

यदि A र B दुईओटा पारस्परिक निषेधक घटनाहरू हुन् भने $P(A \text{ or } B) = P(A \text{ वा } B) = P(A) + P(B)$
If A and B are two mutually exclusive events, $P(A \text{ or } B) = P(A \text{ वा } B) = P(A) + P(B)$

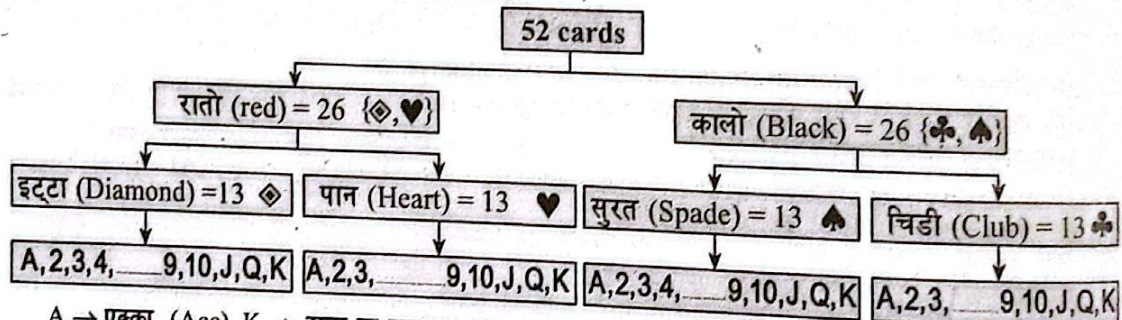
4. यदि A र B दुईओटा पारस्परिक निषेधक घटनाहरू होइनन् भने, $P(A \text{ or } B) = P(A) + P(B) - P(A \cap B)$
If A and B are two mutually nonexclusive events, $P(A \text{ or } B) = P(A) + P(B) - P(A \cap B)$
5. यदि A र B दुईओटा अनाश्रित घटनाहरू हुन् भने, $P(A \text{ and } B) = P(A \text{ र } B) = P(A) \times P(B)$
If A and B are independent events, $P(A \text{ and } B) = P(A \text{ र } B) = P(A) \times P(B)$
- 6.

घटना सम्बन्धी पदावली (Terminology of the event)	समतुल्य सङ्केत (Equivalent notation)
A but not B	$A \cap \bar{B}$
neither A nor B	$\bar{A} \cap \bar{B}$
At least one of A, B or C	$A \cup B \cup C$
Exactly one of A and B	$(A \cap \bar{B}) \cup (\bar{A} \cap B)$
All three of A, B and C	$A \cap B \cap C$
Exactly two of A, B and C	$(A \cap B \cap \bar{C}) \cup (A \cap \bar{B} \cap C) \cup (\bar{A} \cap B \cap C)$

7. सङ्ख्याहरू (Numbers)

- (i) प्राकृतिक सङ्ख्याहरू (Counting Numbers): $N = \{1, 2, 3, 4, 5, \dots\}$
- (ii) पूर्ण सङ्ख्याहरू (Whole Numbers): $W = \{0, 1, 2, 3, 4, 5, \dots\}$
- (iii) पूर्णाङ्कहरू (Integers): $I = \{\dots, -3, -2, -1, 0, 1, 2, 3, \dots\}$
- (iv) जोर सङ्ख्याहरू (Even Numbers): $E = \{2, 4, 6, 8, \dots\}$
- (v) बिजोर सङ्ख्याहरू (Odd Numbers): $O = \{1, 3, 5, 7, 9, \dots\}$
- (vi) रूढ सङ्ख्याहरू (Prime Numbers): $P = \{2, 3, 5, 7, 11, 13, 17, 19, \dots\}$
- (vii) संयुक्त सङ्ख्याहरू (Composite Numbers): $C = \{4, 6, 8, 9, 10, 12, 14, 15, \dots\}$
- (viii) वर्ग सङ्ख्याहरू (Square Numbers): $Sq. = \{1, 4, 9, 16, 25, 36, 49, \dots\}$
- (ix) घन सङ्ख्याहरू (Cube Numbers): $Cu. = \{1, 8, 27, 64, 125, 216, \dots\}$

8. ताससम्बन्धी जानकारी (Information about cards)



A → एक्का (Ace), K → राजा वा बादशाह (King), Q → रानी वा मिस्री (Queen), J → गुलाम (Jack)
K, Q र J लाई अनुहार भएका तासहरू भनिन्छ। त्यसैले एक प्याक तासमा 12 ओटा अनुहारहरू भएका तासहरू हुन्छन्।
K, Q and J are known as face cards. So there are 12 face cards in a pack.

SEE MODEL QUESTIONS ISSUED BY CDC [Q. NO. 16]

- Q.16. राम्रोसँग फिटिएको 52 पत्ती तासको गड्डीबाट नहेरिक्न दुईओटा तासहरू एकपछि अर्को गरी पुनः नराखीकन फिक्किएको छ।
Two cards are drawn randomly one after another without replacement from a well shuffled deck of 52 cards.
- (a) यदि A र B दुई ओटा अनाश्रित घटनाहरू हुन् भने $P(A \cap B)$ पत्ता लगाउने सूत्र के हुन्छ, लेख्नुहोस्।
If two events A and B are independent events, what is the formula for finding $P(A \cap B)$? Write it. [1K]
- (b) अनुहार भएको तास पर्ने र नपर्ने सबै सम्भावित परिणामहरूको सम्भाव्यतालाई वृक्षचित्रमा देखाउनुहोस्।
Show the probability of all the possible outcomes of getting or not-getting faced card in a tree diagram. [2A]
- (c) दुवै तास अनुहार भएको पर्ने सम्भाव्यता कति हुन्छ, पत्ता लगाउनुहोस्।
Find the probability of getting both are faced card. [1U]
- (d) यदि दुईओटा तासहरू एकपछि अर्को गरी पुनः राख्दा दुवै तास अनुहार भएको पर्ने सम्भाव्यता दुवै तास एक्का पर्ने सम्भाव्यता भन्दा कति गुणा बढी हुन्छ?
If two cards are drawn randomly one after another with replacement, how many times more is the probability that both are faced cards than the probability that both cards are ace? [1HA]

⇒ Here,

(a) For two independent events A and B,
 $P(A \cap B) = P(A) \times P(B)$

(b) Let F be the event of getting faced cards and
 $\bar{F}$ be the event of not getting faced cards,
 then the tree-diagram is shown below.

(c) $P(\text{getting both faced cards}) = P_1(F) \times P_2(F)$
 $= \frac{12}{52} \times \frac{11}{51} = \frac{11}{221}$

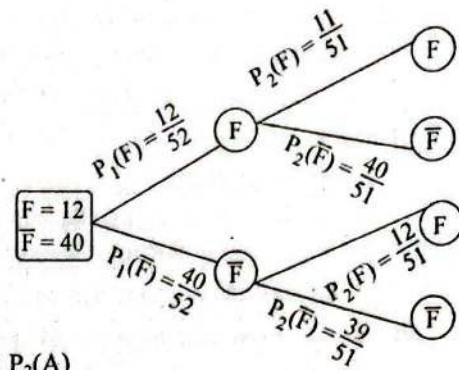
(d) With replacement, $P(\text{both are ace cards}) = P_1(A) \times P_2(A)$
 $= \frac{4}{52} \times \frac{4}{52} = \frac{1}{169}$

Also, $P(\text{both are faced cards}) = P_1(F) \times P_2(F) = \frac{12}{52} \times \frac{12}{52} = \frac{9}{169}$

or, $P(\text{both are faced cards}) = 9 \times \frac{1}{169}$

∴ $P(\text{both are faced cards}) = 9 P(\text{both are ace cards})$

Thus, the probability of getting both faced cards is 9 times more than the probability of getting both ace.



BASIC EXERCISE 13

1. सरिनाले एउटा घनाकार डाइस 2 पटक फ्याकिन् । (Sarina has thrown a cubical dice 2 times.)

(a) पारस्परिक निषेधक घटनाहरूको परिभाषा दिनुहोस् । (Define mutually exclusive events.) [1K]

(b) सम्भाव्यता नमूना क्षेत्र तालिकामा देखाउनुहोस् । (Show the probability sample space in a table.) [2A]

(c) पहिलो पटक 5 र दोस्रो पटक 4 आउने सम्भाव्यता लेख्नुहोस् ।
 Write the probability of getting 5 in first throw and 4 in second throw. [1U]

(d) यदि सो घनाकार डाइसमा 3 को सट्टा पनि 5 राखियो भने दुवै पटक 5 आउने सम्भाव्यता कति होला ?
 If 3 is also replaced by 5 in the cubical dice, what is the probability of getting 5 both times? [1HA]

⇒ Here,

(a) In an experiment, if the occurrence of any one event excludes the occurrence of the other event, then such events are called mutually exclusive events.

(b) The probability sample space is shown in the following table.

	1	2	3	4	5	6
1	(1, 1)	(1, 2)	(1, 3)	(1, 4)	(1, 5)	(1, 6)
2	(2, 1)	(2, 2)	(2, 3)	(2, 4)	(2, 5)	(2, 6)
3	(3, 1)	(3, 2)	(3, 3)	(3, 4)	(3, 5)	(3, 6)
4	(4, 1)	(4, 2)	(4, 3)	(4, 4)	(4, 5)	(4, 6)
5	(5, 1)	(5, 2)	(5, 3)	(5, 4)	(5, 5)	(5, 6)
6	(6, 1)	(6, 2)	(6, 3)	(6, 4)	(6, 5)	(6, 6)

(c) For getting 5 in first throw and 4 in second throw, i.e. (5, 4)

Number of favourable events, $n(E) = 1$

Number of Exhaustive events, $n(S) = 36$

Thus, required probability $P(E) = \frac{n(E)}{n(S)} = \frac{1}{36}$

(d) If 3 is replaced by 5 then from the above table, we see:

(3, 3) → (5, 5), (3, 5) → (5, 5), (5, 3) → (5, 5)

So, $n(E) = 4$ and $n(S) = 36$

Thus, the required probability is: $P(E) = \frac{4}{36} = \frac{1}{9}$

2. एउटा बाक्समा उहि आकारका तीनओटा रातो र दुईओटा सेता बलहरू राखिएका छन् ।

Three red and two white balls of the same size are kept in a box.

- (a) सम्भाव्यताको जोड नियम उल्लेख गर्नुहोस् । (State the addition law of probability.) [1K]
 (b) एकपछि अर्को गरेर दुईओटा बलहरू (पुनः नराखी) निकाल्दा रातो र सेतो बलहरू आउने सम्भाव्यतालाई वृक्षचित्रमा देखाउनुहोस् ।
 Two draws are made one after the other (without replacement), show the probability of getting red and white balls in the tree diagram. [2A]
 (c) दुवै बल सेतो पर्ने सम्भाव्यता पत्ता लगाउनुहोस् । (Find the probability of getting both white balls.) [1U]
 (d) दुईओटा बलहरू एकपछि अर्को गरी पुनः राखी र नराखीकन भिक्दा दुवै बल सेतो पर्ने सम्भाव्यता बिच कति भिन्नता छ ?
 What is the difference between the probabilities of both balls being white if two balls are drawn one after another with replacement or without replacement? [1HA]

⇒ Here,

- (a) If A and B are mutually exclusive events, $P(A \cup B) = P(A) + P(B)$ and if A and C are not mutually exclusive event $P(A \cup C) = P(A) + P(C) - P(A \cap C)$. This is called addition law of probability.

- (b) Let R and W be the set of red and white balls respectively.

The probability tree diagram is shown alongside.

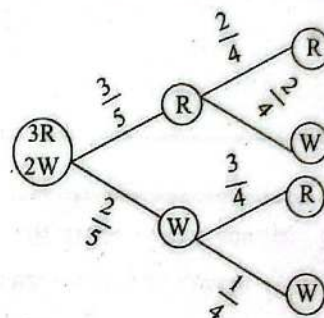
- (c) From the tree diagram, the probability of getting both white balls

$$P(WW) = \frac{2}{5} \times \frac{1}{4} = \frac{1}{10}$$

- (d) If the draw is made with replacement, the probability of getting

$$\text{both balls white } P'(WW) = \frac{2}{5} \times \frac{2}{5} = \frac{4}{25}$$

$$\text{Thus, required difference} = P'(WW) - P(WW) = \frac{4}{25} - \frac{1}{10} = \frac{3}{50}$$



3. एउटा झोलामा 10 ओटा रातो र 6 ओटा काला उस्तै र उत्रै बलहरू राखिएका छन् ।
 In a bag there are 10 red and 6 black balls of the same shape and size.

- (a) कस्तो अवस्थामा $P(A \cup B) = P(A) + P(B)$ हुन्छ ? (In what condition $P(A \cup B) = P(A) + P(B)$?) [1K]
 (b) सो झोलाबाट एकपछि अर्को गरी पुनः नराखी 2 ओटा बलहरू क्रमशः भिक्दा आउने सबै परिणामका सम्भाव्यतालाई वृक्षचित्रमा देखाउनुहोस् ।
 From the bag, two balls are taken randomly in succession without replacement. Show the probabilities of all outcomes in a tree diagram. [2A]
 (c) दुवै बल रातो पर्ने सम्भाव्यता पत्ता लगाउनुहोस् । (Find the probability of getting both red balls.) [1U]
 (d) दुईओटा बलहरू एकपछि अर्को गरी पुनः राखी र नराखीकन भिक्दा दुवै बल रातो पर्ने सम्भाव्यता बिच कति भिन्नता छ ?
 What is the difference between the probabilities of both balls being red if two balls are drawn one after another with replacement or without replacement? [1HA]

⇒ Here,

- (a) If A and B are two mutually exclusive events then $P(A \cup B) = P(A) + P(B)$.

- (b) Let R and B be the set of red and black balls respectively.
 The probability tree diagram is shown alongside.

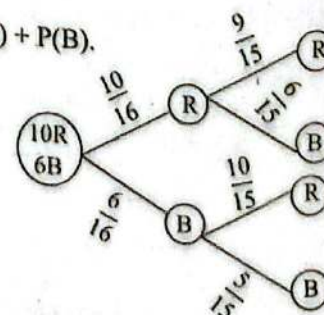
- (c) From the tree diagram, the probability of getting both red balls

$$P(RR) = \frac{10}{16} \times \frac{9}{15} = \frac{3}{8}$$

- (d) If the draw is made with replacement, the probability of getting

$$\text{both balls red } P'(RR) = \frac{10}{16} \times \frac{10}{16} = \frac{25}{64}$$

$$\text{Thus, required difference} = P'(RR) - P(RR) = \frac{25}{64} - \frac{3}{8} = \frac{1}{64}$$



4. एउटा डाइस र एउटा सिक्का एकै साथ उफारिएको छ । (A dice and a coin are tossed simultaneously.)

- (a) कस्तो अवस्थामा $P(A \cap B) = P(A) \times P(B)$ हुन्छ ? (In what condition $P(A \cap B) = P(A) \times P(B)$?) [1K]
 (b) सबै सम्भावित परिणामहरू तालिकामा देखाउनुहोस् । (Tabulate all the possible outcomes.) [2A]
 (c) डाइसमा रूढ सङ्ख्या र सिक्कामा शीर आउने सम्भाव्यता पत्ता लगाउनुहोस् ।
 Find the probability of getting a prime number on the dice and head on the coin. [1U]
 (d) डाइसमा संयुक्त सङ्ख्या र सिक्कामा पुच्छर आउने सम्भाव्यता 1 भन्दा कति कम हुन्छ ?
 How much is the probability of getting a composite number on the dice and tail on the coin is less than 1? [1HA]

⇒ Here,

- (a) If A and B are two independent events then $P(A \cap B) = P(A) \times P(B)$.
 (b) All possible outcomes are tabulated as below:

	H	T
1	(1, H)	(1, T)
2	(2, H)	(2, T)
3	(3, H)	(3, T)
4	(4, H)	(4, T)
5	(5, H)	(5, T)
6	(6, H)	(6, T)

- (c) For getting a prime number on the dice and head on the coin, favourable events
 $= \{(2, H), (3, H), (5, H)\}$ $\therefore n(E) = 3$

$$\text{Thus, required probability} = \frac{n(E)}{n(S)} = \frac{3}{12} = \frac{1}{4}$$

- (d) For getting a composite number on the dice and tail on the coin, favourable events
 $= \{(4, T), (6, T)\}$ $\therefore n(E) = 2$

$$\text{So, } P(E) = \frac{n(E)}{n(S)} = \frac{2}{12} = \frac{1}{6}$$

$$\text{Thus, required difference} = 1 - \frac{1}{6} = \frac{5}{6}$$

5. राम्ररी फिटिएको 52 पत्तीको एक प्याकेट तासबाट नहेरीकन एकपछि अर्को पुनः नराखीकन दुईओटा तास भिकिएका छन् ।
 Two cards are drawn randomly in succession without replacement from a well shuffled pack of 52 cards.

