

## Sample question for COGJET2021

(100 marks)

*[marks distribution for sub-parts is given as bold bracketed numbers]*

To answer the questions asked below, please refer to the following paper. You are welcome to use the internet or any other resources to try and answer these questions.

<https://www.pnas.org/content/117/50/31738>

Q1. The central assumption of the paper is that mouse movements reflect a smoothed version of relative accumulated evidence [section:Mouse Tracking, paragraph 2, line 1].

(a) What do the authors mean by smoothing, and what could be causing the smoothing? **[10]**

(b) Can you think of any characteristics of people that would make this assumption be either more or less likely to be true for them? **[10]**

Q2. Equation 1 and 2 specify a utility function mapping  $x$  to  $u$ .

(a) What is  $x$  and what is  $u$  here in the context of the paper? **[10]**

(b) What sort of values do you expect to see for  $\rho$  and  $\lambda$  for normal human subjects? Why? **[10]**

Q3. Figure 3 is an important summary of the authors' conclusions.

(a) The authors say that they calculate the difference in subjective value of each of the 215 gambles for each participant. Let's say I give you a gamble where you can choose either an option that pays Rs 100 for sure or an option that pays Rs 500 with a probability of 0.2 and nothing otherwise. How will you calculate the difference in subjective value for this gamble for yourself? Assume any information you need to find the answer, and state these assumptions clearly in your answer. **[10]**

(b) Let's say we want to rerun the analysis shown in Fig 3, except I want to average over AUCs rather than the actual trajectory coordinates. Given below is some pseudocode that tries to do this

indices = [23, 44, 65, 86, 107, 128, 149, 170, 191, 214]

for study in studies:

    for participant in participants[study]:

        for gamble in gambles[participant]:

            list = addToList(list, getSubjectiveValue(gamble))

        sortList(list, ascending=True)

        start = 0

        count = 0

        decile = Array[10]

        for end in indices:

            sum = 0

            for idx in range(start,end):

                sum+= gambles[idx].AUC

            value[study, participant, gamble, count] = sum/(end-start)

            start = end

            count+=1

mean = findAverage(value)

- (i) How many times will the function `getSubjectiveValue` be called in total? **[5]**
- (ii) What will be the computational complexity of the `findAverage` function? **[5]**
- (iii) Could you write some better code or pseudocode to accomplish this task? **[10]**

Q4. Fig 6 summarizes the authors' findings of Experiment 3.

- (a) Why do the authors expect less conflict when accepting a gamble and more conflict when rejecting a gamble in the broad bracketing condition? **[10]**
- (b) The authors analyzed the data using a fixed-slope variable intercept model. Why do you think they did this? **[10]**

Q5. What evidence do the authors present to support their claim that mouse tracking is a better measure of conflict than RT? **[10]**