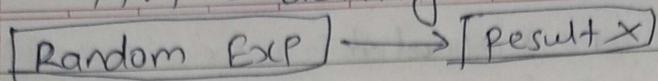


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17. Probability



① 1 coin → [H, T]

② Dice → [1, 2, 3, 4, 5, 6]

③ Cards → [Spade, Diamond, Heart, Club]

④ Balls → [B, G, R]

Probability → Possibility → Random Exp

① Dice :- Sample space = [1, 2, 3, 4, 5, 6] $n(S) = 6$

⇒ Even \Rightarrow [2, 4, 6] $n(E) = 3$

Event

$$P(E) = \frac{n(E)}{n(S)}$$

Imp
○ $0 < P(E) < 1$

$$P(E) + P(\sim E) = 1$$

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

① coin →

1c → [H, T] $n(S) = 2 \Rightarrow 2^1$

2c → [HH, HT, TH, TT] $n(S) = 4 \Rightarrow 2^2$

3c → $2^3 = 8$

⋮

$$n_c \rightarrow [2^n]$$

② Dice :-

1D → [1, 2, 3, 4, 5, 6] $n(S) = 6 = 6^1$

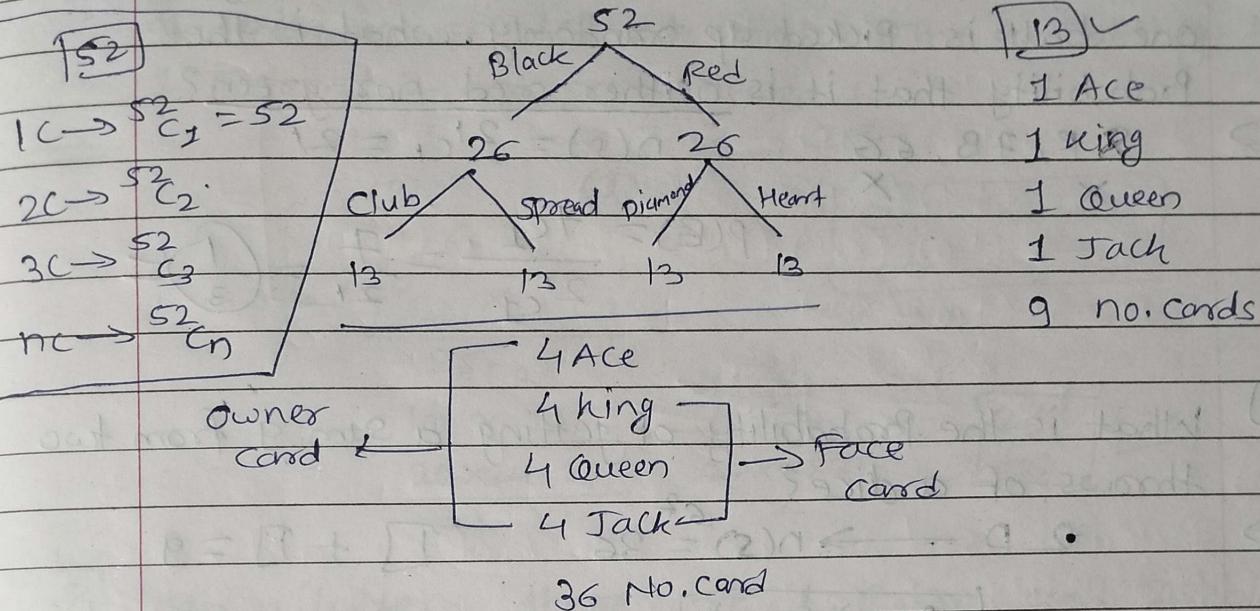
2D → $6^2 = 36$

3D → $6^3 = 216$

⋮

$$n_D \rightarrow [6^n]$$

③ Cards :-



④ Tickets numbered 1 to 20 are mixed up and then a ticket is drawn at random. What is the probability that the ticket drawn has a number which is a multiple of 3 or 5?