- (a) अनाश्रित घटनाहरूको परिभाषा दिनुहोस् । (Define independent events.) [1A]
 (b) वृक्षचित्र खिची अनुहार भएको तास पर्ने र नपर्ने सबै सम्भावित परिणामहरूको सम्भाव्यताहरूलाई देखाउनुहोस् ।
 By drawing a tree diagram, show the probabilities of all the possible outcomes of getting and not getting a faced card. [2A]
 (c) दुवै तास अनुहार नभएको पर्ने सम्भाव्यता कति हुन्छ, पत्ता लगाउनुहोस् ।
 What is the probability of getting both non-faced card? Find it. [1U]
 (d) दुईओटा तासहरू एक पछि अर्को गरी पुनः राखी र नराखीकन भिक्दा दुवै तास अनुहार नभएको पर्ने सम्भाव्यता बिच कति भिन्नता हुन्छ ?
 What is the difference between the probabilities of both cards being non-faced cards if two cards are drawn one after the other with replacement and without replacement? [1HA]

⇒ Here,

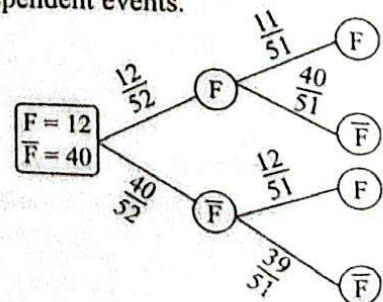
- (a) In two or more events, the occurrence or non-occurrences of any one event does not affect the occurrence or non-occurrences of any other events are called independent events.

- (b) Let F and $\bar{F}$ denote the set of face cards and non faced cards respectively. The probability tree diagram is shown alongside.

- (c) From the tree diagram, the probability of getting both non-faced card; $P(\bar{F} \bar{F}) = \frac{40}{52} \times \frac{39}{51} = \frac{10}{17}$

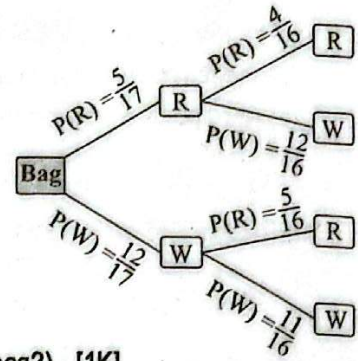
- (d) If the draw is made with replacement, the probability of getting both non-faced card; $P'(\bar{F} \bar{F}) = \frac{40}{52} \times \frac{40}{52} = \frac{100}{169}$

$$\text{Thus, required difference} = P'(\bar{F} \bar{F}) - P(\bar{F} \bar{F}) = \frac{100}{169} - \frac{10}{17} = \frac{10}{2873}$$



6. एउटा झोलामा केही सेता र राता उस्तै र उत्रै बलहरू छन् । दुईओटा बलहरू एकपछि अर्को गरी पुनः नराखीकन भिक्दा आउने सबै सम्भावित परिणामहरूको सम्भाव्यतालाई सँगैको वृक्षचित्रमा देखाइएको छ । सो वृक्षचित्र हेरेर तलका प्रश्नहरूको उत्तर दिइएको विकल्पहरूबाट छानेर लेख्नुहोस् ।

There are some white and red balls of the same shape and same size in a bag. Two balls are drawn randomly one after another without replacement. The tree diagram of probabilities of all the possible outcomes is given. Observing that tree diagram, write the answer of the following questions selecting from the given alternatives.



- (a) झोलामा जम्मा कति बलहरू थिए ? (How many balls were there in the bag?) [1K]
 (b) पहिलो पटक रातो र दोस्रो पटक सेतो बल छानिने सम्भाव्यता कति हुन्छ ?
 What is the probability of getting first red and second white ball? [1U]
 (c) दुवै पटक एउटै रङका बलहरू पर्ने सम्भाव्यता पत्ता लगाउनुहोस् ।
 Find the probability of getting the ball having same colour both the time? [2A]
 (d) एक पछि अर्को गरी पुनः नराखीकनको सट्टा पुनः राखेर दुईओटा बलहरू भिक्दा दुवै बल एउटै रङको पर्ने सम्भाव्यतामा कति भिन्नता पर्छ ?
 What is the difference between the probabilities of both balls being same colour if two balls are drawn one after the other with replacement or without replacement? [1HA]

⇒ Here,

- (a) Total number of balls = 5 Red + 12 White = 17

- (b) Probability of getting first red and second white ball is; $P(RW) = \frac{5}{17} \times \frac{12}{16} = \frac{15}{68}$

- (c) Probability of getting both red balls = $P(RR) = \frac{5}{17} \times \frac{4}{16} = \frac{20}{272}$

$$\text{Probability of getting both white balls} = P(WW) = \frac{12}{17} \times \frac{11}{16} = \frac{132}{272}$$

$$\text{Thus, required probability } (P_1) = P(RR) + P(WW) = \frac{20}{272} + \frac{132}{272} = \frac{19}{34}$$

- (d) If the draw is made with replacement then, $P'(RR) = \frac{5}{17} \times \frac{5}{17} = \frac{25}{289}$ and $P'(WW) = \frac{12}{17} \times \frac{12}{17} = \frac{144}{289}$

$$\text{So, probability of both being of same colour } (P_2) = \frac{25}{289} + \frac{144}{289} = \frac{169}{289}$$

$$\text{Thus, required difference } (P_2 - P_1) = \frac{169}{289} - \frac{19}{34} = \frac{15}{578}$$

7. एउटा बाक्समा 5 ओटा सेता र 4 ओटा राता उत्रै र उस्तै बलहरू राखिएका छन् ।
 A box contains 5 white and 4 red balls of same size and shape.

- (a) पराश्रित घटनाको परिभाषा दिनुहोस् । (Define dependent events.) [1K]
 (b) उक्त बाक्सबाट नहेरीकन दुई ओटा बलहरू एकपछि अर्को भिक्दा (पुनः नराखी) आउने सम्भावित सबै परिणामहरूको सम्भाव्यतालाई वृक्षचित्रमा देखाउनुहोस् ।
 Two balls are drawn randomly one after another from the box without replacement. Show the probability of all the possible outcomes in a tree diagram. [2A]
 (c) दुवै सेतो रङका बलहरू पर्ने सम्भाव्यता पत्ता लगाउनुहोस् ।
 Find the probability of getting both the white balls. [1U]
 (d) दुईओटा बलहरू एक पछि अर्को गरी पुनः राखी र नराखीकन भिक्दा दुवै बल सेतो पर्ने सम्भाव्यता बिच कति भिन्नता हुन्छ ?
 What is the difference between the probabilities of both balls being white if two balls are drawn one after the other with replacement or without replacement? [1HA]

⇒ Here,

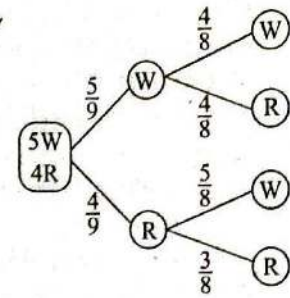
- (a) If the occurrence of any one event affects the occurrences of any other events then such events are called dependent events.

(b) Let W and R denote white and red balls respectively. The probability tree diagram is shown alongside;

(c) The probability of getting both white balls = $P(WW) = \frac{5}{9} \times \frac{4}{8} = \frac{5}{18}$

(d) If the draw is made with replacement, then probability of getting both white balls = $P'(WW) = \frac{5}{9} \times \frac{5}{9} = \frac{25}{81}$

Thus, required difference = $P'(WW) - P(WW) = \frac{25}{81} - \frac{5}{18} = \frac{5}{162}$



8. एउटा बाक्समा 8 देखि 18 सम्म लेखिएका सङ्ख्या पत्तीहरू छन् । (A box contains the number cards from 8 to 18.)

(a) पारस्परिक निषेधक घटनाको परिभाषा दिनुहोस् । (Define mutually exclusive events.) [1K]

(b) नमूना क्षेत्र लेख्नुहोस् । (Write the sample space.) [1U]

(c) सो बाक्सबाट नहेरीकन एउटा पत्ती फिक्दा 7 अथवा 9 ले निःशेष भाग जाने सङ्ख्या पत्ती पर्ने सम्भाव्यता पत्ता लगाउनुहोस् ।

A card is drawn randomly from the box, find the probability of getting a card having a number exactly divisible by 7 or 9. [2A]

(d) यदि एक पटक फिक्केको सङ्ख्या पत्ती 15 पत्थो र फिर्ता गरिएन भने अब अर्को सङ्ख्या पत्ती फिक्दा 7 अथवा 9 ले निःशेष भाग जाने सङ्ख्या पत्ती पर्ने सम्भाव्यता पत्ता लगाउनुहोस् ।

If the card drawn first is 15 and not replaced, then find the probability of getting a card having a number exactly divisible by 7 or 9 in the second time. [1HA]

⇒ Here,

(a) In an experiment, if the occurrence of any one event excludes the occurrence of the other event, then such events are called mutually exclusive events.

(b) Sample space = {8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18} ∴ n(S) = 11

(c) $P(\text{number exactly divisible by 7}) = \frac{n(E)}{n(S)} = \frac{1}{11}$ [∵ E = {14}]

$P(\text{number exactly divisible by 9}) = \frac{n(E)}{n(S)} = \frac{2}{11}$ [∵ E = {9, 18}]

Thus, required probability = $\frac{1}{11} + \frac{2}{11} = \frac{3}{11}$

(d) If 15 is not replaced then n(S) = 10 and number exactly divisible by 7 or 9

= {14, 9, 18} ∴ n(E) = 3

Thus, required probability = $\frac{n(E)}{n(S)} = \frac{3}{10}$

9. एउटा बाक्समा 5 ओटा सेता र 4 ओटा राता उत्रै र उस्तै बलहरू राखिएका छन् ।
A box contains 5 white and 4 red balls of same size and shape.

(a) सम्भाव्यताको गुणन सिद्धान्तको परिभाषा दिनुहोस् । (Define the multiplication law of probability.) [1K]

(b) उक्त बाक्सबाट नहेरीकन दुई ओटा बलहरू एकपछि अर्को फिक्दा (पुनः नराखी) आउने सम्भावित सबै परिणामहरूको सम्भाव्यतालाई वृक्षचित्रमा देखाउनुहोस् ।

Two balls are drawn randomly one after another from the box without replacement. Show the probability of all the possible outcomes in a tree diagram. [2A]

(c) पहिलो बल सेतो र दोस्रो बल रातो पर्ने सम्भाव्यता पत्ता लगाउनुहोस् ।
Find the probability of getting first ball is white and the second ball is red. [1U]

(d) यदि थप 2 ओटा सेता बलहरू सो बाक्समा थपियो र फेरी 2 ओटा बलहरू नहेरीकन (पुनः नराखी) फिक्कियो भने अब पहिलो बल सेतो र दोस्रो बल रातो पर्ने सम्भाव्यता कति होला ?
If two white balls are added in the box and two balls are drawn randomly (without replacement), what will be probability of getting the first ball white and second ball red? [1HA]

⇒ Here,

(a) If two events A and B are independent events then, $P(A \text{ and } B) = P(A \cap B) = P(A) \times P(B)$.
Similarly, if A and B are two dependent events then $P(A \text{ and } B) = P(A \cap B) = P(A) \times P(B/A)$.
This is known as multiplication law of probability.

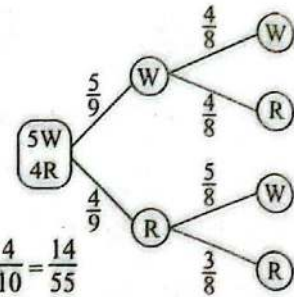
(b) Let W and R denote white and red balls respectively. The probability tree diagram is shown alongside.

(c) The probability of getting first ball white and second ball red

$$\text{is; } P(WR) = \frac{5}{9} \times \frac{4}{8} = \frac{5}{18}$$

(d) Now, new number of white balls = $5 + 2 = 7$ and total number of balls = $7 + 4 = 11$

Thus, the probability of getting first ball white and second ball red = $\frac{7}{11} \times \frac{4}{10} = \frac{14}{55}$



10. एउटा झोलामा 14 ओटा निला र 4 ओटा हरिया गुच्चाहरू छन् ।

A bag contains 14 blue marbles and 4 green marbles.

(a) उक्त झोलाबाट एउटा गुच्चा झिकदा निलो वा हरियो आउने सम्भाव्यता लेख्नुहोस् ।

If a marble is drawn from the bag, find the probability of getting blue or green marble. [1K]

(b) यदि पहिले झिकेको गुच्चा निलो प्यो र उक्त झोलामा फिर्ता गरिएन भने अर्को पटक झिकदा निलो नै पर्ने सम्भाव्यता पत्ता लगाउनुहोस् ।

If the first drawn marble is blue and it is not replaced in the bag, what will be the probability of getting blue in the next time? [2A]

(c) एकपछि अर्को गरी पुनः नराखीकन झिकदा हुने सम्भाव्यतालाई वृक्षचित्रमा देखाउनुहोस् ।

Show in a tree diagram when two marbles are drawn one after another without replacement. [1U]

(d) दुवै पटक फरक रङका गुच्चाहरू पर्ने सम्भाव्यता गणना गर्नुहोस् ।

Calculate the probability of getting marbles of different colours in both the time. [1HA]

⇒ Here,

(a) Probability of getting blue or green marble = $\frac{14}{18} + \frac{4}{18} = 1$

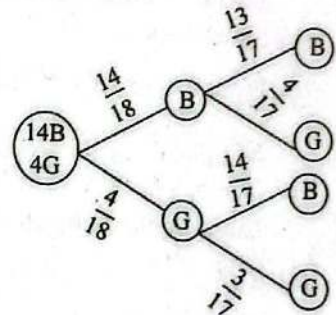
(b) If the first drawn blue marble is not replaced,

Number of blue marbles = 13 and total number of marbles = 17

Thus, $P(\text{blue marble in next draw}) = \frac{13}{17}$

(c) Let B and G denote blue and green marbles respectively. The probability tree diagram is shown alongside.

(d) $P(\text{marbles of different colours}) = P(BG) + P(GB)$
 $= \frac{14}{18} \times \frac{4}{17} + \frac{4}{18} \times \frac{14}{17} = \frac{56}{153}$



11. एउटा बाक्समा 5 देखि 15 सम्म लेखिएका सङ्ख्या पत्तीहरू छन् ।

A box contains the number cards numbered from 5 to 15.

(a) सम्भाव्यता नमूना क्षेत्र लेख्नुहोस् । (Write the probability sample space.) [1K]

(b) सो बाक्सबाट एउटा पत्ती युत्दा 6 अथवा 7 ले निःशेष भाग जाने सङ्ख्या पत्ती पर्ने सम्भाव्यता पत्ता लगाउनुहोस् ।
 From the box, a card is drawn randomly then find the probability of getting a card having a number exactly divisible by 6 or 7. [2A]

(c) यदि सो बाक्सबाट दुईओटा पत्तीहरू एकपछि अर्को पुनः राखीकन झिकियो भने पहिलो पटक रूढ सङ्ख्या र दोस्रो पटक 4 का अपवर्त्य आउने सम्भाव्यता पत्ता लगाउनुहोस् ।

If two cards are drawn one after another with replacement then find the probability of getting prime number in first time and multiples of 4 in the second time. [1U]

(d) कोपिलाले भनिन् "प्रश्न (b) का घटनाहरू पारस्परिक निषेधक घटना होइनन् ।" के कोपिलाको भनाई ठीक छ ?
 कारण सहित प्रष्ट पार्नुहोस् ।

Kopila said, "The events of question (b) are not mutually exclusive." Is the statement of Kopila true? Clarify with reason. [1HA]

⇒ Here,

(a) Probability sample space = $\{5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15\}$

(c) $P(\text{exactly divisible by 6}) = \frac{n(E)}{n(S)} = \frac{2}{11}$ [∵ $E = \{6, 12\}$]

$P(\text{exactly divisible by 7}) = \frac{n(E)}{n(S)} = \frac{2}{11}$ [∵ $E = \{7, 14\}$]

Thus, required probability = $\frac{2}{11} + \frac{2}{11} = \frac{4}{11}$

$$(c) P(\text{prime number in first draw}) = \frac{4}{11}$$

$$P(\text{multiples of 4 in second draw}) = \frac{2}{11}$$

$$\text{Thus, required probability} = \frac{4}{11} \times \frac{2}{11} = \frac{8}{121}$$

(d) In question (b); favourable events exactly divisible by 6 = {6, 12}

Favourable events exactly divisible by 7 = {7, 14}

So, we see that the occurrence of one event does not affect the occurrence of other. Thus, they are mutually exclusive and the statement of Kopila is false.

