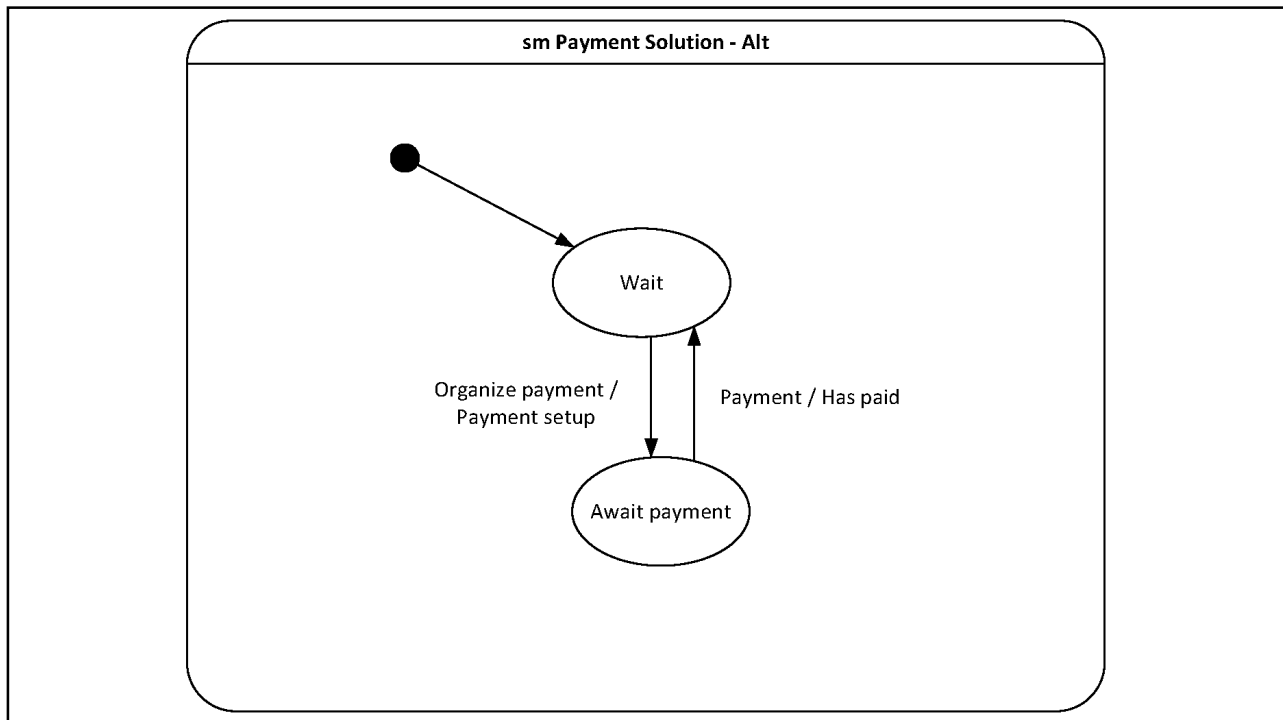
Question 1 answers

- a) !Switch on
- b) !Switch on
- c) ?Switch off, ?Logout, ?Goodbye, ?Interact
- d) 26

