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Exercise sheet 2

Exercise 2 - 1

Weak Syllogism
Given three statements A, B, and C, label the statement "$A \Rightarrow BC$", i.e. "if A is true, B and C are true" with I. Show

a) $P(A|BI) \geq P(A|I)$ (1 point).

b) $P(A|B+C,I) \geq P(A|I)$.
Note that a comma binds the arguments of a probability function as a logical "and", i.e., $P(A|B+C,I) = P(A|(B+C)I)$. (1 point)

Exercise 2 - 2

Given two statements A and B, label the statement $A \Rightarrow B$, i.e., "If A is true, then B is true.", with C. Show the strong syllogisms $P(B|AC) = 1$ and $P(A|\overline{B}C) = 0$ (2 points).

Exercise 2 - 3

You are a secret agent following the activities of the notorious Charlie. Charlie's masterplan is hidden in a safe with the passcode being the month and date of her birthday. Charlie is away this week and has entrusted her passcode to Alice and Bob: she tells Alice the month of her birthday and Bob the date of her birthday. Everybody involved (Alice, Bob, you, and of course Charlie) knows that

- Charlie's birthday belongs to one of the following dates: Jan 12, Jan 13, Jan 16, Feb 14, Mar 13, Mar 14, Mar 15, Apr 11, Apr 13, May 11, Jun 11, Jun 12, Jun 14.

Everyone also knows that the others know this.

Moreover you secretly overhear the following conversation:

1. Agent α: "I don't know the passcode but I know you don't know either"
2. Agent β: "I didn't know the passcode but now I do"
3. Agent α: "I also now know the passcode".

a) Recognising agent α as Alice and agent β as Bob can you figure out when Charlie's birthday is? (4 points)

b) You realise you've made a mistake. Agent α is actually Bob and agent β is Alice. Can you now figure out when Charlie's birthday is? (4 points)

c) Do the answers match? Explain with respect to the principle stated in the lecture that "The order of information is irrelevant". (2 points)

d) Explain why the concept of a Theory of Mind (ToM) is relevant here! ToM of which order is required to find Charlie's password? (2 points)

Exercise 2 - 4

What is Intelligent?

1. A rock.
2. A human.

3. An ant colony.
4. Language.

a) Which of the above would you classify as an intelligent system. Why? (2 point)

b) Which of the above is a physical system? (1 points)

c) Draw an "intelligence spectrum" line with intelligent systems on one end and non-intelligent systems on the other. Mark a few systems on this intelligence spectrum. (2 points)