12. एउटा बाक्समा 3 ओटा रातो र 5 ओटा हरिया उत्रै र उस्तै बलहरू राखिएका छन् ।
A box contains 3 red and 5 green balls of same size and shape.

(a) यदि T र Q पारस्परिक निःपेक्षक घटनाहरू भए $P(T \cup Q)$ को सूत्र लेख्नुहोस् । [1K]
If T and Q are mutually exclusive events then write the formula of $P(T \cup Q)$.

(b) उक्त बाक्सबाट नहेरिकन दुई ओटा बलहरू एकपछि अर्को फिक्दा (पुनः नराखी) आउने सम्भावित सबै परिणामहरूको सम्भाव्यतालाई वृक्षचित्रमा देखाउनुहोस् । [2A]
Two balls are drawn randomly one after another from the box without replacement. Show the probability of all the possible outcomes in a tree diagram.

(c) दुवै पटक हरिया बलहरू पर्ने सम्भाव्यता पत्ता लगाउनुहोस् । [1U]
Find the probability of getting both the green balls.

(d) दुईओटा बलहरू एक पछि अर्को गरी पुनः राखी फिक्दा दुवै पटक हरियो बलहरू पर्ने सम्भाव्यतामा के परिवर्तन आउँछ ? [1HA]
If two balls are drawn one after the other with replacement, what will be change in probability of getting both the green balls?

⇒ Here,

(a) For mutually exclusive events T and Q, $P(T \cup Q) = P(T) + P(Q)$ is the required formula.

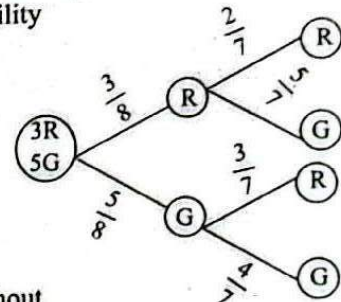
(b) Let R and G denote red and green balls respectively. The probability tree diagram is shown alongside.

$$(c) P(\text{getting both green balls}) = P(GG) = \frac{5}{8} \times \frac{4}{7} = \frac{5}{14}$$

$$(d) \text{ With replacement, } P(\text{getting both green balls}) = \frac{5}{8} \times \frac{5}{8} = \frac{25}{64}$$

$$\text{Change in probability} = \frac{25}{64} - \frac{5}{14} = \frac{15}{448}$$

Thus, with replacement, the probability is more by $\frac{15}{448}$ than without replacement.



13. एउटा झोलामा उस्तै र उत्रै 5 ओटा रातो र 7 ओटा निला बलहरू छन् ।
A bag contains 5 red and 7 blue balls of the same shape and size.

(a) सम्भाव्यताको गुणन नियम उल्लेख गर्नुहोस् । (State the multiplication law of probability.) [1K]

(b) उक्त झोलाबाट एकपछि अर्को पुनः नराखी दुईओटा बलहरू फिक्दा आउने सम्भावित सबै परिणामहरूको सम्भाव्यतालाई वृक्षचित्रमा प्रस्तुत गर्नुहोस् । [2U]
Two balls are drawn randomly one after another without replacement from the bag. Show the probabilities of all possible outcomes in a tree diagram.

(c) एकै धरी रङका बलहरू पर्ने सम्भाव्यता पत्ता लगाउनुहोस् । [1A]
Find the probability of getting the balls of same colour.

(d) दुई ओटा बलहरू एकपछि अर्को गरी पुनः राखी फिक्दा एकै धरी रङका बलहरू पर्ने सम्भाव्यता कतिले बढ्छ ? [1HA]
If two balls are drawn one after another with replacement, how much will increase the probability of getting the balls of same colour?

⇒ Here,

(a) If two events A and B are independent events then, $P(A \text{ and } B) = P(A \cap B) = P(A) \times P(B)$. Similarly, if A and B are two dependent events then $P(A \text{ and } B) = P(A \cap B) = P(A) \times P(B/A)$. This is known as multiplication law of probability.

(b) Let R and B denote red and blue balls respectively. The probability tree diagram is shown alongside.

(c) $P(\text{getting both balls of same colour}) = P(RR) + P(BB)$

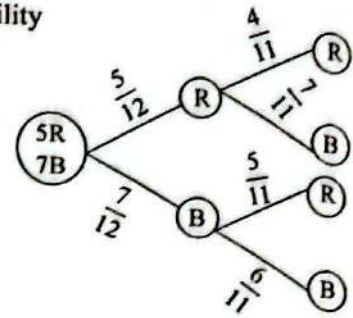
$$= \frac{5}{12} \times \frac{4}{11} + \frac{7}{12} \times \frac{6}{11} = \frac{31}{66}$$

(d) If the balls are drawn with replacement then;

$P(\text{getting both balls of same colour}) = P(RR) + P(BB)$

$$= \frac{5}{12} \times \frac{5}{12} + \frac{7}{12} \times \frac{7}{12} = \frac{37}{72}$$

Thus, increase in probability $= \frac{37}{72} - \frac{31}{66} = \frac{35}{792}$



14. एउटा फोलामा उस्तै र उत्रै 10 ओटा रातो र 8 ओटा हरिया बलहरू छन् ।
 A bag contains 10 red and 8 green balls of the same shape and size.

(a) उक्त फोलाबाट एउटा बल निकालियो भने रातो वा हरियो बल पर्ने सम्भाव्यता पत्ता लगाउनुहोस् ।
 If a ball is drawn from the bag then find the probability of getting red or green ball. [1K]

(b) उक्त फोलाबाट एकपछि अर्को पुनः नराखी दुईओटा बलहरू फिक्दा आउने सम्भावित परिणामहरूको सम्भाव्यतालाई वृक्षचित्रमा प्रस्तुत गर्नुहोस् ।
 Two balls are drawn randomly one after another without replacement from the bag. Show the probabilities of all possible outcomes in a tree diagram. [2A]

(c) दुवै बल हरियो आउने सम्भाव्यता पत्ता लगाउनुहोस् ।
 Find the probability of getting both green balls. [2A]

(d) दुईओटा बलहरू एकपछि अर्को गरी पुनः राखी फिक्दा दुवै बल हरियो आउने सम्भाव्यता कतिले बढ्ला ?
 If two balls are drawn one after another with replacement, how much will increase the probability of getting both the green balls? [1U]

⇒ Here,

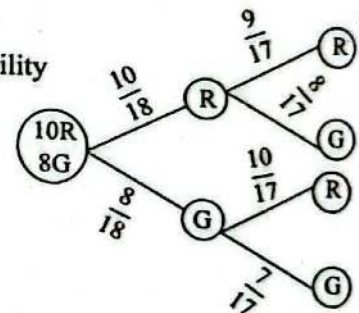
(a) $P(\text{getting red or green ball}) = \frac{10}{18} + \frac{8}{18} = 1$

(b) Let R and G denote red and green balls respectively. The probability tree diagram is shown alongside.

(c) $P(\text{getting both green balls}) = P(GG) = \frac{8}{18} \times \frac{7}{17} = \frac{28}{153}$

(d) With replacement, $P(\text{getting both green balls}) = \frac{8}{18} \times \frac{8}{18} = \frac{16}{81}$

Thus, increase in probability $= \frac{16}{81} - \frac{28}{153} = \frac{20}{1377}$



15. एउटा टेबलमा राम्ररी फिटिएको 52 पत्ती तासको गड्डी छ ।
 In a table, there is a well shuffled deck of 52 cards.

(a) सो तासको गड्डीबाट एउटा तास अनायसी फिक्दा रातो वा कालो रङको तास पर्ने सम्भाव्यता कति होला ?
 If a card is drawn at random from the pack, what is the probability of getting red or black card? [1K]

(b) सो तासका गड्डीबाट दुईओटा तासहरू नहेरीकन एकपछि अर्को गरी पुनः नराखीकन फिक्दा रानी तास पर्ने र नपर्ने सम्भावित परिणामहरूका सम्भाव्यताहरूलाई एउटा वृक्षचित्रमा देखाउनुहोस् ।
 Two cards are drawn randomly in succession without replacement from the deck. Show the probabilities of the possible outcomes of getting and not getting a queen card in a tree diagram. [2A]

(c) दुवै तास रानी आउने सम्भाव्यता पत्ता लगाउनुहोस् ।
 Find the probability of getting both cards are queen. [1U]

(d) दुईओटा तासहरू एक पछि अर्को गरी पुनः राखी फिक्दा दुवै तास रानी आउने सम्भाव्यता कतिले बढ्ला ?
 If two cards are drawn one after another with replacement, how much will increase the probability of getting both the queens? [1HA]

⇒ Here,

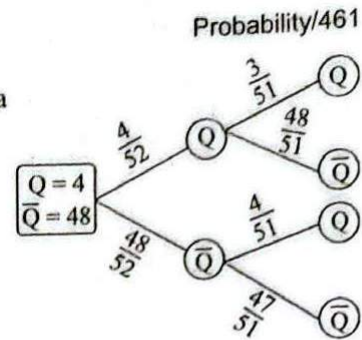
(a) $P(\text{getting red or black card}) = \frac{26}{52} + \frac{26}{52} = 1$

- (b) Let Q and $\bar{Q}$ denote the events of getting a queen and not getting a queen respectively. So, $n(Q) = 4$, $n(\bar{Q}) = 48$ and $n(S) = 52$.
The probability tree diagram is shown alongside.

(c) $P(\text{getting both cards queen}) = P(QQ) = \frac{4}{52} \times \frac{3}{51} = \frac{1}{221}$

(d) With replacement, $P(\text{getting both queens}) = \frac{4}{52} \times \frac{4}{52} = \frac{1}{169}$

Thus, increase in probability = $\frac{1}{169} - \frac{1}{221} = \frac{4}{2873}$



16. एउटा टेबलमा राम्ररी फिटिएको 52 पत्ती तासको गड्डी छ ।
In a table, there is a well shuffled deck of 52 cards.

- (a) सो तासको गड्डीबाट एउटा तास अनायसी फिक्दा राजा पर्ने वा नपर्ने सम्भाव्यता कति होला ?
If a card is drawn at random from the pack, what is the probability of getting king or not getting king? [1K]
- (b) दुईओटा तासहरू नहेरीकन एकपछि अर्को गरी पुनः नराखीकन फिक्दा राजा पर्ने र नपर्ने सम्भावित परिणामहरूका सम्भाव्यताहरूलाई एउटा वृक्षचित्रमा देखाउनुहोस् ।
Two cards are drawn randomly from a well shuffled in succession without replacement. Show the probabilities of possible outcomes of getting and not getting a king in a tree diagram. [2A]
- (c) दुवै तास राजा आउने सम्भाव्यता पत्ता लगाउनुहोस् । (Find the probability of getting both cards are king.) [1U]
- (d) दुईओटा तासहरू एक पछि अर्को गरी पुनः राखी फिक्दा दुवै तास राजा आउने सम्भाव्यता कतिले बढेला ?
If two cards are drawn one after another with replacement, how much will increase the probability of getting both the kings? [1HA]

⇒ Here,

(a) $P(\text{getting or not getting king}) = \frac{4}{52} + \frac{48}{52} = 1$

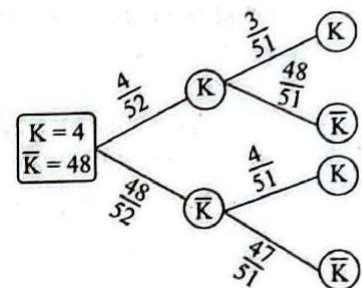
- (b) Let K and $\bar{K}$ denote the events of getting a king and not getting a king respectively.

So, $n(K) = 4$, $n(\bar{K}) = 48$ and $n(S) = 52$
The probability tree diagram is shown alongside.

(c) $P(\text{getting both cards king}) = P(KK) = \frac{4}{52} \times \frac{3}{51} = \frac{1}{221}$

(d) With replacement, $P(\text{getting both kings}) = \frac{4}{52} \times \frac{4}{52} = \frac{1}{169}$

Thus, increase in probability = $\frac{1}{169} - \frac{1}{221} = \frac{4}{2873}$



17. राम्रोसँग फिटिएको 52 पत्ती तासको गड्डीबाट नहेरीकन दुईओटा तासहरू एकपछि अर्को गरी पुनः नराखीकन फिक्किएको छ ।
Two cards are drawn randomly one after another without replacement from a well shuffled deck of 52 cards.

Two cards are drawn randomly one after another without replacement from a well shuffled deck of 52 cards.

- (a) यदि A र B दुई ओटा अनाश्रित घटनाहरू हुन् भने $P(A \cap B)$ पत्ता लगाउने सूत्र के हुन्छ, लेख्नुहोस् ।
If two events A and B are independent events, what is the formula for finding $P(A \cap B)$? Write it. [1K]
- (b) अनुहार भएको तास पर्ने र नपर्ने सबै सम्भावित परिणामहरूको सम्भाव्यतालाई वृक्षचित्रमा देखाउनुहोस् ।
Show the probability of all the possible outcomes of getting or not-getting faced card in a tree diagram. [2A]
- (c) दुवै तास अनुहार भएको पर्ने सम्भाव्यता कति हुन्छ, पत्ता लगाउनुहोस् ।
Find the probability of getting both are faced card. [1U]
- (d) यदि दुईओटा तासहरू एकपछि अर्को गरी पुनः राख्दा दुवै तास अनुहार भएको पर्ने सम्भाव्यता दुवै तास एक्का पर्ने सम्भाव्यता भन्दा कति गुणा बढी हुन्छ ?
If two cards are drawn randomly one after another with replacement, how many times more is the probability that both are faced cards than the probability that both cards are ace? [1HA]

⇒ Here,

- (a) For any two independent events A and B ; $P(A \cap B) = P(A) \times P(B)$

- (b) Let F and $\bar{F}$ denote the events of getting faced card and not getting faced card respectively.

So, $n(F) = 12$, $n(\bar{F}) = 40$ and $n(S) = 52$

The probability tree diagram is shown alongside.

(c) $P(\text{getting both faced card}) = P(FF) = \frac{12}{52} \times \frac{11}{51} = \frac{11}{221}$

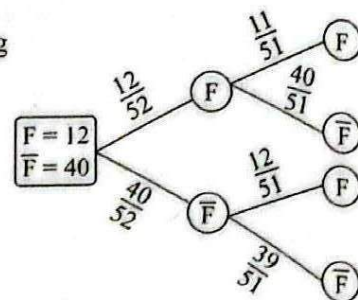
(d) With replacement, $P(\text{both are faced cards}) = P_1 = \frac{12}{52} \times \frac{12}{52} = \frac{9}{169}$

$P(\text{both are ace cards}) = P_2 = \frac{4}{52} \times \frac{4}{52} = \frac{1}{169}$

So, $\frac{P_1}{P_2} = \frac{\frac{9}{169}}{\frac{1}{169}} = \frac{9}{1}$

$\therefore P_1 = 9P_2$

Thus, probability of both being faced cards is 9 times the probability that both cards are ace.



18. एउटा झोलामा उत्रै र उस्तै आकारका 3 ओटा राता र 2 ओटा निला बलहरू छन् ।

A bag contains 3 red and 2 blue balls of the same shape and size.

- (a) सम्भाव्यताको जोड नियम उल्लेख गर्नुहोस् । (State the addition law of probability.)

[1K]

- (b) दुई ओटा बलहरू एक पछि अर्को गरी पुनः राखेर भिक्दा रातो वा निलो बल आउन सक्ने घटना र तिनीहरूको सम्भाव्यतालाई वृक्षचित्रमा प्रस्तुत गर्नुहोस् ।

[1U]

Two balls are drawn randomly one after another with replacement. Show the probabilities of all events of red or blue balls in a tree diagram.

- (c) पुनः नराखि भिक्दा पहिलो बल रातो र दोस्रो बल निलो पर्ने सम्भाव्यता पत्ता लगाउनुहोस् ।

[2A]

Find the probability of getting the first ball red and the second ball blue without replacement.

- (d) दुईओटा बलहरू एक पछि अर्को गरी पुनः राखी वा नराखीकन भिक्दा दुवै बल निला पर्ने सम्भाव्यता बिच कति भिन्नता हुन्छ ?

[1HA]

What is the difference between the probabilities of both balls being blue if two balls are drawn one after the other with replacement or without replacement?

⇒ Here,

- (a) If A and B are mutually exclusive events, $P(A \cup B) = P(A) + P(B)$ and if A and C are not mutually exclusive event $P(A \cup C) = P(A) + P(C) - P(A \cap C)$. This is called addition law of probability.

