$\frac{\text{CGS602A: Basic Statistics, Data Analysis and Inference}}{\text{Quiz } \#1:}$

Max marks: 45 Time: 1hr

- 1. Answer all 4 questions.
- 2. While it is easy to collaborate in an online exam. I hope you will not violate the honesty policy of the course.
- 1. A coffee loving south Indian friend of yours claims that he can instantly distinguish between filter coffee and a popular brand of instant coffee. Design an experiment to test his/her claim. Where does randomization enter your experiment? And what outcome will falsify his/her claim assuming that the probability of that outcome happening purely by chance should be bounded by 0.05?.

Give all the necessary details of your design justifying your choices.

2. In the early days of the pandemic many developed nations and Iran saw a rapidly rising surge of infections whereas developing countries had very few infections and much lower infection rates a theory put forward by some scientists was that the BCG vaccine which is universally given in childhood in the developing countries but not in the developed countries and in Iran was the cause populations in developing countries showed such low numbers - that is BCG was also making it harder for the Corona virus to infect a person. They did this by using available world-wide BCG data and infection numbers.

No one talks of this theory today. Criticize this theory as a theory of causation and briefly point out what other factors may have been at play for the observed data.

- 3. You and two friends go to the swimming pool. All three of you remove your shoes and put them in the shoe cupboard in the change room. After the swim all three come and draw out **a pair** of shoes randomly from the cupboard. Answer the questions below based on the above assuming there are no other shoes in the cupboard. In case you need to make any other assumptions state them.
 - (a) What is the probability that each of you obtains the correct pair of shoes? (that is your own left and right shoes).
 - (b) What is the probability that each of you obtains a pair of shoes but they need not be the correct pair? (this means the pair is proper but it need not be your pair)
 - (c) What is the probability that at least one of you obtains the correct pair of shoes?
 - (d) Assume two of the three pairs are black and one is brown. Assume each person picks shoes of the right colour without bothering about right and left and wears them. What is the probability that each of you end up wearing their own shoes correctly?

10-10-2020

[10]

[15]

4. Many decision making experiments ask subjects to assess probabilities by moving a pointer on a scale labelled by 0 and 1 and the two extremes and some intermediate values.

Now assume one subject is clueless about probabilities and essentially chooses randomly between 0 and 1 where each point in the interval is equally likely to be chosen. Any chosen point will divide the [0, 1] interval into two segments one of which is shorter than the other (except if the point chosen is exactly in the centre). If X is the random variable for the position then answer the following:

- (a) What is the distribution of X?
- (b) Calculate the probability that the ratio $\frac{\text{(short-segment)}}{\text{(long-segment)}} < \frac{1}{4}$.

[2,4=6]