**Assignment 06:**

**Notes and discussion on Lecture 7 beyond out of the lecture slides.**

Answer:

Discussed topics out and beyond of lecture slides:

1. **Probability**
2. **Probability in Dice rolling**
3. **The probability of getting 6 on a dice**
4. **Probability when rolling two dice**
5. **The probability of getting 6 on both the dice**

They were explained with Bayes' theorem.

**Probability:**

In mathematics, probability is a branch of study that deals with the likelihood of an event occurring. [It is expressed as a number between 0 and 1, where 0 indicates that the event is impossible and 1 indicates that the event is certain to occur](https://byjus.com/maths/probability/).

[The probability of an event can be calculated by dividing the number of favorable outcomes by the total number of possible outcomes](https://byjus.com/maths/probability/). For example, if we toss a fair coin, the probability of getting heads is 1/2 or 0.5. Similarly, if we roll a fair die, the probability of getting a 6 is 1/6 or approximately 0.1667.

[Probability theory has many applications in various fields such as statistics, physics, finance, and computer science](https://en.wikipedia.org/wiki/Probability). It is used to model and analyze random phenomena such as weather patterns, stock prices, and traffic flow.

Using Bayes’ theorem, we can answer some questions about dice rolling:

**Probability in Dice rolling:**

Probability in dice rolling is the study of how likely it is to get a certain outcome when rolling one or more dice. Different types of dice have different numbers of faces, such as 4, 6, 8, 10, 12, or 20. The probability of rolling any value from a die is equal to 1 divided by the number of faces. For example, the probability of rolling a 6 on a standard 6-sided die is 1/6.

**Probability of getting 6 on a dice:**

The probability of getting 6 on a dice is the chance of rolling a single die and getting a face with 6 dots. It is calculated by dividing the number of favorable outcomes by the total number of possible outcomes. For a fair 6-sided die, there is only one way to roll a 6 out of 6 possible outcomes. Therefore, the probability of getting 6 on a dice is:

P(6)=1/6​≈0.167

This means that if you roll a die many times, you can expect to get a 6 about 16.7% of the time.

* This is simply the prior probability of rolling a 6 on a die, which is 1/6. We don’t need to use Bayes’ theorem for this, since we have no additional information or evidence.

**Probability when rolling two dice:**

The expected value of a dice roll is the average value that you would get if you rolled the die many times. It is calculated by multiplying each possible outcome by its probability and then adding up these products. For example, the expected value of a 6-sided die is:

EV=1×1/6 +2×1/6 +3×1/6 ​+4×1/6 +5×1/6 +6×1/6 =3.5

The probability of rolling two dice is the chance of getting a certain sum or combination of numbers when rolling two dice. It is calculated by counting the number of favorable outcomes and dividing by the total number of possible outcomes.

* This is the probability of getting a certain sum or combination of numbers when rolling two dice. It depends on how many ways we can get that sum or combination out of 36 possible outcomes. For example, the probability of rolling a sum of 7 with two 6-sided dice is:

P(7)=6/36​=1/6

This is because there are 6 ways to roll a 7 out of 36 possible outcomes: (1, 6), (2, 5), (3, 4), (4, 3), (5, 2), and (6, 1).

**The probability of getting 6 on both the dice:**

The probability of getting 6 on both the dice is the chance of rolling two dice and getting a face with 6 dots on each of them. It is calculated by multiplying the probability of getting 6 on one die by itself since the dice are independent. For a fair 6-sided die, the probability of getting 6 on one die is 1/6, so the probability of getting 6 on both the dice is:

P(6 and 6)=1/6 ×1/6 ​=1/36≈0.028

This means that if you roll two dice many times, you can expect to get a 6 on both of them about 2.8% of the time.

* This is the posterior probability of rolling two 6s given that we have rolled two dice. We can use Bayes’ theorem to calculate it as follows:

P(6 and 6∣two dice)={P(two dice∣6 and 6)P(6 and 6)​}/P(two dice)

The likelihood term, P(two dice∣6 and 6), is equal to 1, since if we roll two 6s, we must have rolled two dice.

The prior term, P(6 and 6), is equal to the product of the probabilities of rolling a 6 on each die, which is (1/6)×(1/6)=1/36, since the dice are independent.

The marginal term, P(two dice), is equal to 1 since we always roll two dice in this scenario.

Plugging in these values into Bayes’ theorem, we get:

**P(6 and 6∣two dice)={1×(1/36)​}/1=1/36**

This means that if we roll two dice many times, we can expect to get a 6 on both of them about 2.8% of the time.