- (b) Let R and B denote red and blue balls respectively. The probability tree diagram is shown alongside.

- (c) Without replacement; $P(\text{first ball red}) = \frac{3}{5}$

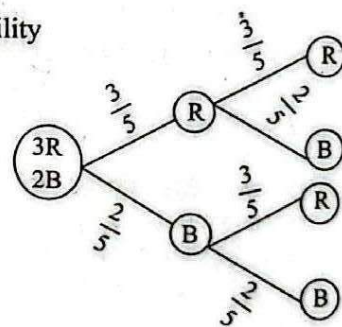
$P(\text{second ball blue}) = \frac{2}{4} = \frac{1}{2}$

Thus, $P(\text{first red and second blue ball}) = \frac{3}{5} \times \frac{1}{2} = \frac{3}{10}$

- (d) Without replacement; $P(\text{both blue balls}) = P_1 = \frac{2}{5} \times \frac{1}{4} = \frac{1}{10}$

With replacement; $P(\text{both blue balls}) = P_2 = \frac{2}{5} \times \frac{2}{5} = \frac{4}{25}$

Thus, difference in probabilities $= P_2 - P_1 = \frac{4}{25} - \frac{1}{10} = \frac{3}{50}$



19. एउटा झोलामा उत्रै र उस्तै आकारका 9 ओटा राता र 6 ओटा निला बलहरू छन् ।

A bag contains 9 red and 6 blue balls of the same shape and size.

- (a) सम्भाव्यताको गुणन नियम उल्लेख गर्नुहोस् । (State the multiplication law of probability.)

[1K]

- (b) दुई ओटा बलहरू एक पछि अर्को गरी पुनः राखेर भिक्दा रातो वा निलो बल आउन सक्ने घटना र तिनीहरूको सम्भाव्यतालाई वृक्षचित्रमा प्रस्तुत गर्नुहोस् ।

[1U]

Two balls are drawn randomly one after another with replacement. Show the probabilities of all events of getting red or blue balls in a tree diagram.

- (c) पुनः नराखी फिक्दा पहिलो बल रातो र दोस्रो बल निलो पर्ने सम्भाव्यता पत्ता लगाउनुहोस् । [2A]

Find the probability of getting the first ball red and the second ball blue without replacement.

- (d) दुईओटा बलहरू एक पछि अर्को गरी पुनः राखी र नराखीकन फिक्दा दुवै बल निला पर्ने सम्भावना विच कति भिन्नता हुन्छ ? [1HA]

What is the difference between the probabilities of both balls being blue if two balls are drawn one after the other with replacement or without replacement?

⇒ Here,

- (a) If two events A and B are independent events then, $P(A \text{ and } B) = P(A \cap B) = P(A) \times P(B)$.
Similarly, if A and B are two dependent events then $P(A \text{ and } B) = P(A \cap B) = P(A) \times P(B/A)$.
This is known as multiplication law of probability.

- (b) Let R and B denote red and blue balls respectively. The probability tree diagram is shown alongside.

- (c) Without replacement; $P(\text{first ball red}) = \frac{9}{15}$

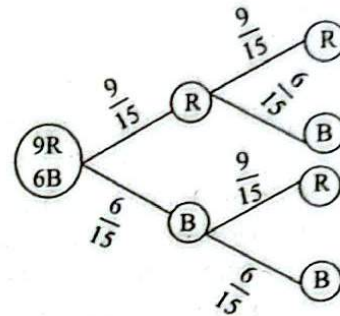
$$P(\text{second ball blue}) = \frac{6}{14}$$

$$\text{Thus, } P(\text{first red and second blue ball}) = \frac{9}{15} \times \frac{6}{14} = \frac{9}{35}$$

- (d) Without replacement; $P(\text{both blue balls}) = P_1 = \frac{6}{15} \times \frac{5}{14} = \frac{1}{7}$

$$\text{With replacement; } P(\text{both blue balls}) = P_2 = \frac{6}{15} \times \frac{6}{15} = \frac{4}{25}$$

$$\text{Thus, difference in probabilities} = P_2 - P_1 = \frac{4}{25} - \frac{1}{7} = \frac{3}{175}$$



20. एउटा झोलामा एउटा पहेँलो, एउटा रातो र एउटा सेतो गरी तीनओटा जस्तै र उत्रै मिठाइहरू राखिएका छन् ।
There are one yellow, one red and one white sweets of same shape and size in a bag.

- (a) सो झोलाबाट एउटा मिठाइ फिक्दा रातो वा सेतो मिठाइ पर्ने सम्भाव्यता पत्ता लगाउनुहोस् । [1K]
If a sweet is drawn at random, find the probability of getting red or white sweet.

- (b) उक्त झोलाबाट नहेरिकन एउटा मिठाई तान्ने र उक्त मिठाई पुनः झोलामा नराखी अर्को मिठाई तान्दा आउन सक्ने परिणामहरूका सम्भाव्यताहरूलाई वृक्षचित्रमा देखाउनुहोस् ।
A sweet is drawn randomly and without replacing the sweet, another sweet is drawn from the bag.
Show all the possible outcomes of the probabilities in a tree diagram. [2A]

- (c) नमूना क्षेत्र लेख्नुहोस् । (Write the sample space) [1 U]

- (d) पहिलो पटक रातो र दोस्रो पटक सेतो मिठाइ आउने सम्भाव्यता कति प्रतिशत रहेछ ?
What is the percentage of probability of getting red sweet in first time and white sweet in second time? [1HA]

⇒ Here,

$$(a) P(\text{getting red or white sweet}) = \frac{1}{3} + \frac{1}{3} = \frac{2}{3}$$

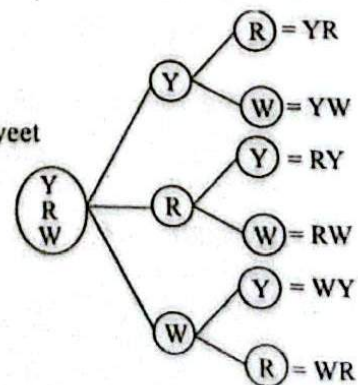
- (b) Let Y, R and W denote yellow sweet, red sweet and white sweet respectively. The probability tree diagram is shown alongside.

- (c) The sample space = {YR, YW, RY, RW, WY, WR}

- (d) $P(\text{getting red sweet in first time and white sweet in second})$

$$= \frac{1}{3} \times \frac{1}{2} = \frac{1}{6}$$

$$\text{Thus, required percentage} = \frac{1}{6} \times 100\% = 16 \frac{2}{3}\%$$



14.1 पारस्परिक निषेधक घटनाहरूको जोड सिद्धान्त

Addition Law of Mutually Exclusive Events

QUESTIONS FROM CDC TEXTBOOKS

[EXERCISE 14.1]

1. दिइएका घटना पारस्परिक निषेधक हुन् वा होइनन् पत्ता लगाउनुहोस् :
Find out whether the given events are mutually exclusive or not.

 - (a) एउटा सिक्का उफार्दा, A = अग्र भाग (H) आउने र B = पश्च भाग (T) आउने
When a coin is tossed, A = getting the head (H) and B = getting the tail (T).
⇒ Here, mutually exclusive events.
 - (b) एउटा डाइस उफार्दा, P = जोर सङ्ख्या आउने र Q = बिजोर सङ्ख्या आउने
When a dice is rolled, P = getting an even number and Q = getting an odd number die.
⇒ Here, mutually exclusive events.
 - (c) राम्ररी फिटिएका तासको गड्डीबाट एउटा तास थुत्दा, F = मुहार आकृति भएको आउने र A = हुकुम आउने
A card is drawn from a well-shuffled pack of cards, F = getting a face card and A = getting a spade.
⇒ Here, not mutually exclusive events.
 - (d) राम्ररी फिटिएका तासको गड्डीबाट एउटा तास थुत्दा, T = 10 आउने र A = एक्का आउने
A card is drawn from a well-shuffled pack of cards, T = getting 10 and A = getting an ace.
⇒ Here, mutually exclusive events.
 - (e) 5 ओटा सेता, 8 ओटा हरिया र 7 ओटा निला बल भएको झोलाबाट एउटा बल नहेरीकन निकाल्दा, G = हरियो बल आउने र B = निलो बल आउने
A bag contains 5 white, 8 green and 7 blue balls. A ball is drawn at random, G = getting green ball and B = getting blue ball.
⇒ Here, mutually exclusive events.
2. दिइएका घटनाका सम्भाव्यता पत्ता लगाउनुहोस् । (Find the probability of the given events.)

 - (a) दुईओटा सिक्का उफार्दा कम्तीमा एउटा अग्र भाग (H) आउने
Getting at least one head (H) when two coins are tossed
⇒ Here, sample space (S) = {HH, HT, TH, TT} ∴ n(S) = 4
Favourable events (E) = {HH, HT, TH} ∴ n(E) = 3
Thus, $P(E) = \frac{n(E)}{n(S)} = \frac{3}{4}$
 - (b) एउटा डाइस उफार्दा रूढ सङ्ख्या आउने (Getting prime number when a die is rolled)
⇒ Here, sample space (S) = {1, 2, 3, 4, 5, 6} ∴ n(S) = 6
Favourable events (E) = Prime number = {2, 3, 5} ∴ n(E) = 3
Thus, $P(E) = \frac{n(E)}{n(S)} = \frac{3}{6} = \frac{1}{2}$
 - (c) राम्ररी फिटिएको तासको गड्डीबाट एउटा तास थुत्दा मुहार आकृति भएको आउने
Getting a face card when a card is drawn from a well-shuffled pack of cards
⇒ Here, n(S) = 52, n(E) = 12
Thus, $P(E) = \frac{n(E)}{n(S)} = \frac{12}{52} = \frac{3}{13}$
 - (d) अङ्ग्रेजी महिनाअनुसार कुनै एउटा बालकको जन्म 30 दिन भएको महिनामै हुने
According to the English Months, a boy is born in a month with 30 days
⇒ Here, n(S) = 12 and n(E) = n{April, June, September, November} = 4
Thus, $P(E) = \frac{n(E)}{n(S)} = \frac{4}{12} = \frac{1}{3}$
 - (e) 4 ओटा सेता, 7 ओटा हरिया र 5 ओटा निला बल भएको झोलाबाट एउटा बल नहेरीकन निकाल्दा सेतो बल आउने
Getting a white ball when a ball is drawn from a bag containing 4 white, 7 green and 5 blue balls.
⇒ Here, n(S) = 4 + 7 + 5 = 16, n(E) = 4
Thus, $P(E) = \frac{n(E)}{n(S)} = \frac{4}{16} = \frac{1}{4}$

3. तलका घटनाको सम्भाव्यता कति हुन्छ, पत्ता लगाउनुहोस् । (What is the probability of the following events? Find.)
 (a) 6 ओटा राता, 5 ओटा पहेँला र 7 ओटा निला उही आकारको बल भएको झोलाबाट एउटा बल नहेरीकन निकाल्दा राता अथवा निला बल आउने
 A bag contains 6 red, 5 yellow and 7 blue identical balls. If a ball is drawn randomly from the bag, it may be either, red or blue ball

⇒ Here, $n(S) = 6 + 5 + 7 = 18$, $n(E) = 6 + 7 = 13$

Thus, $P(E) = \frac{n(E)}{n(S)} = \frac{13}{18}$

- (b) तीनओटा सिक्कालाई सँगै उफार्दा तीनओटा अग्र भाग (H) आउने अथवा तीनओटा पश्च भाग (T) आउने
 Three coins are tossed together, getting all three are head (H) or all three are tail

⇒ Here, sample space $(S) = \{HHH, HHT, HTT, TTT, THT, TTH, HTH, THH\} \therefore n(S) = 8$

$P(HHH) = \frac{n(E)}{n(S)} = \frac{1}{8}$; $P(TTT) = \frac{n(E)}{n(S)} = \frac{1}{8}$

Thus, $P(HHH \text{ or } TTT) = \frac{1}{8} + \frac{1}{8} = \frac{2}{8} = \frac{1}{4}$

- (c) एउटा डाइस उफार्दा रूढ सङ्ख्या आउने अथवा 4 आउने (When a die is rolled, getting prime number or 4)

⇒ Here, $n(S) = n\{1, 2, 3, 4, 5, 6\} = 6$, $n(p) = n\{2, 3, 5\} = 3$ and $n(4) = 1$

Thus, $P(p \text{ or } 4) = \frac{n(p)}{n(S)} + \frac{n(4)}{n(S)} = \frac{3}{6} + \frac{1}{6} = \frac{4}{6} = \frac{2}{3}$

- (d) राम्ररी फिटिएको तासको गड्डीबाट एउटा तास थुन्दा 10 आउने वा एक्का (A) आउने
 When a card is drawn from a well-shuffled pack of cards, 10 card or ace card (A)

⇒ Here, $n(S) = 52$, $n(10) = 4$ and $n(A) = 4$

Thus, $P(10 \text{ or } A) = \frac{n(10)}{n(S)} + \frac{n(A)}{n(S)} = \frac{4}{52} + \frac{4}{52} = \frac{8}{52} = \frac{2}{13}$

- (e) राम्ररी फिटिएको तासको गड्डीबाट एउटा तास थुन्दा मुहार आकृति भएको आउने वा हुकुम आउने
 When a card is drawn from a well-shuffled pack of cards, face card or spade cards

⇒ Here, no. of sample space $n(S) = 52$, no. of face cards $n(F) = 12$, no. of spade cards $n(H) = 13$ and $n(F \cap H) = 3$

Thus, $P(F \text{ or } H) = \frac{n(F)}{n(S)} + \frac{n(H)}{n(S)} - \frac{n(F \cap H)}{n(S)} = \frac{12}{52} + \frac{13}{52} - \frac{3}{52} = \frac{12 + 13 - 3}{52} = \frac{22}{52} = \frac{11}{26}$

4. तलका घटनाको सम्भाव्यता पत्ता लगाउनुहोस् । (Find the probability of the following events.)

- (a) MATHEMATICS मा भएका अक्षरहरूमा एउटा तान्दा M अथवा T आउने
 When a letter is drawn from MATHEMATICS, getting the letter M or T

⇒ Here, $n(S) = 11$, $n(M) = 2$ and $n(T) = 2$

Thus, $P(M \text{ or } T) = \frac{n(M)}{n(S)} + \frac{n(T)}{n(S)} = \frac{2}{11} + \frac{2}{11} = \frac{2+2}{11} = \frac{4}{11}$

- (b) STATISTICS मा भएका अक्षरहरूमा एउटा तान्दा S अथवा T आउने
 When a letter is drawn from STATISTICS, getting the letter S or T

⇒ Here, no. of sample space $n(S') = 10$, no. of letters S $n(S) = 3$ and no. of letter T $n(T) = 3$

Thus, $P(S \text{ or } T) = \frac{n(S)}{n(S')} + \frac{n(T)}{n(S')} = \frac{3}{10} + \frac{3}{10} = \frac{3+3}{10} = \frac{6}{10} = \frac{3}{5}$

- (c) RHODODENDRON मा भएका अक्षरहरूमा एउटा तान्दा O अथवा D आउने
 When a letter is drawn from RHODODENDRON, getting the letter O or D

⇒ Here, $n(S) = 12$, $n(O) = 3$ and $n(D) = 3$

Thus, $P(O \text{ or } D) = \frac{n(O)}{n(S)} + \frac{n(D)}{n(S)} = \frac{3}{12} + \frac{3}{12} = \frac{3+3}{12} = \frac{6}{12} = \frac{1}{2}$

- (d) कक्षाका 15 विद्यार्थीमध्ये 8 जनाले अङ्ग्रेजी, 9 जनाले गणित र 4 जनाले दुवै विषय छाने। एक जना विद्यार्थीलाई नहेरीकन छनोट गर्दा गणित वा अङ्ग्रेजी छनोट गर्ने विद्यार्थी पर्ने सम्भाव्यता पत्ता लगाउनुहोस्।
Out of 15 students of a class, 8 students opted English, 9 students opted Mathematics and 4 students opted both subjects. When a student is selected at random, what is the probability of getting a student opting Mathematics or English?

⇒ Here, $n(S) = 15$, $n(M) = 9$, $n(E) = 8$ and $n(M \cap E) = 4$

$$P(M \text{ or } E) = \frac{n(M)}{n(S)} + \frac{n(E)}{n(S)} - \frac{n(M \cap E)}{n(S)} = \frac{9}{15} + \frac{8}{15} - \frac{4}{15} = \frac{9+8-4}{15} = \frac{13}{15}$$

14.2 सम्भाव्यताको गुणन सिद्धान्त (Multiplication Principle of Probability)

QUESTIONS FROM CDC TEXTBOOKS

[EXERCISE 14.2]

1. एउटा सिक्का र एउटा डाइस एकसाथ उफार्दा सिक्कामा पछिल्लो भाग (T) र डाइसमा 3 आउने सम्भाव्यता निकाल्नुहोस्।
When a coin is tossed and a dice is rolled simultaneously. What is the probability of getting tail (T) on coin and 3 on dice?