$$\rightarrow n(S) = 20 \rightarrow (1 \text{ to } 20)$$

$$(3, 6, 9, 12, 15, 18) \rightarrow 9 \\ 5, 10, 20$$

$$P(E) = \frac{9}{20}$$

(3 or 5) \rightarrow 3 and 5 multiples all

(3 and 5) \rightarrow 3 and 5 divisible no. i.e. (15)

⑤ A bag contains 2 red, 3 green and 2 blue balls. Two balls are drawn at random. What is the probability that none of the balls drawn is blue?

$$\Rightarrow (2R, 3G) \quad 2B$$

$$n(S) = {}^7C_2 = 21 \\ n(E) = {}^5C_2 = 10$$

2 ball draw
None Ball is Blue

$$P(E) = \frac{{}^5C_2}{{}^7C_2} = \frac{10}{21}$$

$$P(E) = \frac{10}{21}$$

Card or ball \rightarrow Combination

3) In a box, there are 8 red, 7 blue, and 6 green balls. One ball is picked up randomly. What is the probability that it is neither red nor green?

$$\Rightarrow 8R, 7B, 6G \quad n(S) = {}^{21}C_1 = 21$$

$$X \quad X$$

$$P(E) = \frac{7C_1}{21C_1} = \frac{7}{21} = \left(\frac{1}{3}\right) \checkmark$$

4) What is the Probability of getting a sum 9 from two throws of a dice?

$$\Rightarrow 2D \rightarrow n(S) = {}^{6^2}C_2 = 36 \quad \square + \square = 9$$

$$\begin{bmatrix} (3,6), (4,5) \\ (6,3), (5,4) \end{bmatrix}_4 \quad P = \frac{4}{36} = \left(\frac{1}{9}\right) \checkmark$$

5) Three unbiased coins are tossed. What is the probability of getting at most two heads?

$$\Rightarrow 3C \rightarrow 2^3 = [8]$$

$$\begin{bmatrix} HHH, THH, HTH, HHT, \\ TTT, HTT, THT, TTH \end{bmatrix} = 8$$

at most 2 heads \rightarrow पार्सित घास 2 आणि त्रिपासा करी

$$\begin{bmatrix} 2 \rightarrow 3 \\ 1 \rightarrow 3 \\ 0 \rightarrow 1 \end{bmatrix} \rightarrow 7 \quad \boxed{P = \frac{7}{8}} \checkmark$$

6) Two dice are thrown simultaneously. What is the probability of getting two numbers whose product is even?

$$\Rightarrow 2D \rightarrow [36]$$

or $E \times E = \text{Even}$

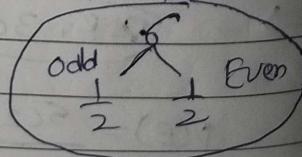
or $E \times O \rightarrow \text{Even}$

$O \times E \rightarrow \text{Even}$

$$E \times E + E \times O + O \times E$$

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

$$\frac{1}{4} + \frac{1}{4} + \frac{1}{4} \Rightarrow \left(\frac{3}{4}\right) \checkmark$$



7) In a class, there are 15 boys and 10 girls. Three students are selected at random. The probability that 1 girl and 2 boys are selected is:

$$\Rightarrow 15B \quad 10G \rightarrow 25$$

(2) (1)

$p = \frac{10C_1 \times 15C_2}{25C_3}$

$$= \frac{10 \times 105}{\cancel{25} \times 24 \times 23} = \frac{\cancel{1050}}{\cancel{25} \times 4 \times 23} = \boxed{\frac{21}{46}}$$

\checkmark

And $\rightarrow \times$
or $\rightarrow +$

8) In a lottery, there are 10 prizes and 25 blanks. A lottery is drawn at random. What is the probability of getting a prize?

$$\Rightarrow 10P \quad 25b \rightarrow 35 \quad \text{one select}$$

$$p = \frac{10^{(1)}}{35^{(35C_1)}} = \boxed{\frac{2}{7}} \checkmark$$

9) From a pack of 52 cards, two cards are drawn together at random. What is the probability of both the cards being kings?

$$\Rightarrow \frac{4C_2}{52C_2} = \frac{63}{\cancel{26} \cancel{52} \times 51} = \boxed{\frac{3}{13 \times 51}} \checkmark = \boxed{\frac{1}{221}} \checkmark$$

