ABC High School, Kathmandu, Nepal

Topic : Probability

Grade 10 **Teacher: Shyam Prasad Acharya**

1. Objective of the Module:

At the end of this lesson, students will be able to define and say formula of

1. define Mutually exclusives events
2. Addition law for mutually exclusive events

2. Content of the module

1. Mutually exclusive Events
2. Addition law of Mutually exclusive events.

3. Materials to use

1. Playing cards
2. Dice
3. Balls in an urn.

4. Teaching and learning Activities

Activity 1. Ask students about the number and kinds of playing cards. Focus on Face cards, number cards, colour of the cards etc. At last, provide the information like below:

In a pack of playing cards, generally there are 52 cards from A, 2, … , 10, J, Q and K of heart (♥), diamond (♦), spade (♠) and club (♣). Following tables give the clear account of the set of playing cards.

Show a chart of playing cards.

Red Cards (26 cards)													
Heart	**A** ♥	**2** ♥	**3** ♥	**4** ♥	**5** ♥	**6** ♥	**7** ♥	**8** ♥	**9** ♥	**10** ♥	**J** ♥	**Q** ♥	**K** ♥
Diamond	**A** ♦	**2** ♦	**3** ♦	**4** ♦	**5** ♦	**6** ♦	**7** ♦	**8** ♦	**9** ♦	**10** ♦	**J** ♦	**Q** ♦	**K** ♦

Black Cards (26 cards)													
Club	**A** ♣	**2** ♣	**3** ♣	**4** ♣	**5** ♣	**6** ♣	**7** ♣	**8** ♣	**9** ♣	**10** ♣	**J** ♣	**Q** ♣	**K** ♣
Spade	**A** ♠	**2** ♠	**3** ♠	**4** ♠	**5** ♠	**6** ♠	**7** ♠	**8** ♠	**9** ♠	**10** ♠	**J** ♠	**Q** ♠	**K** ♠

Cards indicating J, Q and K represent the Jack, Queen and King which contain the picture or face.

Therefore they are called **face cards**. Altogether in the four sets, there are 12 face cards in the pack of 52 cards.

Activity 2. Discuss and review the probability of events when drawing a card from the pack of the playing cards.

- What is the probability when a card is randomly drawn from a pack of 52 cards?
- What is the probability when a card is drawn randomly is a face card?

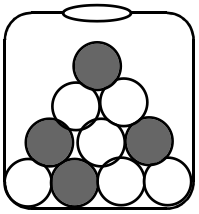
After discussing such questions, give a summary as given below:

The probability of occurrence of any one of the cards of 52 cards is $\frac{1}{52}$. *But, probability of occurrence king (K) while drawing a card from a pack of 52 cards becomes* $\frac{4}{52}$ *because there are only four kings. Similar method is used to calculate the probability of drawing the cards of different types.*

Activity 3. Discuss and review the probability of events when drawing a ball from the basket randomly

Include following information:

- If a ball is drawn randomly from an urn containing four black and 6 white balls, then probability of occurrence a white ball is $\frac{6}{10}$
- If a ball is drawn randomly, occurrence of black ball is $\frac{4}{10}$
- If you are satisfied what ever the ball comes, probability becomes just $\frac{1}{10}$



Activity 4. Discuss and review the probability of events when drawing a dice is thrown.

- **Discuss on, what are the numbers printed in the dice?**
- **How many faces are there?**
- **What is the probability of occurrence any number like 1, 2, …, 6 individually?**

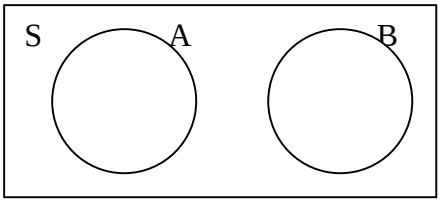
At last summarize as given below:

A dice have six faces which can equally roll on the plain surface. Such dice is called unbiased dice. In six faces of the dice, there are the numbers indicating from 1 to 6 in the form of dots. Look at the picture of dice given alongside. The probability of occurrence of any one face while throwing a dice is $\frac{1}{6}$.

Activity 5. Discuss and clarify the concept of Mutually exclusives events. At last define *Mutually exclusive events.*

Consider an experiment of rolling a dice. The possible outcomes are (1, 2, 3, 4, 5, 6}. If the dice is unbiased , the possibility of occurrence of any of the numbers 1 to 6 is equal. But, if any one of the number occurs, the other can not be occurred at the same time. That means, they are not overlapped they are mutually exclusive. Similarly, in a toss of a fair coin, if head occurs, the occurrence of tail is impossible. That's why, head and tail are also the mutually exclusive events.