⇒ Here, In a coin sample space $(S_1) = \{H, T\}$

In a dice sample space $(S_2) = \{1, 2, 3, 4, 5, 6\}$

$$\therefore n(S_1) = 2$$

$$\therefore n(S_2) = 6$$

$$\text{Now, } P(\text{Tail and } 3) = P(\text{Tail}) \times P(3) = \frac{n(\text{Tail})}{n(S_1)} \times \frac{n(3)}{n(S_2)} = \frac{1}{2} \times \frac{1}{6}$$

Thus, the required probability is $\frac{1}{12}$.

2. एउटा बाक्समा 2 ओटा हरिया, 3 ओटा रातो र 5 ओटा काला उस्तै र उत्रै बल राखिएका छन्। त्यसबाट नहेरीकन एउटा बल निकाली पुनः त्यसमा राखी अर्को बल नहेरी निकाल्दा निम्नानुसारका बलहरू आउने सम्भाव्यता पत्ता लगाउनुहोस् :

A box contains 2 green, 3 red and 5 black balls of same shape and size. One ball is drawn randomly and replaced. Then after, another ball is drawn. Find the probabilities of getting following balls.

(i) दुवै एउटै रङका (Both of them are of the same color.)

(ii) दुईओटा भिन्ना भिन्नै रङका (Both of them are of the different color.)

(iii) कम्तीमा एउटा बल रातो अथवा कालो रङको (At least one ball is red or black.)

⇒ Here, let G, R and B represent green, red and black balls respectively.

Sample space $(S) = \{GG, RR, BB, GR, GB, RG, RB, BG, BR\}$

Total no. of balls = $2 + 3 + 5 = 10$

First drawn ball is replaced in a bag

$$(i) P(\text{Both of same colour}) = P(GG) \text{ or } P(RR) \text{ or } P(BB) = \frac{2}{10} \times \frac{2}{10} + \frac{3}{10} \times \frac{3}{10} + \frac{5}{10} \times \frac{5}{10} \\ = \frac{4+9+25}{100} = \frac{38}{100} = \frac{19}{50}$$

$$(ii) P(\text{Both are of different color}) = 1 - P(\text{Same color}) = 1 - \frac{19}{50} = \frac{31}{50}$$

$$(iii) P(\text{At least one red or black}) = 1 - P(GG) = 1 - \frac{2}{10} \times \frac{2}{10} = 1 - \frac{4}{100} = \frac{100-4}{100} = \frac{96}{100} = \frac{24}{25}$$

3. एउटा बाक्समा 2 ओटा हरिया, 3 ओटा रातो र 5 ओटा काला उस्तै र उत्रै बलहरू राखिएका छन्। त्यसबाट नहेरीकन एउटा बल निकाली पुनः त्यसमा नराखी अर्को बल नहेरी निकाल्दा निम्नानुसारका बलहरू आउने सम्भाव्यता पत्ता लगाउनुहोस् :

A box contains 2 green, 3 red and 5 black balls of same shape and size. Two balls are drawn randomly one after another without replacement. Find the probabilities of getting following balls.

(i) दुवै एउटै रङका (Both of them are of the same color.)

(ii) दुईओटा भिन्ना भिन्नै रङका (Both of them are of the different color.)

(iii) कम्तीमा एउटा बल रातो अथवा कालो रङको (At least one ball is red or black.)

⇒ Here, let G, R and B represent green, red and black balls respectively.

Sample space $(S) = \{GG, RR, BB, GR, GB, RG, RB, BG, BR\}$

Total no. of balls = $2 + 3 + 5 = 10$

First drawn ball is not replaced in a bag

$$(i) P(\text{Both of same color}) = P(GG) \text{ or } P(RR) \text{ or } P(BB) = \frac{2}{10} \times \frac{1}{9} + \frac{3}{10} \times \frac{2}{9} + \frac{5}{10} \times \frac{4}{9} \\ = \frac{2+6+20}{90} = \frac{28}{90} = \frac{14}{45}$$

$$(ii) P(\text{Both are of different color}) = 1 - P(\text{Same colour}) = 1 - \frac{14}{45} = \frac{31}{45}$$

$$(iii) P(\text{At least one red or black}) = 1 - P(GG) = 1 - \frac{2}{10} \times \frac{1}{9} = 1 - \frac{2}{90} = \frac{90-2}{90} = \frac{88}{90} = \frac{44}{45}$$

4. एउटा झोलामा राखिएका 7 ओटा रातो र 8 ओटा पहेँला उस्तै उस्तै बलमा दुईओटा बल पालैपालो निकाल्दा दुवै पटक रातो अथवा पहेँलो बल आउने सम्भाव्यता पत्ता लगाउनुहोस् । (पहिले निकालिएको बल पुनः झोलामा नराख्ने ।)
A bag contains 7 red and 8 yellow balls of same shape and size. Two balls are drawn randomly one after another. Find the probabilities of getting both balls are red or yellow. (First drawn ball is not replaced in a bag.)

⇒ Here, let R and Y represent red and yellow balls respectively.

So, sample space (S) = {RR, YY, RY, YR}

Total no. of balls = 7 + 8 = 15

First drawn ball is not replaced in the bag.

$$\text{Probability of getting both red or yellow balls} = P(RR) \text{ or } P(YY) = \frac{7}{15} \times \frac{6}{14} + \frac{8}{15} \times \frac{7}{14} \\ = \frac{42+56}{210} = \frac{98}{210} = \frac{7}{15}$$

Thus, the required probability is $\frac{7}{15}$.

5. राम्ररी फिटिएको 52 पत्तीको 1 सेट तासबाट नहेरीकन एउटा तास फिकेर पुनः त्यसमा नराखी नहेरीकन दोस्रो तास फिकेदा, Two cards are drawn randomly from a well shuffled deck of 52 cards in succession without replacement.

(i) दुवै पटक एक्का पर्ने सम्भाव्यता कति हुन्छ ? (What is the probability of getting both are ace cards?)

(ii) एक एकओटा एक्का वा बादशाह पर्ने सम्भाव्यता कति हुन्छ ?

What is the probability of getting one is ace card or other is king card?

⇒ Here, let A and K represent ace card and king card respectively.

So, n(S) = 52

$$(i) P_1(A) \times P_2(A) = \frac{4}{52} \times \frac{3}{51} = \frac{1}{221}$$

$$(ii) P(AK) \text{ or } P(KA) = \frac{4}{52} \times \frac{4}{51} + \frac{4}{52} \times \frac{4}{51} = \frac{8}{663}$$

Thus, the required probabilities are $\frac{1}{221}$ and $\frac{8}{663}$ respectively.

6. एउटा झोलामा रातो, हरियो र कालो एक एकओटा उस्तै र उत्रै गुच्छा राखिएका छन् । उक्त झोलाबाट नहेरीकन एउटा गुच्छा निकाल्ने र पुनः त्यसमा नराखी अर्को गुच्छा निकाल्दा हुने सबै सम्भाव्यताहरू पत्ता लगाउनुहोस् ।
A bag contains one red, one green and one black marble of the same shape and size. One marble is drawn randomly and not replaced. Then after, another marble is drawn. Find all the probabilities.

⇒ Here, let R, G and B represent red, green and black marbles respectively.

So, no. of sample space, n(S) = 1 + 1 + 1 = 3

When the first drawn marble is red then $P_1(R) = \frac{1}{3}$

So, second drawn marble may be green or black. Without replacement, $P_2(G) = \frac{1}{2}$ and $P_2(B) = \frac{1}{2}$

Thus, required probabilities are:

$$(i) P_1(R) \times P_2(G) = \frac{1}{3} \times \frac{1}{2} = \frac{1}{6}$$

$$(ii) P_1(R) \times P_2(B) = \frac{1}{3} \times \frac{1}{2} = \frac{1}{6}$$

When the first drawn marble is green then $P_1(G) = \frac{1}{3}$

So, second drawn marble may be red or black. Without replacement, $P_2(R) = \frac{1}{2}$ and $P_2(B) = \frac{1}{2}$

Thus, required probabilities are:

$$(iii) P_1(G) \times P_2(R) = \frac{1}{3} \times \frac{1}{2} = \frac{1}{6}$$

$$(iv) P_1(G) \times P_2(B) = \frac{1}{3} \times \frac{1}{2} = \frac{1}{6}$$

When the first drawn marble is black then $P_1(B) = \frac{1}{3}$

So, second drawn marble may be green or red. Without replacement, $P_2(G) = \frac{1}{2}$ and $P_2(R) = \frac{1}{2}$

Thus, required probabilities are:

$$(v) P_1(B) \times P_2(G) = \frac{1}{3} \times \frac{1}{2} = \frac{1}{6}$$

$$(vi) P_1(B) \times P_2(R) = \frac{1}{3} \times \frac{1}{2} = \frac{1}{6}$$

14.3 वृक्ष चित्र (Tree diagram)

QUESTIONS FROM CDC TEXTBOOKS

[EXERCISE 14.3]

1. एउटा सिक्कालाई तीन पटक उफार्दा आउने सम्भावित घटनालाई वृक्ष चित्रमा देखाउनुहोस् र निम्नानुसारका सम्भाव्यताहरू पत्ता लगाउनुहोस् :

A coin is tossed three times. Draw a probability tree diagram to show all the possible outcomes. Find the probabilities of the following.

- (a) सबै तीनओटा पश्चभाग (T) (All three are tail (T))
 (b) कम्तीमा दुईओटा अग्रभाग (H) (At least two heads (H))
 (c) तीनओटा अग्रभाग (H) (Three heads(H))

⇒ Here, let H = Head and T = Tail

The probability tree diagram is shown below.

$S = \{HHH, HHT, HTH, HTT, THH, THT, TTH, TTT\}$

- (a) $P(\text{All three T}) = P(TTT) = P_1(T) \times P_2(T) \times P_3(T)$

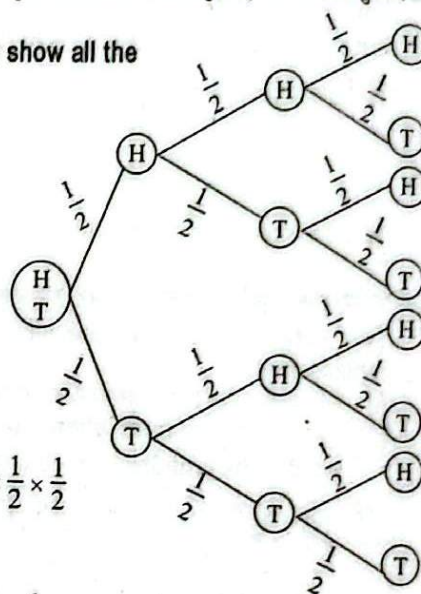
$$= \frac{1}{2} \times \frac{1}{2} \times \frac{1}{2} = \frac{1}{8}$$

- (b) $P(\text{At least two H}) = P(HHH, HHT, HTH, THH)$

$$= \frac{1}{2} \times \frac{1}{2} \times \frac{1}{2} + \frac{1}{2} \times \frac{1}{2} \times \frac{1}{2} + \frac{1}{2} \times \frac{1}{2} \times \frac{1}{2} + \frac{1}{2} \times \frac{1}{2} \times \frac{1}{2}$$

$$= \frac{1}{8} + \frac{1}{8} + \frac{1}{8} + \frac{1}{8} = \frac{4}{8} = \frac{1}{2}$$

- (c) $P(\text{Three H}) = P(HHH) = P_1(H) \times P_2(H) \times P_3(H) = \frac{1}{2} \times \frac{1}{2} \times \frac{1}{2} = \frac{1}{8}$



2. राता, निला र खैरा तीनाओटा रङ भएको एउटा स्पिनर घुमाएर एउटा सिक्का उफार्दा आउन सक्ने सबै घटनालाई देखाउने वृक्षचित्र तयार पार्नुहोस् । वृक्ष चित्रको प्रयोग गरी तलका सम्भाव्यताहरू पत्ता लगाउनुहोस् :
 A spinner with three colors viz red, blue and brown is spun and a coin is tossed together. Draw a probability tree diagram to show all the possible outcomes. By using a probability tree diagram, find the probabilities of the following.

- (a) स्पिनरको सुई रातो रङमा अडिने र सिक्कामा H आउने (The spinner can land on red and head (H) on coin.)

- (b) स्पिनरको सुई खैरो रङमा अडिने र सिक्कामा T अथवा H आउने

The spinner can land on brown and tail (T) or head (H) on coin.

⇒ Here, let, R, B, Z represent red, blue, brown colors and H, T represent head, tail on coin respectively.

The probability tree diagram is shown below.

$S = \{RH, RT, BH, BT, ZH, ZT\}$

- (a) $P(\text{spinner land on red and head on coin})$

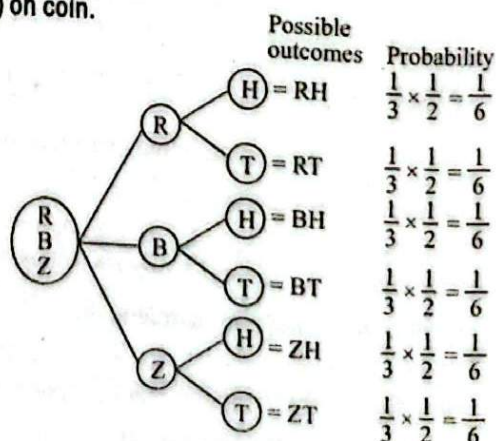
$= P(\text{spinner land on red}) \times P(\text{head on coin})$

$$= \frac{1}{3} \times \frac{1}{2} = \frac{1}{6}$$

- (b) $P(\text{spinner land on brown & tail or head on coin})$

$= P(\text{spinner land on brown}) \times P(\text{tail or head})$

$$= \frac{1}{3} \times \left(\frac{1}{2} + \frac{1}{2}\right) = \frac{1}{3} \times \frac{2}{2} = \frac{1}{3}$$



3. एउटा सिक्कालाई र एउटा डाइसलाई एकपछि अर्को गरी उफारियो। यसरी उफार्दा आउनसक्ने सबै घटनालाई वृक्ष चित्रमा देखाउनुहोस्। वृक्ष चित्रको प्रयोग गरी तलका सम्भाव्यता पत्ता लगाउनुहोस् :

A coin is tossed and a die is rolled one after another. Draw a probability tree diagram to show all the possible outcomes. By using a probability tree diagram, find the probabilities of the following.

(a) सिक्कामा H र डाइसमा जोर सङ्ख्या आउने
Head (H) on the coin and even number on the dice.

(b) सिक्कामा T र डाइसमा वर्ग सङ्ख्या आउने
Tail (T) on the coin and square number on the dice.

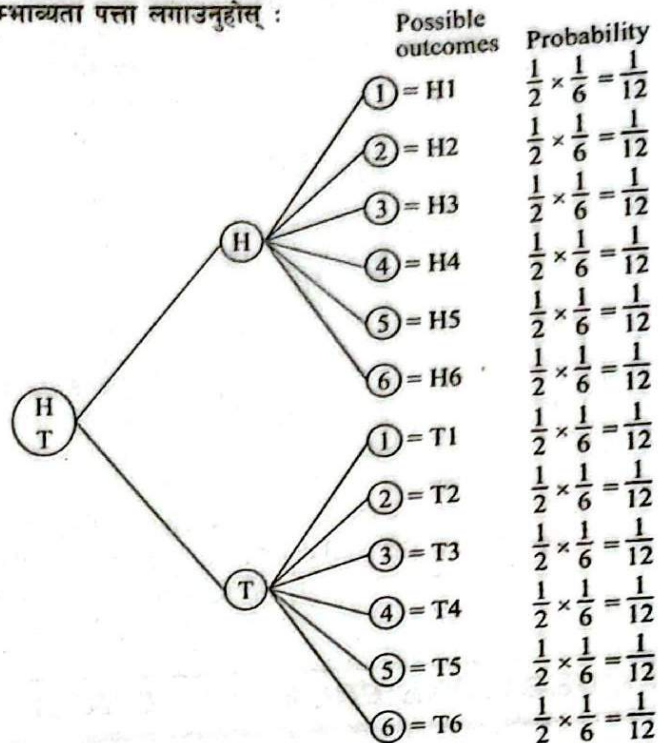
⇒ Here, let H and T represent head and tail on coin respectively. The probability tree diagram is shown below.