5



6



7

Question 2

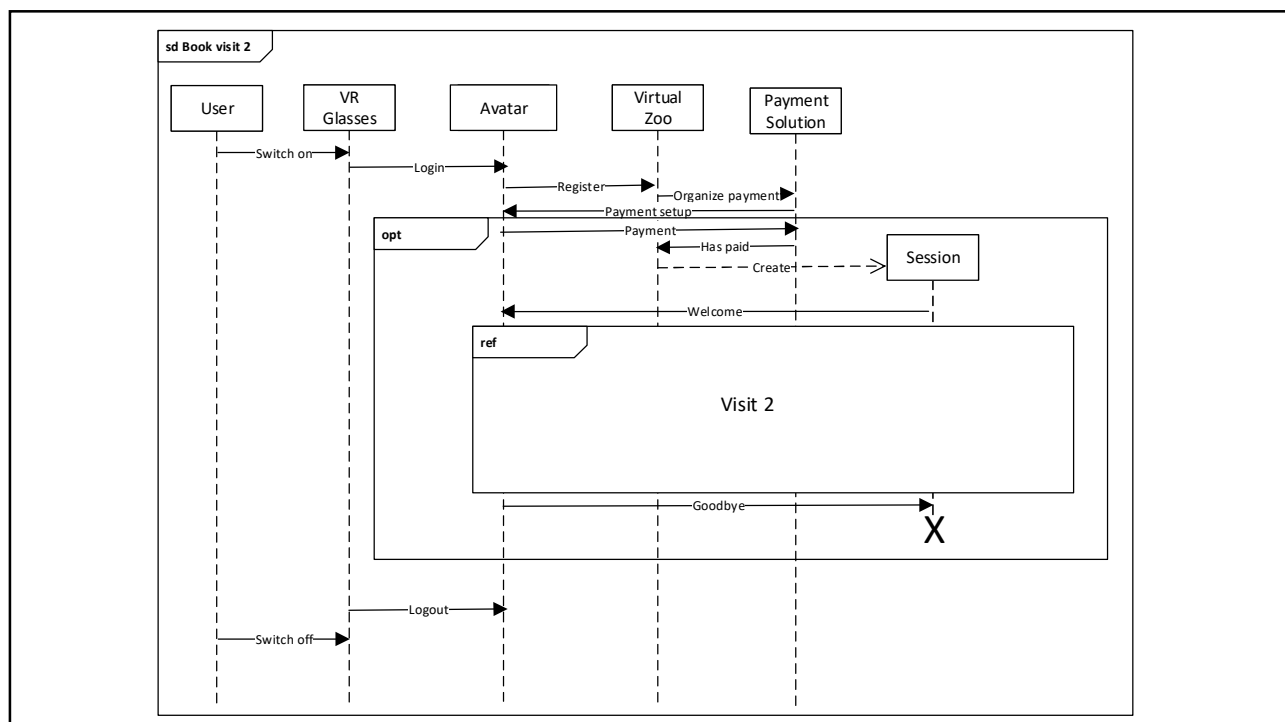
- Does sm Payment Solution correctly reflect all traces specified by the lifeline Payment Solution in sd Book visit 1. Explain your answer.
- Is sm Payment Solution - Alt a refinement of sm Payment Solution? Explain your answer.