King = 4 → select 2

$\boxed{\frac{42}{52}}$ select 2

10) Two dice are tossed. The probability that the total score is a prime number is:

$$\Rightarrow 2D \rightarrow \boxed{186} \quad \text{③}$$

$D + D = \text{Prime No.}$

$1+1 \rightarrow 2 \checkmark$
 $6+6 = 12 \checkmark$

2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12

Prime \rightarrow 2, 3, 5, 7, 11 \rightarrow Prime no. \Rightarrow divide by 1 and itself

2 \rightarrow (1, 1)

3 \rightarrow (1, 2) (2, 1)

5 \rightarrow (1, 4) (4, 1) (2, 3) (3, 2)

7 \rightarrow (1, 6) (6, 1) (2, 5) (5, 2) (3, 4) (4, 3)

11 \rightarrow (5, 6) (6, 5)

$$P_i = \frac{15}{36} = \boxed{\frac{5}{12}}$$

$\Rightarrow 15$

11) A card is drawn from a pack of 52 cards. The Probability of getting a queen of club or a king of heart is.

\Rightarrow (52) cards queen club or king heart
 1 + 1

$$P = \frac{1+1}{52} = \frac{2}{52} = \boxed{\frac{1}{26}}$$

12) A bag contains 4 white, 5 red and 6 blue balls. Three balls are drawn at random from the bag. The Probability that all of them are red is

\Rightarrow 4 w, 5 R, 6 B

$$P = \frac{5C_3}{15C_3} = \frac{\frac{5 \times 4 \times 3}{3 \times 2 \times 1}}{\frac{15 \times 14 \times 13}{3 \times 2 \times 1}} = \frac{60}{455} = \boxed{\frac{2}{91}}$$

13) Two cards are drawn together from a pack of 52 cards. The Probability that one is a spade and one is a heart is:

\Rightarrow

$$P = \frac{13C_1 \times 13C_1}{52C_2} = \frac{13 \times 13}{\frac{52 \times 51}{2}} = \frac{13 \times 13}{26 \times 51}$$

$$= \left(\frac{13}{102} \right) \checkmark$$

(14) One card is drawn at random from a pack of 52 cards. What is the probability that the card drawn is a Face card (Jack, Queen and King only)?

\Rightarrow (One card) Face card (K, Q, J) = 4K, 4Q, 4J = 12 cards

$$P = \frac{12}{52} = \left(\frac{3}{13} \right) \checkmark$$

(15) A bag contains 6 black and 8 white balls. One ball is drawn at random. What is the probability that the ball drawn is white?

\Rightarrow 6 B [8 W]

$$P = \frac{8C_1}{14C_1} = \frac{8}{14} = \left(\frac{4}{7} \right) \checkmark$$

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$$P(\text{at least 1}) = P(T) - P(\text{None}) \\ = 1 - P(\text{None})$$

1) A single die is tossed. what is the probability of a 2 turning up?



$$\boxed{\frac{1}{6}}$$

2) Two cards are drawn from a well-shuffled ordinary deck of 52 cards. what is the probability that they are both aces if the first card is replaced?



$$\boxed{\frac{4}{52} \times \frac{4}{52}}$$

3) Two cards are drawn from a well-shuffled ordinary deck of 52 cards. what is the probability that they are both aces if the first card is not replaced?



$$\boxed{\frac{4}{52} \times \frac{3}{51}}$$

4) A ball is drawn at random from a box containing 6 red balls, 4 white balls and 5 blue balls. what is the probability that it is red?



6R, 4W, 5B

$$\frac{6}{15} \Rightarrow \boxed{\left(\frac{2}{5}\right)}$$

5) Find the probability of 4 turning up at least once in two tosses of a fair die.



$$P(\text{At least } 1) = 1 - P(\text{None})$$

$$= 1 - \frac{5}{6} \times \frac{5}{6}$$

$$= 1 - \frac{25}{36}$$

$$= \frac{11}{36} \quad \checkmark$$

6) One bag contains 4 white balls and 2 black balls; another contains 3 white balls and 5 black balls. If one ball is drawn from each bag, find the probability that both are white?