(a) $P(\text{Head on coin and even number on dice})$
 $= P(\text{head}) \times P(\text{even number})$

$$= \frac{1}{2} \times \frac{3}{6} = \frac{1}{4}$$

(b) $P(\text{Tail and square number})$
 $= P(\text{Tail}) \times P(\text{Square number})$

$$= \frac{1}{2} \times \frac{2}{6} = \frac{1}{6}$$



4. राम्ररी फिटिएको 52 पत्ती तासको गड्डीबाट एउटा तास तान्दा (हुकुम, चिडी, हँटा र पान) मध्ये एउटा आउने र त्यसपछि सिक्कालाई उफार्दा आउने सम्भाव्य घटना जनाउने वृक्ष चित्र तयार गर्नुहोस्। उक्त वृक्ष चित्र प्रयोग गरी Draw a probability tree diagram to show all the possible outcomes of getting a card (spade, club, diamond and heart) from a well-shuffled pack of 52 cards and when a coin is tossed. By using a probability tree diagram, find the probabilities of the following.

(a) रातो र H आउने (Red on the card and head (H) on the coin.)

(b) कालो र T आउने सम्भाव्यता पत्ता लगाउनुहोस्।
Black on the card and tail (T) on the coin.

⇒ Here, let spade, club, diamond and heart are S, C, D and P respectively.

The probability tree diagram is shown below.

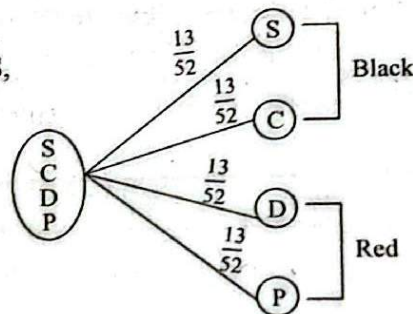
(a) $P(\text{Red and Head}) = P(\text{Red}) \times P(\text{Head})$

$$= \left(\frac{13}{52} + \frac{13}{52} \right) \times \frac{1}{2}$$

$$= \frac{26}{52} \times \frac{1}{2} = \frac{1}{4}$$

(b) $P(\text{Black and Tail}) = P(\text{Black}) \times P(\text{Tail})$

$$= \left(\frac{13}{52} + \frac{13}{52} \right) \times \frac{1}{2} = \frac{26}{52} \times \frac{1}{2} = \frac{1}{4}$$



5. एउटा झोलामा भएका 7 ओटा रातो र 5 ओटा हरिया गुच्चाबाट नहेरीकन 3 ओटा गुच्चा एकपछि अर्को पालैपालो निकाल्दा
A bag contains 7 red and 5 green marbles. Three marbles are drawn one after another;

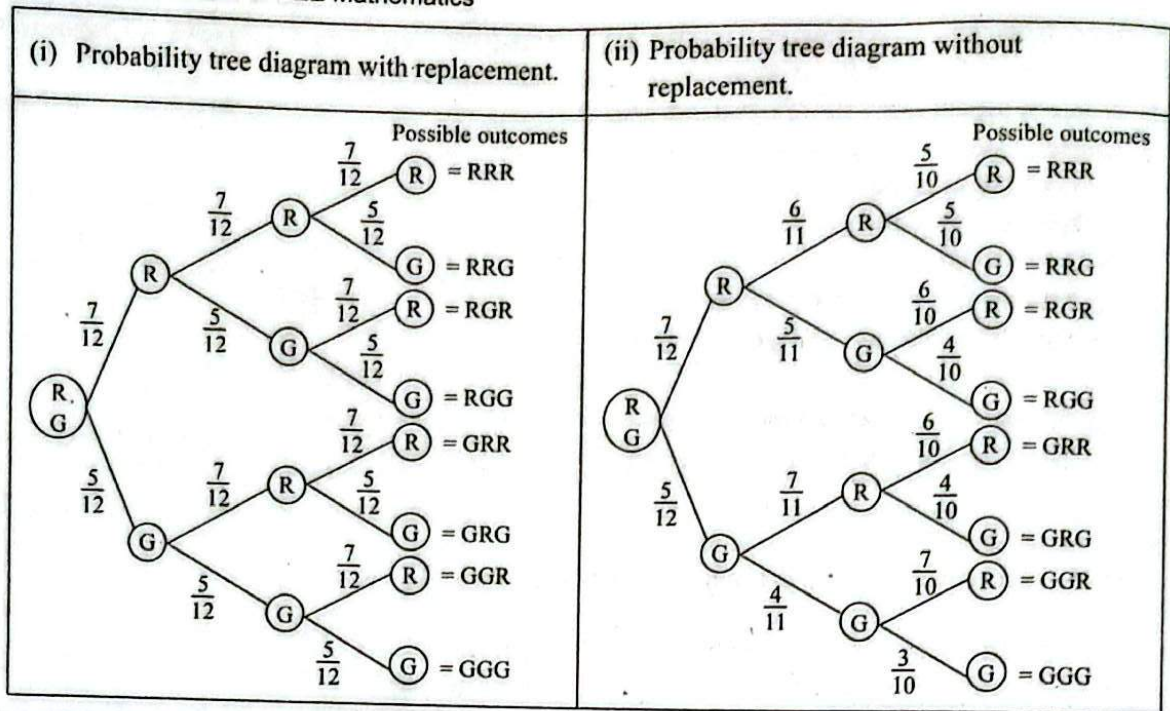
(i) पुनः राखेर (with replacement)

(ii) पुनः नराखीकन (without replacement)

आउनसक्ने घटनालाई जनाउने वृक्ष चित्र तयार पार्नुहोस्।

Draw a probability tree diagram to show all the possible outcomes.

⇒ Here, let R and G represent red marbles and green marbles respectively. We have, $n(S) = 7 + 5 = 12$

**QUESTIONS FROM CDC TEXTBOOKS****[MIXED EXERCISE]**

1. 50 जना मानिसको उचाइ (से.मि. मा) तल दिइएको छ । (The heights (in cm) of 50 people are given below.)

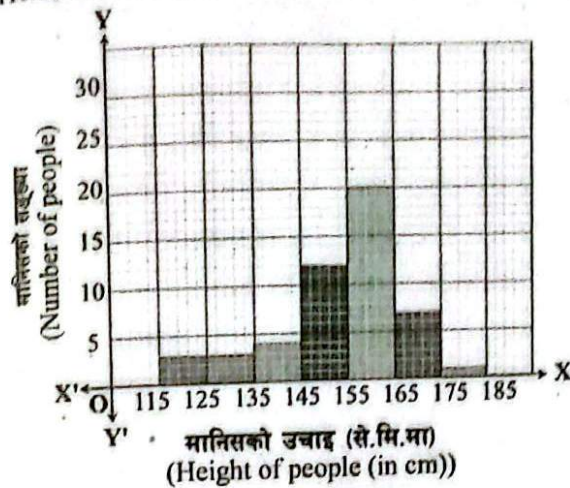
उचाइ (से.मि. मा) (Height (in cm))
125, 137, 155, 149, 122, 128, 133, 144, 115, 118, 142, 145, 151, 157, 159, 160, 165, 162, 156, 158, 155, 141, 147, 149, 148, 159, 154, 155, 166, 168, 169, 172, 174, 173, 176, 161, 164, 163, 149, 150, 154, 153, 152, 164, 158, 159, 162, 157, 156, 155

- (a) उक्त तथ्याङ्कलाई 10 को वर्गान्तर बनाइ बारम्बारता तालिका तयार पार्नुहोस् ।
Construct a frequency distribution table with the class interval 10 of the given data.
- (b) माथिको बारम्बारता तालिकाबाट मध्यक पत्ता लगाउनुहोस् ।
Find the mean from the above frequency distribution table.
- (c) (a) मा तयार पारिएको बारम्बारता तालिकालाई हिस्टोग्राममा देखाउनुहोस् ।
Show the histogram of frequency distribution table prepared in (a).
- (d) माथिको तथ्याङ्कको मध्यिका मान कति होला ? (What is the median value of the above data?)
- ⇒ (a) Here, construction of frequency distribution table.

C.I	Tallies	m	f	fm	cf
115 - 125		120	3	360	3
125 - 135		130	3	390	6
135 - 145		140	4	560	10
145 - 155		150	12	1800	22
155 - 165		160	20	3200	42
165 - 175		170	7	1190	49
175 - 185		180	1	180	50
			N = 50	Σfm = 7680	

(b) Here, mean $(\bar{X}) = \frac{\Sigma fm}{N} = \frac{7680}{50} = 153.6$

(c) Here, the histogram of the above data is;



(d) Here, position of median = $\left(\frac{N}{2}\right)^{\text{th}}$ item = $\left(\frac{50}{2}\right)^{\text{th}}$ item = 25th item

$\therefore$ Median class = (155 - 165) so, $L = 155$, $cf = 22$, $f = 20$ and $i = 10$

We know that, median = $L + \frac{i}{f} \left(\frac{N}{2} - cf \right)$

$$= 155 + \frac{10}{20} (25 - 22) = 155 + \frac{10 \times 3}{20} = 155 + 1.5 = 156.5$$

Thus, the median value of the above data is 156.5.

2. तलको तालिकाले एउटा विद्यालयका विद्यार्थीहरूको तौल (kg) मा जनाउँछ ।
The table given below represents the weight (in kg) of students of a school.

तौल (Weight) (Kg)
18, 20, 13, 24, 35, 34, 56, 45, 33, 23, 24, 56, 33, 22, 26, 35, 39, 44, 42, 47, 46, 48, 55, 51, 44, 40, 47, 49, 34, 31, 28, 29, 35, 39, 28, 48, 51, 50, 47, 23, 19, 27, 57, 42, 33, 23, 38, 36, 45, 45, 37, 29, 27, 22, 28, 36, 35, 57, 54, 40, 50, 30, 29, 36

- (a) माथिको तथ्याङ्कबाट 5 वर्गान्तरमा बारम्बारता तालिका तयार पार्नुहोस् ।
Construct a frequency distribution table with the class interval 5 of the given data.
- (b) भन्दा सानो र भन्दा ठुलो बारम्बारता तालिका तयार पार्नुहोस् ।
Prepare a less than and more than cumulative frequency table.
- (c) बहुलक र मध्यिकाको फरक पत्ता लगाउनुहोस् । (Find the difference of median and mode.)

$\Rightarrow$ (a) Here, construction of frequency distribution table with class interval 5.

C.I	Tallies	Frequency (f)	cf
10 - 15		1	1
15 - 20		2	3
20 - 25		8	11
25 - 30		9	20
30 - 35		7	27
35 - 40		11	38
40 - 45		6	44
45 - 50		10	54
50 - 55		5	59
55 - 60		5	64
		N = 64	

(b) Here, construction of less than and more than cumulative frequency table:

X (Weight)	Frequency (f)	X (Weight)	Frequency (f)
Less than 15	1	More than 10	64
Less than 20	3	More than 15	63
Less than 25	11	More than 20	61
Less than 30	20	More than 25	53
Less than 35	27	More than 30	44
Less than 40	38	More than 35	37
Less than 45	44	More than 40	26
Less than 50	54	More than 45	20
Less than 55	59	More than 50	10
Less than 60	64	More than 55	5

(c) Here,

$$\text{Position of median} = \left(\frac{N}{2}\right)^{\text{th}} \text{ item} = \left(\frac{64}{2}\right)^{\text{th}} \text{ item} = 32^{\text{nd}} \text{ item}$$

$\therefore$ Median class = (35 - 40) so, $L = 35$, $cf = 27$, $f = 11$ and $i = 5$

$$\text{We know, median} = L + \frac{i}{f} \left(\frac{N}{2} - cf \right)$$

$$= 35 + \frac{5}{11} (32 - 27) = 35 + \frac{5}{11} \times 5 = 35 + 2.27 = 37.27$$

The maximum frequency value is 11 and its corresponding class is 35 - 40.

$\therefore$ Modal class = (35 - 40)

So, $f_0 = 7$, $f_1 = 11$, $f_2 = 6$, $i = 5$

$$\text{We know, mode } (M_0) = L + \frac{f_1 - f_0}{2f_1 - f_0 - f_2} \times i$$

$$= 35 + \frac{11 - 7}{2 \times 11 - 7 - 6} \times 5 = 35 + 2.22 = 37.22$$

Thus, difference of median and mode = $37.27 - 37.22 = 0.05$

3. एउटा समुदायमा जागिरहरूको उमेरका बारेमा गरिएको सर्वेक्षणमा निम्नानुसारको तथ्याङ्क प्राप्त भयो :
In a survey conducted in a community related to the job holder's age, the following data is obtained.

उमेर (वर्षमा) (Age (year))	0-15	15-30	30-45	45-60	60-75
जागिरको सङ्ख्या (No. of job holder's)	5	6	10	6	3

- (a) माथिको तालिकामा सबैभन्दा धेरै जागिर कुन उमेर समूहका रहेछन् ?
In the above table, which age group has the maximum number of job holder's?
- (b) जागिरहरूको औसत उमेर कति रहेछ ? (What is the average age of the job holder's?)
- (c) एन्जलले औसत र मध्यिका एउटै वर्गान्तरमा पर्छन् भन्ने । के यो कुरा ठिक हो ?
Angel said that mean and median lie on the same class interval. Is it right?
- $\Rightarrow$ (a) Here, the age group 30 - 45 has the maximum number of job holder's i.e. 10.
- (b) Here, calculation of mean:

C.I	m	f	fm	cf
0 - 15	7.5	5	37.5	5
15 - 30	22.5	6	135	11
30 - 45	37.5	10	375	21
45 - 60	52.5	6	315	27
60 - 75	67.5	3	202.5	30
		N = 30	$\Sigma fm = 1065$	

$$\text{We know, mean } (\bar{X}) = \frac{\Sigma fm}{N} = \frac{1065}{30} = 35.5$$

Thus, the average age of the employees is 35.5 years.

(c) Here,

Probability/473

$$\text{Position of median} = \left(\frac{N}{2}\right)^{\text{th}} \text{ item} = \left(\frac{30}{2}\right)^{\text{th}} \text{ item} = 15^{\text{th}} \text{ item}$$

$$\therefore \text{Median class} = (30 - 45)$$

Since mean = 35.5 which also lies in the interval (30 - 45). So, the statement of Angel is right.

4. थाहा नगरपालिकाका 40 घरधुरीले मासिक खपत गर्ने बिजुलीको विवरण निम्नानुसार रहेको छ :
The details of monthly electricity consumption by 40 households of Thaha Municipality are as follows:

खपत युनिट (Consumption unit)	10-20	20-30	30-40	40-50	50-60	60-70	70-80
घरधुरी सङ्ख्या (No. of household)	5	6	8	9	7	4	1

- (a) माथिको तालिकाबाट भन्दा सानो र भन्दा ठुलो सञ्चित बारम्बारता तालिका तयार पार्नुहोस् ।
From the above table, prepare the less than and more than cumulative frequency table.

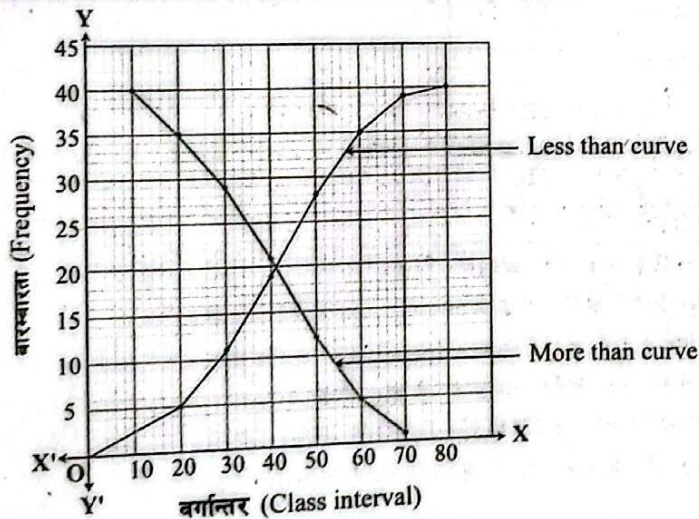
- (b) प्रश्न (a) को उत्तरका आधारमा सञ्चित बारम्बारता वक्रहरू तयार पार्नुहोस् ।
On the basis of the answer of (a), draw the cumulative frequency curve.

- (c) के औसत र मध्याका एउटै वर्गान्तरमा पर्छन् ? (Do the mean and median lie on the same class interval?)

- ⇒ (a) Here, construction of less than and more than cumulative frequency table.

