PART A (THEORY)

LECTURE 1 & 2

1. Give an example from a social phenomenon where we can apply the knowledge of statistics and how?

2. Discuss the concepts of data points/observations and distribution. Distinguish between qualitative and quantitative variable with examples. Why qualitative variables are also known as categorical variables? What tools do we use for descriptive statistics of a set of data?

3. What is the difference between a 'statistics' and a 'parameter'?

4. Discuss different types of measurement of variables, Nominal, Ordinal, Categorical, Interval and Ratio variables

5. Distinguish between Observational and experimental studies, what is a problem in confounding? Response variable depends on other factors also.

LECTURE 3, 4, 5 &6

6. Under what circumstance may mean of a distribution give a misleading impression about a phenomenon?

7. The mean of various distributions may not give us a comparable picture when data represent different aspects/issues but standard deviation and coefficient of variation can do that regardless of the fact that they represent completely different sets. Why and how?

LECTURES ON PROBABILITY

8. Give examples of two circumstances where you should apply special rule of addition in one instance and general rule of addition in another instance

9. Give examples of two circumstances where you should apply special rule of multiplication in one instance and general rule of multiplication in another instance.

10. Discuss the concepts; classical probability, empirical probability, subjective probability, conditional probability and law of large numbers.

11. Distinguish between a discrete random variable and a continuous random variable. What are the characteristics of a binomial probability distribution?

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12. Distinguish between a uniform distribution and a normal distribution. What are the properties of a normal probability distribution? Why do we transform a normal variable into a standard normal variable?

PART B (PROBLEM SOLVING)

1. Suppose a shopping mall has 8 standby employees to address emergency needs, but only 3 from 8 employees at a time. How many different combinations of 3 employees are likely to be available in such emergency situations? (Hint: Use the formula of combination)

2. Suppose a GO BUS has 6 standby employees to address emergency needs, but only 4 from 6 employees at a time. How many different combinations of 4 employees are likely to be available in such emergency situations? (Hint: Use the formula of combination)

2. Suppose, a box contains 500 packets of mangoes. Out of these 500 packets, it is likely that some of the packets will contain ripe mangoes, some will contain raw mangoes and while the rest will contain medium mangoes (little bit ripe and little bit raw), what is the probability that a particular packet will contain either ripe OR raw OR medium mangoes (Hint: Special rule of addition of probability when events are mutually exclusive)

3. Suppose, a group of 400 tourists visited Toronto recently. Out of them, 300 visited CN Tower and 200 visited Ripley's aquarium. Some of them visited both CN Tower and Repley's aquarium. What is the probability that tourists visited either CN Tower or Repley's aquarium? It was revealed that 150 of the tourists visited both places (Hint: General rule of addition of probability when events are NOT mutually exclusive).

4. Suppose, three friends roll a die each at a time, what is the probability that there will appear 3 6s face up? (Hint: Special rule of multiplication when two events are independent meaning all events can occur at a time)

5. There are 12 cans in a cooler, 5 of them are Coke and the rest 7 are Pepsi. Probability of selecting a Coke is 5/12 while the probability of selecting a Pepsi is 7/12. Now, if a second can is selected from the cooler without returning the first one, What is the probability for selecting the second can to be Coke if the first one selected is Pepsi? What is the probability for selecting the second can to be Pepsi if the first one selected is Coke? (Hint: Conditional probability).

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6. Someone has a total of 10 pens. Of them, 6 are black and 4 others are green in color. He picks randomly a pen one day and then grabs another pen next day without replacing the first one. The probability of the first pen to be black is P(A) = 6/10 .

What is the probability that the second pen grabbed is black given that the first pen is also black, P(BlA) = 5/9 .

Now, what is the probability that both pens are black?

P(A and B) = P(A)P(BlA) = (6/10) (5/9).

7. Someone has a total of 12 pens. Of them, 3 are black, 4 are green and 5 are pink in color. He randomly picks up a pen one day, grabs another pen next day without replacing the first one and grabs another one the third day without replacing the first and second ones. The probability of a pen picked first day to be black is P(A) =3/12.

What is the probability that the second pen grabbed is black given that the first pen is also black, P(BlA) = 2/11 .

Now, what is the probability that the third pen is green given that both first and the second pens are black

P(C lA and B) =4/10

Therefore, P(A and B and C) = P(A)P(BlA)P(ClA and B)

= (3/12)x(2/11)x(4/10) = (1/4)x(2/11)x(2/5) =4/220 = 2/110

8. There are 10 daily morning flights from New York to Toronto. Suppose, the probability that any flight arrives late is 0.10.

a. What is the probability that none of the flights is late today? (Hint: Binomial distribution, success=late and not success=not late)

Total flights =n=10, x refers to the number of successes, here x=0.

Use this formula $P(x) = nCx\ P^x(1-P)^{n-x}$ and replace the values of n and x.

b. At least 8 flights will be late (Find probabilities of x=8, x=9 and x=10 and then add all these probabilities)

c. Maximum 2 flights will be late. (Hints: Find the probabilities of x=0, x=1 and x=2 and then add all these probabilities)

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9. The waiting time, in minutes, for service at a Tim Hortons outlet follows a uniform distribution between 1 minute and 5 minutes.

a. What is the probability of waiting for less than 2 minutes?

p(x<2) =

b. What is the probability of waiting for exactly 3 minutes?

p(x=3) =

c. What is the probability of waiting for at least 3 minutes?

p(x=3and more) =

d. c. What is the probability of waiting for at best 2 minutes?

p(x=2 and less) =

10. What is the probability if z value is at least 2 (z=2 and more)?

11. What is the probability if z value is maximum 2 (z=2 and less)?

12. What is the probability if z value is between -2 and +1.25?

13. If for a set of batteries, the mean life is 145 years and standard deviation is 15 and the life of battery follows a normal distribution,

a. What is the probability that the life of the batteries will be at least 100 years?

b. What is the probability that the life of the batteries will be maximum 160 years?

c. What is the probability that the life of the batteries will be between 100 to 150 years?

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