Definition :
Two or more events of a sample space are said to be mutually exclusive, if the occurrence of any one event excludes the occurrence of the other events. In the adjoining figure event A and event B are mutually exclusive events.



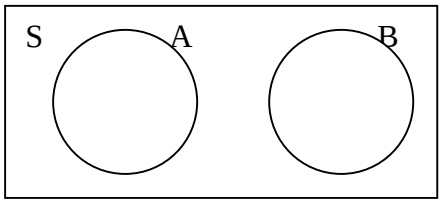
Notes :

- Occurrence of one event excludes the occurrence of the other event.
- Mutually exclusive events are disjoint.
- If A and B are mutually exclusive, then, $A \cap B = \phi \rightarrow P(A \cap B) = 0$

Activity 6. Develop the formula for Addition law for mutually exclusive events

Connect the concept of Sets, union of sets and describe/discuss as following:

If A and B are two mutually exclusive events then
$P(A \cup B) = P(A) + P(B)$
To prove above relation
Let us consider A and B two mutually exclusive events and S be sample space



We have

$$n(A \cup B) = n(A) + n(B)$$

Now dividing both side by n(S)

Or $$\frac{n(A \cup B)}{n(S)} = \frac{n(A)}{n(S)} + \frac{n(B)}{n(S)}.$$

$\therefore$ $P(A \cup B) = P(A) + P(B)$

If A, B and C are three mutually exclusive events then

$$P(A \cup B \cup C) = P(A) + P(B) + P(C).$$

Here 'or' represents union of events and 'and' represents the intersection of events. That is
A or B = A $\cup$ B and
A and B =A $\cap$ B

Activity 7. Involve students to solve simple problems related to mutually exclusive events.

Example 1. What is the probability of getting a 2 or a 6 in the roll of a dice?
Solution

The sample space for rolling a fair dice is.
$S = \{1,2,3,4,5,6\}$
$\therefore n(S) = 6$
Number of 2, $n(2) = 1$

Number of 6, n(6) = 1

Probability of getting 2, $P(2) = \frac{1}{6}$

Probability of getting 6, $P(6) = \frac{1}{6}$

Since the events are mutually exclusive,

Probability of getting 2 or 6 ie, P(2 or 6) is given by,

$P(2 \cup 6) = P(2) + P(6)$ $(\therefore P(A \cup B) = P(A) + P(B)$

$= \frac{1}{6} + \frac{1}{6}$

$= \frac{2}{6}$

$= \frac{1}{3}$

$\therefore$ Probability of getting 2 or 6 is $\frac{1}{3}$.

Example 2.

A card is drawn from a well shuffled deck of 52 cards. What is the probability that it is a club or spade?

Solution,

Let C represents the event that the card drawn is a club, D represents the event that the card drawn is a spade and S represents the sample space then,

Now, n(S) = 52

n(C) = 13

n(D) = 13

$P(C) = \frac{n(C)}{n(S)} = \frac{13}{52} = \frac{1}{4}$

$P(C) = \frac{n(D)}{n(S)} = \frac{13}{52} = \frac{1}{4}$

Since the events are mutually exclusive,

$\therefore P(C \text{ or } D) = P(C \cup D) = P(C) + P(D)$

$= \frac{1}{4} + \frac{1}{4}$

$= \frac{2}{4}$

$= \frac{1}{2}$

Hence, the probability of getting club or spade is $\frac{1}{2}$.

Activity 7. Ask students to solve following problem

A coin is weighted so that the head is three times as likely to appear as tail. Find P (H) and P (T).

Solution

Let P (T) = P then by the question

P (H) = 3P

Since the sum of the probabilities equals to one

$\therefore \quad p + 3p = 1$

Or $\quad 4p = 1$

$$p = \frac{1}{4}$$

and $\quad 3p = 3 \times \frac{1}{4} = \frac{3}{4}$

Thus, $\quad P(T) = p = \frac{1}{4}$

$$P(H) = 3P = \frac{3}{4}$$

4. Evaluation : Evaluate student during the process of teaching and learning Process. However, students can be evaluated by asking some questions related to the lesson.

Q.No. 1. (*give question)*

Q.No. 2. *(give question)*

References for further reading

Acharya S.P. & Bhusal S. *Asia's School level Mathematics, Grade 10,* Asia Publication, Kathmandu, Nepal