Consumption unit (X)	No. of household (f)	Consumption unit (X)	No. of household (f)
Less than 20	5	More than 10	40
Less than 30	11	More than 20	35
Less than 40	19	More than 30	29
Less than 50	28	More than 40	21
Less than 60	35	More than 50	12
Less than 70	39	More than 60	5
Less than 80	40	More than 70	1

- (b) Here, construction of cumulative frequency curves.



- (c) Here, calculation table:

X	m	f	fm	cf
10 - 20	15	5	75	5
20 - 30	25	6	150	11
30 - 40	35	8	280	19
40 - 50	45	9	405	28
50 - 60	55	7	385	35
60 - 70	65	4	260	39
70 - 80	75	1	75	40
		N = 40	Σfm = 1630	

We have, $\bar{X} = \frac{\sum fm}{N} = \frac{1630}{40} = 40.75$ units

$\therefore$ Mean class interval = 40 - 50

Now, position of median = $\left(\frac{N}{2}\right)^{\text{th}}$ item = $\left(\frac{40}{2}\right)^{\text{th}}$ item = 20th item

$\therefore$ Median class = (40 - 50)

Thus, the mean and median lie on the same class interval.

5. दिइएको तथ्याङ्कले एउटा अस्पतालमा एक हप्तामा भर्ना हुने बिरामीको सङ्ख्या जनाउँदछ :

The data given below represents the number of patients admitted in a hospital in a week:

उमेर (वर्षमा) Age (yrs)	0-10	10-20	20-30	30-40	40-50	50-60	60-70	70-80	80-90
बिरामी सङ्ख्या No. of patients	4	5	8	13	12	8	4	9	7

- (a) माथिको तथ्याङ्कबाट पहिलो चतुर्थांश र तेस्रो चतुर्थांश पत्ता लगाउनुहोस् ।

From the above data, find the first and third quartiles.

- (b) माथिको तथ्याङ्कको कुन मानले बिरामीको सङ्ख्यालाई बराबर दुई भागमा विभाजन गर्छ होला ?

Which value of the given data divides the number of the patients into two equal parts?

- (c) निरुताले बहुलक र मध्यिका एउटै वर्गान्तरमा पर्छ भन्नुभयो । के उहाँ ठिक हुनुहुन्छ ?

Niruta said that mode and median lie on the same class interval. Is she right?

- $\Rightarrow$ (a) Here, calculation of quartiles:

C.I	f	cf
0 - 10	4	4
10 - 20	5	9
20 - 30	8	17
30 - 40	13	30
40 - 50	12	42
50 - 60	8	50
60 - 70	4	54
70 - 80	9	63
80 - 90	7	70
	N = 70	

Position of $Q_1 = \left(\frac{N}{4}\right)^{\text{th}}$ item = $\left(\frac{70}{4}\right)^{\text{th}}$ item = 17.5th item

$\therefore Q_1$ class = (30 - 40) so, L = 30, cf = 17, f = 13 and i = 10

We know that, $Q_1 = L + \frac{i}{f} \left(\frac{N}{4} - cf\right)$

$= 30 + \frac{10}{13} (17.5 - 17) = 30 + \frac{10 \times 0.5}{13} = 30 + 0.38$

$\therefore Q_1 = 30.38$

Position of Q_3 class = $\left(\frac{3N}{4}\right)^{\text{th}}$ item = $\left(\frac{3 \times 70}{4}\right)^{\text{th}}$ item = 52.5th item

$\therefore Q_3$ class = 60 - 70 so, L = 60, cf = 50, f = 4 and i = 10

We know that, $Q_3 = L + \frac{i}{f} \left(\frac{3N}{4} - cf\right)$

$= 60 + \frac{10}{4} (52.5 - 50) = 60 + \frac{10 \times 2.5}{4} = 60 + 6.25$

$\therefore Q_3 = 66.25$

Thus, Q_1 and Q_3 are 30.38 and 66.25 respectively.

- (b) Here, Position of median = $\left(\frac{N}{2}\right)^{\text{th}}$ item = $\left(\frac{70}{2}\right)^{\text{th}}$ item = 35th item divides the number of the patients into two equal parts.

- (c) Here, position of median class = 40 - 50 and position of modal class = 30 - 40 [$\because$ max. frequency = 13]
Thus, the mode and median do not lie on the same class interval.

6. दिइएको तथ्याङ्कले लामापटनका केही परिवारको मासिक खर्च (हजारमा) जनाउँछ भने,
The given data represents the monthly expenditure (in thousands) of the families of Lamapatan.

खर्च (Expenditure (000))	10-20	20-30	30-40	40-50	50-60
परिवार सङ्ख्या (No. of family)	3	2	6	5	4

- (a) माथिको तथ्याङ्कबाट बहुलक पर्ने वर्गान्तर लेख्नुहोस् । (From the above data, write the class interval of mode.)
(b) माथिको तथ्याङ्कबाट सबैभन्दा धेरै परिवारले गर्ने खर्च कति रहेछ ?
From the above data, what is the expenditure of the maximum family?
(c) माथिको तथ्याङ्कबाट पहिलो चतुर्थांश र तेस्रो चतुर्थांश पत्ता लगाउनुहोस् ।
From the above data, find the first and third quartiles.
- ⇒ (a) 6 is the highest frequency. So, frequency class is 30 - 40 i.e. modal class = 30 - 40.
(b) For mode, $L = 30$, $f_1 = 6$, $f_0 = 2$, $f_2 = 5$ and $h = 10$

$$\begin{aligned}\text{Mode} &= L + \frac{f_1 - f_0}{2f_1 - f_2 - f_0} \times h \\ &= 30 + \frac{6 - 2}{2 \times 6 - 5 - 2} \times 10 = 30 + \frac{4}{12 - 7} \times 10 = 30 + 8 = 38\end{aligned}$$

Thus, the expenditure of the maximum family is Rs 38000.

- (c) Calculation of quartile,

X	f	cf
10 - 20	3	3
20 - 30	2	5
30 - 40	6	11
40 - 50	5	16
50 - 60	4	20
	N = 20	

$$\text{Position of } Q_1 = \left(\frac{N}{4}\right)^{\text{th}} \text{ item} = \left(\frac{20}{4}\right)^{\text{th}} \text{ item} = 5^{\text{th}} \text{ item}$$

$$\therefore Q_1 \text{ class} = 20 - 30 \text{ or } 30 - 40$$

So for class 20 - 30; $L = 20$, $cf = 3$, $f = 2$ and $i = 10$

$$Q_1 = L + \frac{i}{f} \left(\frac{N}{4} - cf\right) = 20 + \frac{10}{2} (5 - 3)$$

$$\therefore Q_1 = 30$$

$$\text{Position of } Q_3 = \left(\frac{3N}{4}\right)^{\text{th}} \text{ item} = \left(\frac{3 \times 20}{4}\right)^{\text{th}} \text{ item} = 15^{\text{th}} \text{ item}$$

$$\therefore Q_3 \text{ class} = 40 - 50$$

So, $L = 40$, $cf = 11$, $f = 5$ and $i = 10$

$$Q_3 = L + \frac{i}{f} \left(\frac{3N}{4} - cf\right) = 40 + \frac{10}{5} (15 - 11) = 40 + 4 \times 2 = 48$$

Thus, the first and third quartiles are 30 and 48 respectively.

For class 30 - 40 ;

$$L = 30, f = 6, cf = 5, i = 10$$

$$\begin{aligned}\therefore Q_1 &= L + \frac{i}{f} \left(\frac{N}{4} - cf\right) \\ &= 30 + \frac{10}{6} (5 - 5) = 30\end{aligned}$$

$$\therefore Q_1 = 30$$

7. कक्षा 10 को दोस्रो त्रैमासिक परीक्षामा 30 पूर्णाङ्कको गणित विषयको परीक्षामा विद्यार्थीले प्राप्त गरेको अङ्कलाई तलको तालिकामा दिइएको छ । उक्त तथ्याङ्क हेरी सोधिएका प्रश्नको जवाफ दिनुहोस् ।
The marks obtained in mathematics by the students of class 10 in the first terminal examination are given below in the table. Answer the following questions.

प्राप्ताङ्क (Marks obtained)	0 - 5	5 - 10	10 - 15	15 - 20	20 - 25	25 - 30
विद्यार्थी सङ्ख्या (No. of students)	2	4	5	3	2	4

- (a) कक्षा 10 मा 20 भन्दा कम प्राप्ताङ्क ल्याउने विद्यार्थीको सङ्ख्या कति रहेछ ?
How many students of class 10 obtained the marks less than 20?
(b) दिइएको तालिकाको आधारमा सञ्चित बारम्बरता तालिका बनाउनुहोस् ।
Construct the cumulative frequency table on the basis of the given table.
(c) माथिको तालिकाबाट तथ्याङ्कलाई बराबर 4 भागमा बाँड्ने मानहरू मध्ये कुनै एउटा तथ्याङ्कीय मान पत्ता लगाउनुहोस् ।
Find any one of the statistical values which divide the data given in the above table into 4 equal parts.
(d) मध्यिका श्रेणीभन्दा कम अङ्क प्राप्त गर्ने अधिकतम विद्यार्थी कति जना छन् ?
What is the maximum number of students who obtained the marks less than the median class?

⇒ Here,

- (a) The number of class 10 students who obtained the marks less than 20 = 2 + 4 + 5 + 3 = 14.
 (b) Construction of cumulative frequency table;

X	f	cf
0 - 5	2	2
5 - 10	4	6
10 - 15	5	11
15 - 20	3	14
20 - 25	2	16
25 - 30	4	20
	N = 20	

(c) Position of $Q_1 = \left(\frac{N}{4}\right)^{\text{th}}$ item = $\left(\frac{20}{4}\right)^{\text{th}}$ item = 5th item

Q_1 class = 5 - 10, $L = 5$, $cf = 2$, $f = 4$ and $i = 5$

We know, $Q_1 = L + \frac{i}{f} \left(\frac{N}{4} - cf\right) = 5 + \frac{5}{4} (5 - 2)$

$$= 5 + \frac{5}{4} \times 3 = 8.75$$

Thus, the required value is 8.75.

(d) Position of median = $\left(\frac{N}{2}\right)^{\text{th}}$ item = $\left(\frac{20}{2}\right)^{\text{th}}$ item = 10th item

∴ Median class = 10 - 15

Thus, the maximum number of students who obtained the marks less than the median class is (2 + 4) = 6.

8. तीनओटा सिक्कालाई एकै पटक उफार्दा (Three coins are tossed together then,)

- (a) आजने सम्भावित नमुना क्षेत्र लेख्नुहोस् । (Write the possible outcomes.)
 (b) एउटा मात्र अग्र भाग आउने सम्भाव्यता पत्ता लगाउनुहोस् । (Find the probability of getting only one head.)
 (c) कम्तीमा 2 ओटा पश्च भाग (T) आउने सम्भाव्यता पत्ता लगाउनुहोस् ।
 Find the probability of getting at least 2 tails (T).
 (d) कति पनि अग्र भाग (H) नआउने सम्भाव्यता पत्ता लगाउनुहोस् । (Find the probability of not getting head (H).)
 (e) 2 ओटा H आउने अथवा H नआउने घटनाको सम्भाव्यता पत्ता लगाउनुहोस् ।
 Find the probability of getting 2 heads (H) or not to get H.

⇒ Here, let H = Head and T = Tail

(a) Three coins are tossed so, possible outcomes, (S) = {HHH, HHT, HTH, HTT, THH, THT, TTH, TTT}

(b) P(Only one 'H') = P(HTT, THT, TTH) = $\frac{3}{8}$

(c) P(At least two 'T') = P(HTT, THT, TTH, TTT) = $\frac{4}{8} = \frac{1}{2}$

(d) P(not getting 'H') = P(TTT) = $\frac{1}{8}$

(e) P(HHT, HTH, THH) or P(TTT) = P(2 heads) + P(No head) = $\frac{3}{8} + \frac{1}{8} = \frac{4}{8} = \frac{1}{2}$

9. राम्ररी फिटिएका 52 पत्ती तासको गड्डीबाट एउटा तास तान्दा,

A card is drawn randomly from a well-shuffled deck of 52 cards then,

- (a) एक्का आउने सम्भाव्यता कति हुन्छ ? (What is the probability of getting an ace?)
 (b) हुकुम वा ईँटा पर्ने सम्भाव्यता पत्ता लगाउनुहोस् । (Find the probability of getting a spade or diamond.)
 (c) हुकुम वा एक्का आउने सम्भाव्यता पत्ता लगाउनुहोस् । (Find the probability of getting a spade or ace.)
 (d) चिडी वा मुहार भएको पत्ती आउने सम्भाव्यता पत्ता लगाउनुहोस् ।
 Find the probability of getting a club or face card.

⇒ Here, $n(S) = 52$

(a) P(getting an ace) = $P(A) = \frac{n(E)}{n(S)} = \frac{4}{52} = \frac{1}{13}$

(b) Let, H and D represent spade and diamond respectively.

$$\text{Now, } P(H \text{ or } D) = \frac{n(H)}{n(S)} + \frac{n(D)}{n(S)} = \frac{13}{52} + \frac{13}{52} = \frac{26}{52} = \frac{1}{2}$$

(c) Let, H and A represent spade and ace respectively.

$$\text{Now, } P(H \text{ or } A) = \frac{n(H)}{n(S)} + \frac{n(A)}{n(S)} - \frac{n(H \cap A)}{n(S)} = \frac{13}{52} + \frac{4}{52} - \frac{1}{52} = \frac{13 + 4 - 1}{52} = \frac{16}{52} = \frac{4}{13}$$

(d) Let, C and F represent club and face card respectively.

$$\text{Now, } P(C \text{ or } F) = \frac{n(C)}{n(S)} + \frac{n(F)}{n(S)} - \frac{n(C \cap F)}{n(S)} = \frac{13}{52} + \frac{12}{52} - \frac{3}{52} = \frac{13 + 12 - 3}{52} = \frac{22}{52} = \frac{11}{26}$$

10. एउटा सिक्का उफारियो र चारओटा रङ (निलो, हरियो, रातो, प्याजी) भएको स्पिनरलाई एकसाथ घुमाइयो :
A coin is tossed and a spinner with 4 colours (blue, green, red, purple) is spun together:

(a) उक्त परीक्षणलाई वृक्ष चित्रमा देखाउनुहोस् । परीक्षणको छुट्टाछुट्टै र सँगसँगैको सम्भावित नमुना क्षेत्र पत्ता लगाउनुहोस् ।

Draw a probability tree diagram to show all the possible outcomes. Find the possible outcomes of this experiment separately and together.

(b) सिक्काको H र स्पिनरको सुई हरियो वा निलोमा अडिने सम्भाव्यता पत्ता लगाउनुहोस् ।

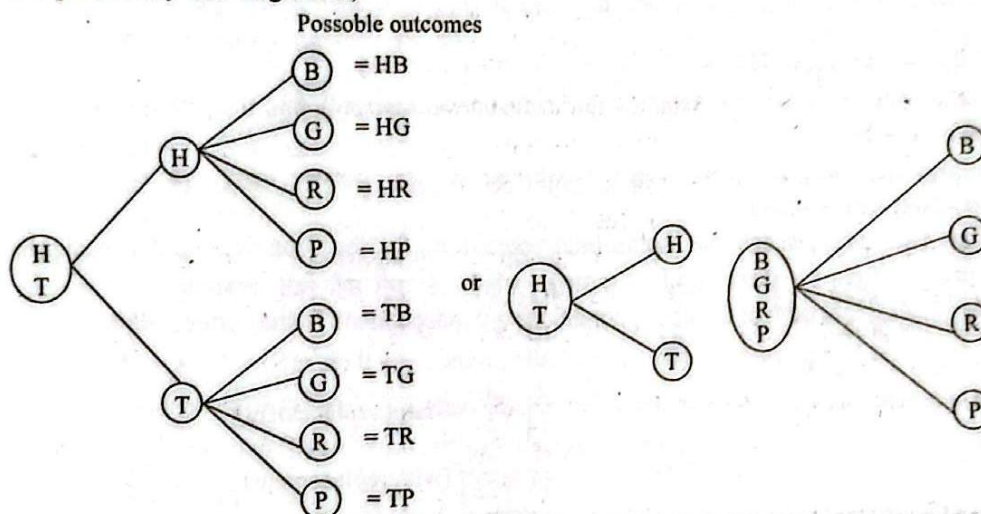
Find the probability of getting the head (H) in the coin and landing the needle at green or blue.

(c) सिक्कामा H र स्पिनरको सुई हरियोमा अडिने सम्भाव्यता पत्ता लगाउनुहोस् ।

Find the probability of getting head (H) in the coin and landing the needle at green.

⇒ Here, let B, G, R, P represent 4 colours blue, green, red and purple and H and T represent head and tail of coin respectively.