8

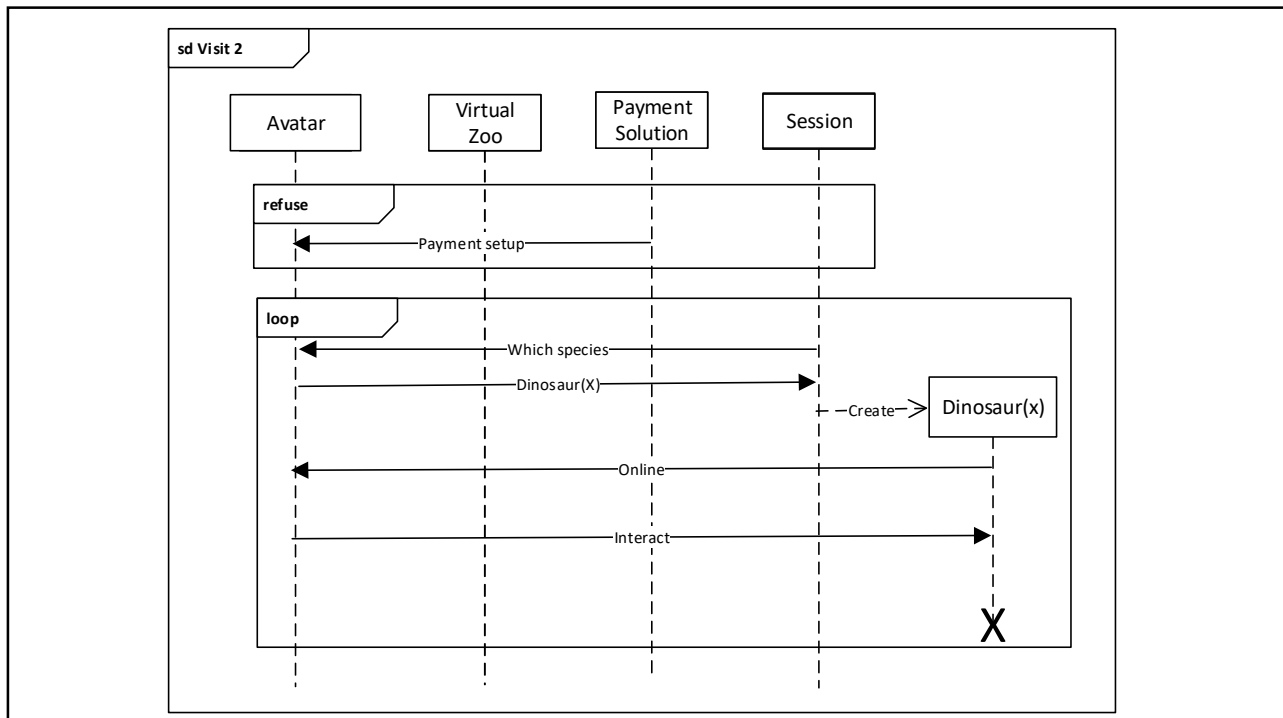
Question 2 answers

- a) Yes. The positive are allowed; the negative are not allowed.
- b) No. Any behavior involving sending a message after receiving Organize control or Findings(Result) are negative in Payment solution – Alt. However, we get an implicit transition from Wait to itself for Organize control. This is positive behavior that was negative.

9



10



11

Question 3

- Describe two different positive traces of sd Book visit 2 in full. Use the style $\langle e_1, e_2, \dots, e_N \rangle$ where $e_1, e_2, \dots, e_N$ are events.
- To what extent can sd Book visit 1 and sd Book visit 2 be related by supplementing, narrowing or a combination in one way or another? Explain your answer.
- To what extent can sd Book visit 1 and sd Book visit 2 be related by general refinement or limited refinement in one way or another? Explain your answer.

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Question 3 answers

a)

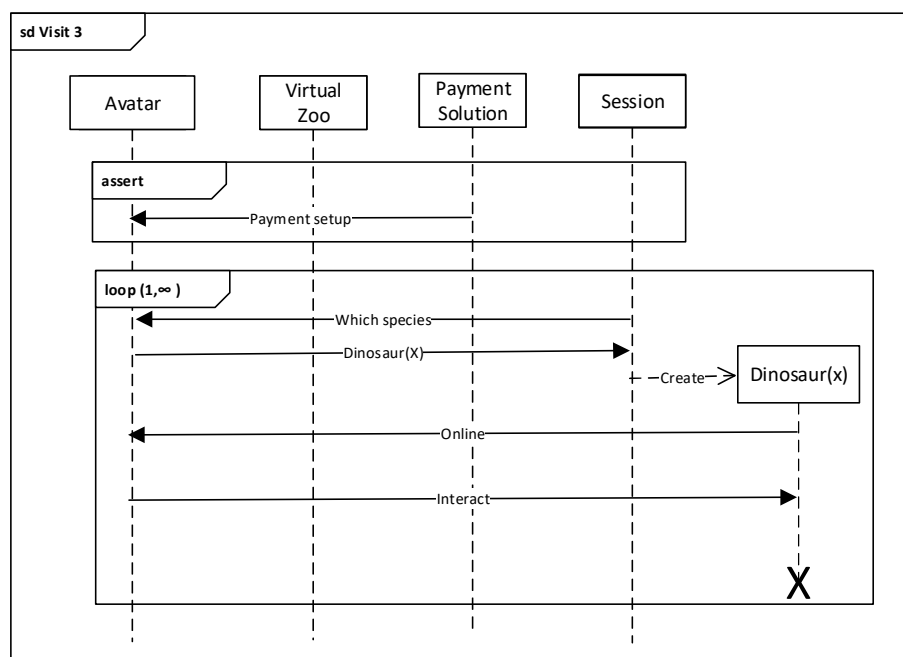
<!Switch on, ?Switch on, !Login, ?Login, !Register, ?Register, !Organize payment, ?Organize payment, !Payment setup, ?Payment setup! Logout, ?Logout, !Switch off, ?Switch off>

<!Switch on, ?Switch on, !Login, ?Login, !Register, ?Register, !Organize payment, ?Organize payment, !Payment setup, ?Payment setup! Logout, !Switch off, ?Logout, ?Switch off>

b) Visit 1 supplements Visit 2 in which case Book visit 1 supplements Book visit 2. No other relation holds.

c) Limited refinement and general refinement degenerates to ordinary refinement for specifications without xalt. Hence, Book visit 1 is both a general and a limited refinement of Book visit 2.

13



14

Question 4

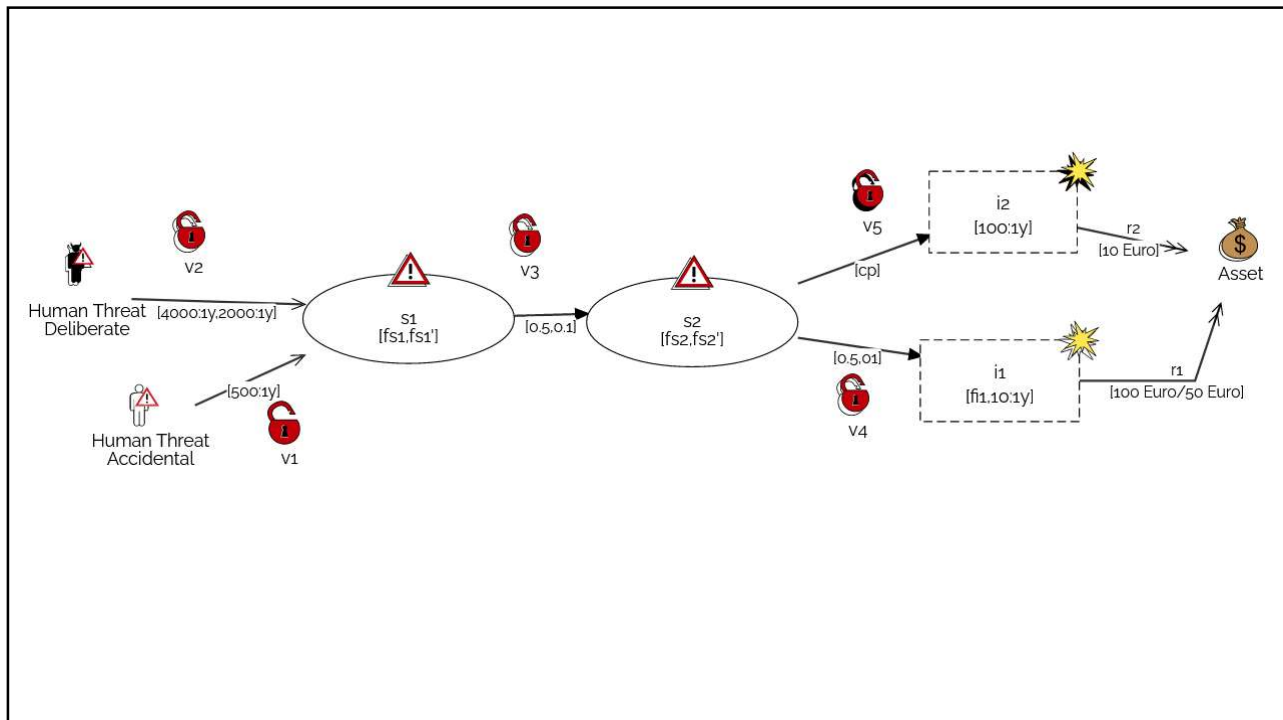
- a) Which events may occur as the first event in a negative trace of sd Visit 3. Explain your answer. Note that $\text{loop}(1, \infty)$ means that the loop may iterate any number of times between 1 and ∞ .
- b) Which events may occur as the last event in a negative trace of sd Visit 3? Explain your answer.
- c) How many traces are inconclusive with respect to sd Visit 3. Explain your answer.

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Question 4 answers

- a) Any event.
- b) No event on Avatar and Session, ?Interact on Dinosaur, any event on Virtual Zoo and Payment Solution.
- c) Infinitely many.

16



17

Question 5

- Calculate the frequency $fs1'$ under the assumption that the diagram is complete
- What can we deduce about the frequency $fs1$ under the assumption that the diagram is complete
- What can we deduce about the frequency $fi1$ independent of whether the diagram is complete

18

Question 5 answers

- a) Two correct answers: 2000:1y or 1000:1y (depending on forward or backward calculation).
 - Full score as long as you come up with one of the alternatives.
- b) Minimum 4000:1y. Maximum 4500:1y
- c) At least 1000:1y.

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Question 6

- a) Calculate the conditional probability cp under the assumption that the diagram is complete
- b) What can we deduce about the conditional probability cp independent of whether the diagram is complete
- c) Calculate the consequence of $i1$ or $i2$ in the after situation under the assumption that $i1$ and $i2$ are separate.

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Question 6 answers

- a) Two correct answers: 0.5 or 1 (depending on forward or backward calculation).
 - Full score as long as you come up with one of the alternatives.
- b) Two correct answers: It cannot be larger than 0.5 or 1 (depending on forward or backward calculation).
 - Full score as long as you come up with one of the alternatives.
- c) $(10 \cdot 100 + 50 \cdot 10) / (100 + 10) = 1500 / 110 = 13.64$