(a) The probability tree diagram is;



(b) $P(\text{head in coin and needle landing at green or blue}) = P(\text{Head}) \times P(\text{landing at green or blue})$

$$= \frac{1}{2} \times \left(\frac{1}{4} + \frac{1}{4} \right) = \frac{1}{2} \times \frac{1}{2} = \frac{1}{4}$$

(c) $P(HG) = \frac{1}{2} \times \frac{1}{4} = \frac{1}{8}$

11. राम्ररी फिटिएको 52 पत्ती तासको गड्डीबाट दुईओटा तास एकपछि अर्को गर्दै तान्दा,
When two cards are drawn randomly from a well-shuffled deck of 52 cards one after another, then,

(a) यदि पहिलो तास पुनः राखेर दोस्रो तास तान्दा दुवै तास हुकुम आउने सम्भाव्यता पत्ता लगाउनुहोस् ।
If the first drawn card is replaced and second card is drawn; what is the probability of getting both cards are spade?

(b) यदि पहिलो तास पुनः नराखेर दोस्रो तास तान्दा पहिलो तास हुकुम र दोस्रो तास पान आउने सम्भाव्यता पत्ता लगाउनुहोस् ।
If the first drawn card is not replaced and second card is drawn, what is the probability of getting the first card spade and the second card heart?

(c) माथि (a) र (b) को सम्भाव्यतालाई छुट्टा छुट्टै वृक्ष चित्रमा देखाउनुहोस् ।
Show the probability tree diagram for (a) and (b) separately.

⇒ Here, $n(S) = 52$

(a) Let, S' denote spade then, $P(\text{both cards spade}) = P_1(S') \times P_2(S') = \frac{13}{52} \times \frac{13}{52} = \frac{1}{16}$

(b) Let spade and heart be S' and H respectively then, $n(S') = 13$ and $n(H) = 13$

$$\text{Now, } P(\text{first card spade and second card heart}) = P_1(S') \times P_2(H) = \frac{13}{52} \times \frac{13}{51} = \frac{13}{204}$$

(c)

(a) Tree diagram with replacement; $\bar{S}$ = not getting spade	(b) Tree diagram without replacement

12. एउटा झोलामा 7 ओटा रातो र 8 ओटा पहेँला उस्तै र उत्रै बल राखिएका छन् :

A bag contains 7 red and 8 yellow balls of the same shape and size:

- (a) दुईओटा बल पालैपालो निकाल्दा (पहिले निकालिएको बल पुनः झोलामा नराख्ने) दुवै पटक रातो बल आउने सम्भाव्यता पत्ता लगाउनुहोस् ।

If the balls are drawn one after another (without replacement), find the probability of getting both balls are red.

- (b) दुईओटा बल पालैपालो निकाल्दा (पहिले निकालिएको बल पुनः झोलामा राखेर) दुवै पटक रातो बल आउने सम्भाव्यता पत्ता लगाउनुहोस् ।

If two balls are drawn one after another (with replacement), find the probability of getting both balls are red.

- (c) रमिलाले माथिका दुवै अवस्था अनाश्रित घटना हुन् भनिन् । के उनी सही छिन्, लेख्नुहोस् ।

Ramila said that both of the above conditions are independent. Is she correct? Write.

⇒ Here, let R and Y represent red and yellow balls respectively then, $n(S) = 7 + 8 = 15$

(a) $P(\text{both balls red}) = P_1(R) \times P_2(R) = \frac{7}{15} \times \frac{6}{14} = \frac{1}{5}$ (without replacement)

(b) $P(\text{both balls red}) = P_1(R) \times P_2(R) = \frac{7}{15} \times \frac{7}{15} = \frac{49}{225}$ (with replacement)

- (c) Ramila is not correct because here one's result affect another and they are dependent to one another.

13. एउटा झोलामा रातो, हरियो र कालो एक एकओटा उस्तै र उत्रै गुच्चा राखिएका छन् । उक्त झोलाबाट नहेरीकन एउटा गुच्चा निकाल्ने र पुनः त्यसमा नराखी अर्को गुच्चा निकाल्दा हुने,

A bag contains one red, one green and one black marble of the same shape and size. A marble is drawn randomly and without replacing the marble, another marble is drawn from the bag. Then,

- (a) उक्त घटनालाई वृक्ष चित्रमा प्रस्तुत गर्नुहोस् । (Show the probability tree diagram for the events.)

- (b) उक्त घटनाको सम्भाव्यता पत्ता लगाउनुहोस् । (Find the probability of the events.)

⇒ Here, let R, G and B denote red, green and black marble respectively.

- (a) The probability tree diagram is shown alongside.

- (b) Probability of the events,

$$P(RG) = \frac{1}{3} \times \frac{1}{2} = \frac{1}{6}$$

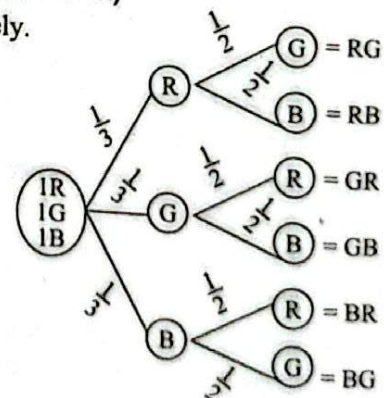
$$P(RB) = \frac{1}{3} \times \frac{1}{2} = \frac{1}{6}$$

$$P(GR) = \frac{1}{3} \times \frac{1}{2} = \frac{1}{6}$$

$$P(GB) = \frac{1}{3} \times \frac{1}{2} = \frac{1}{6}$$

$$P(BR) = \frac{1}{3} \times \frac{1}{2} = \frac{1}{6}$$

$$P(BG) = \frac{1}{3} \times \frac{1}{2} = \frac{1}{6}$$



14. एउटा सिक्कालाई र एउटा डाइसलाई एकपछि अर्को गरी उफारियो,
A coin is tossed and a die is thrown then,

- (a) यसरी उफार्दा आउनसक्ने सबै घटनालाई वृक्ष चित्रमा देखाउनुहोस् ।

Draw a probability tree diagram to show all the possible outcomes.

- (b) वृक्ष चित्रको प्रयोग गरी तलका सम्भाव्यता पत्ता लगाउनुहोस् ।

By using the probability tree diagram, find the probabilities of the following.

- (i) सिक्कामा H र डाइसमा जोर सङ्ख्या आउने (Head (H) in the coin and even number in the dice.)

- (ii) सिक्कामा T र डाइसमा वर्ग सङ्ख्या आउने (Tail (T) in the coin and square number in the dice.)

- (c) माथि (b) का घटना अनाश्रित हुन् त ? कारणसहित लेख्नुहोस् ।
Are the events of (b) independent? Write with reason.

⇒ Here, for (a) and (b); refer to page no. 377 Q. no. 3.

- (c) Events of (b) are independent because either head or tail appears while tossing the coin which doesn't affect the result of thrown die.

15. राम्ररी फिटिएका 52 पत्ती तासको गड्डीबाट एउटा तास तानिएको छ (हुकुम, चिडी, ईटा र पान) र त्यसपछि सिक्कालाई उफारिएको छ ।

A card is drawn randomly from a well-shuffled deck of 52 cards (spade, club, diamond and heart) and a coin is tossed.

- (a) आउन सक्ने सबै सम्भाव्य घटना जनाउने वृक्ष चित्र तयार गर्नुहोस् ।
Draw the probability tree diagram to show all the possible outcomes.
- (b) उक्त वृक्ष चित्रका आधारमा परीक्षणका नमुना क्षेत्र लेख्नुहोस् ।
On the basis of probability tree diagram, write the sample space.
- (c) उक्त वृक्ष चित्र प्रयोग गरी (By using a probability tree diagram, find the probabilities of the following:)
(i) रातो र H आउने (Red in cards and H on the coin.)
(ii) कालो र T आउने सम्भाव्यता पत्ता लगाउनुहोस् । (Black in cards and tail (T) in the coin.)
- (d) विकासले तास र सिक्काबाट आउने घटना आपसमा पराश्रित हुने कुरा बताए । के विकासको भनाइ ठिक हो ? लेख्नुहोस् ।
Bikash said that the events obtained from the cards and the coin is dependent. Is that statement correct? Write.

⇒ Here, let S, C, D and P represents spade, club, diamond and heart of cards and H and T represents head and tail of a coin.

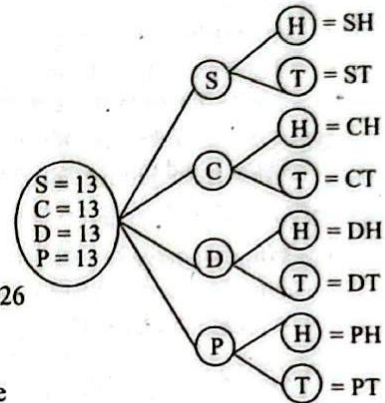
- (a) The probability tree diagram is shown alongside.
(b) Sample space (S) = {SH, ST, CH, CT, DH, DT, PH, PT}
(c) (i) Diamond (D) and heart (P) are red cards so, total red cards = 26

$$\therefore P(\text{Red cards and Head}) = \frac{26}{52} \times \frac{1}{2} = \frac{1}{4}$$

- (ii) Spade (S) and club (C) are black cards so, total black cards = 26

$$P(\text{Black cards and tail}) = \frac{26}{52} \times \frac{1}{2} = \frac{1}{4}$$

- (d) That statement is not correct, because cards and coins are independent and doesn't affect in the result of one another.



16. एउटा झोलामा भएका 7 ओटा रातो र 5 ओटा हरिया गुच्चाबाट नहेरीकन 2 ओटा गुच्चा एकपछि अर्को पालैपालो [(i) पुनः राखेर, (ii) पुनः नराखीकन] निकाल्दा निम्नलिखित अवस्थामा आउन सक्ने घटनालाई जनाउने वृक्ष चित्र तयार पार्नुहोस्, A bag contains 7 red, and 5 green marbles. 2 marbles are drawn randomly one after other: (i) With replacement (ii) Without replacement. Draw a probability tree diagram to show all the possible outcomes in the following conditions.

- (a) वृक्ष चित्रका आधारमा दुवै गुच्चा रातो पर्ने सम्भाव्यता कति हुन्छ ?
On the basis of the tree diagram, what is the probability of getting both marbles red?
- (b) दुवै गुच्चा हरियो पर्ने सम्भाव्यता कति हुन्छ ? (What is the probability of getting both marbles green?)
- (c) के पहिलो रातो र दोस्रो हरियो पर्ने सम्भाव्यता तथा पहिलो हरियो र दोस्रो रातो पर्ने सम्भाव्यता बराबर हुन्छ ?
Is the probability of getting first red and the second green equal to the probability of getting the first green and the second red?

⇒ Here,

- (i) Tree diagram with replacement,

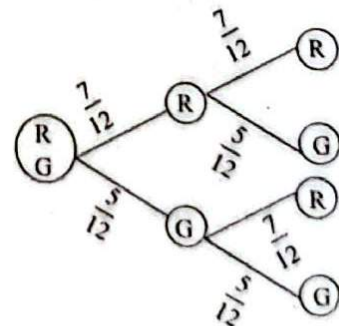
$$(a) P(\text{both red}) = P_1(R) \times P_2(R) = \frac{7}{12} \times \frac{7}{12} = \frac{49}{144}$$

$$(b) P(\text{both green}) = P_1(G) \times P_2(G) = \frac{5}{12} \times \frac{5}{12} = \frac{25}{144}$$

$$(c) P_1(R) \times P_2(G) = \frac{7}{12} \times \frac{5}{12} = \frac{35}{144}$$

$$P_1(G) \times P_2(R) = \frac{5}{12} \times \frac{7}{12} = \frac{35}{144}$$

Yes, the probability of getting first red and the second green equal to the probability of getting the first green and the second red.



(ii) Tree diagram without replacement,

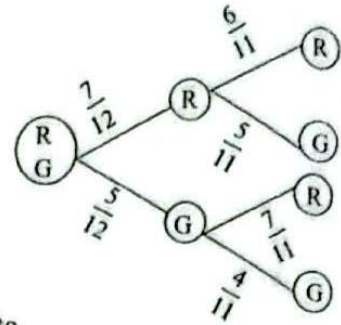
(a) $P(\text{both red}) = P_1(R) \times P_2(R) = \frac{7}{12} \times \frac{6}{11} = \frac{7}{22}$

(b) $P(\text{both green}) = P_1(G) \times P_2(G) = \frac{5}{12} \times \frac{4}{11} = \frac{5}{33}$

(c) $P_1(R) \times P_2(G) = \frac{7}{12} \times \frac{5}{11} = \frac{35}{132}$

$P_1(G) \times P_2(R) = \frac{5}{12} \times \frac{7}{11} = \frac{35}{132}$

Yes, the probability of getting first red and the second green equal to the probability of getting the first green and the second red.



17. 1 देखि 20 सम्म लेखिएका सङ्ख्या पत्तीबाट एउटा पत्ती नहेरीकन थुत्दा,

From the number cards numbered from 1 to 20, a card is drawn at random,

(a) 3 ले भाग जाने र 5 ले भाग जाने सङ्ख्या पत्तीहरूको सूची बनाउनुहोस् ।
Make a list of number cards divisible by 3 and divisible by 5.(b) 3 ले मात्र भाग जाने सङ्ख्या पत्ती वा 5 ले मात्र भाग जाने सङ्ख्या पत्ती पर्ने सम्भाव्यता कति कति हुन्छ ?
What is the probability of getting a number card having a number divisible only by 3 or divisible only by 5?(c) कोपिलाले भनिन् "प्रश्न (a) को घटनाहरू पारस्परिक निषेधक घटना होइनन् ।" के कोपिलाको भनाइ ठिक छ ?
कारणसहित प्रस्ट पार्नुहोस् ।

Kopila said that the events in question (a) are not mutually exclusive events. Is Kopila's statement correct? Write with reason.

(d) 3 ले भाग जाने अथवा 5 ले भाग जाने सङ्ख्या पत्ती पर्ने सम्भाव्यता कति हुन्छ ?

What is the probability of getting a number card having a number either divisible by 3 or by 5?

⇒ Here, $S = \{1, 2, 3, 4, \dots, 20\}$ ∴ $n(S) = 20$ (a) Number cards divisible by 3 = $(M_3) = \{3, 6, 9, 12, 15, 18\}$ ∴ $n(M_3) = 6$ Number cards divisible by 5 = $(M_5) = \{5, 10, 15, 20\}$ ∴ $n(M_5) = 4$ ∴ $(M_3 \cap M_5) = 15$ (b) Numbers divisible only by 3 = $\{3, 6, 9, 12, 18\}$ ∴ $n_o(3) = 5$ Numbers divisible only by 5 = $\{5, 10, 20\}$ ∴ $n_o(5) = 3$

So, $P(\text{Divisible only by 3 or only by 5}) = \frac{n_o(3)}{n(S)} + \frac{n_o(5)}{n(S)} = \frac{5}{20} + \frac{3}{20} = \frac{8}{20} = \frac{2}{5}$

(c) Yes, she is right because there is common event i.e. 15 on both. So they are not mutually exclusive events.

(d) $P(M_3 \text{ or } M_5) = P(M_3) + P(M_5) - P(M_3 \cap M_5) = \frac{6}{20} + \frac{4}{20} - \frac{1}{20} = \frac{6+4-1}{20} = \frac{9}{20}$

18. एउटा झोलामा 5 राता र 3 निला बल छन् । एक बल नहेरीकन निकालिएको छ र पुनः प्रतिस्थापन गरिएको छ ।
त्यसपछि अर्को बल निकालिन्छ भने,

In a bag, there are 5 red and 3 blue balls. A ball is drawn randomly and replaced and drawn the second ball then,

(a) दुवै बल निलो आउने सम्भाव्यता पत्ता लगाउनुहोस् । (Find the probability of getting both blue balls.)

(b) तीमध्ये कुनै पनि बल निलो नआउने सम्भाव्यता पत्ता लगाउनुहोस् ।
What is the probability that none of them are blue?

(c) माथिको दुवै सम्भाव्यतालाई वृक्ष चित्रमा देखाउनुहोस् । (Show both the above probabilities in a tree diagram.)

⇒ Here, let R and B denote red and blue balls respectively.

Then total no. of balls = $n(S) = 5 + 3 = 8$

(a) $P(\text{getting both balls blue}) = P_1(B) \times P_2(B) = \frac{3}{8} \times \frac{3}{8} = \frac{9}{64}$

(b) $P(\text{not getting any blue ball}) = P_1(R) \times P_2(R)$
 $= \frac{5}{8} \times \frac{5}{8} = \frac{25}{64}$

(c) The tree diagram of above probabilities (with replacement) is shown below.