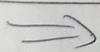
$$\Rightarrow 4W, 2B \mid 3W, 5B$$

$$\left(\frac{4}{6} \times \frac{3}{8} \right)$$

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

$$= \frac{1}{4} \quad \checkmark$$

7) A die is rolled, find the Probability that an even number is obtained.



$$\left(\frac{1}{2} \right) \checkmark$$

$$2, 4, 6 = 3$$

$$= \frac{3}{6} = \frac{1}{2} \quad \checkmark$$

8) Two coins are tossed, find the Probability that two heads are obtained.



$$(\text{HH}, \text{TT}, \text{TH}, \text{HT})$$

$$= \left(\frac{1}{4} \right) \checkmark$$

9) A dice is rolled and a coin is tossed, find the probability that the die shows an odd number and the coin shows a head.

$$\Rightarrow D \{1, 2, 3, 4, 5, 6\} \quad C \{H, T\}$$

$$\text{odd} = \frac{3}{6} = \left(\frac{1}{2}\right) \times \frac{1}{2} \\ = \frac{1}{2} \times \frac{1}{2} = \left(\frac{1}{4}\right)$$

10) A card is drawn at random from a deck of cards. Find the probability of getting the 3 of diamond.

$$\Rightarrow$$

$\frac{1}{52}$	← 1 card of 3 diamond
↙	← Total cards

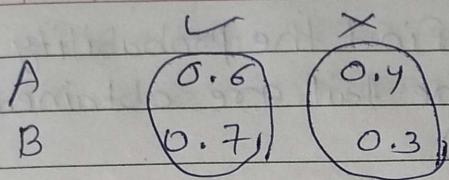
11) A person draws a card from a pack of playing cards, replaces it and shuffles the pack. He continues doing this until he draws a spade. The chance that he will fail in first two times is

$$\Rightarrow \text{Fail probability} = \frac{3}{52} \times \frac{3}{52} \\ = \frac{3}{4} \times \frac{3}{4} = \left(\frac{9}{16}\right)$$

12) A speaks truth in 60 percent cases and B speaks truth is 70 percent cases. The probability that they will say the same thing while describing a single event is:

A B	$\frac{3}{5}$ $\frac{7}{10}$	$\frac{2}{5}$ $\frac{3}{10}$	$\frac{3}{5} \times \frac{7}{10} + \frac{2}{5} \times \frac{3}{10}$ $= \frac{21}{50} + \frac{6}{50} = \frac{27}{50} = \frac{54}{100}$ $= 0.54$
--------	---------------------------------	---------------------------------	--

(Q)



$$0.42 + 0.12 = \textcircled{0.54}$$

- (13) In a box there are 2 red, 3 black and 4 white balls. Out of these three balls are drawn together. The probability of these being of the same color is:

$$\Rightarrow 2P, \textcircled{3B} \textcircled{4W} \rightarrow 9$$

$$3 \rightarrow \frac{3}{9} \binom{3}{3} + \frac{4}{9} \binom{4}{3} = \frac{1+4}{\frac{9 \times 8 \times 7}{3 \times 2 \times 1}} = \frac{1+4}{\frac{9 \times 8 \times 7}{3 \times 2 \times 1}} = \frac{5}{84}$$

- (14) If two regular six-sided dice are thrown, the probability that the sum will be a prime number is:

$$\Rightarrow 2D = \boxed{36} \quad \boxed{1} + \boxed{1} = \text{prime}$$

$$\begin{aligned} 2 &\rightarrow (1,1) \\ \frac{15}{36} &= \frac{5}{12} \\ 3 &\rightarrow (1,2)(2,1) \\ 5 &\rightarrow (1,4)(4,1)(2,3)(3,2) \\ 7 &\rightarrow (1,6)(6,1)(2,5)(5,2)(3,4)(4,3) \\ 11 &\rightarrow (5,6)(6,5) \end{aligned}$$

(15) (15) (15)

- 15) Two coins are tossed. Find the probability that at least one head and one tail are obtained?
 $\Rightarrow (HH, TT, HT, TH)$

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

- 16) Two dice are thrown. Find the probability that the sum is even number?

$$\Rightarrow 2D = 36 \quad D + D = \text{Even}$$

$$\begin{array}{ll} 2 \rightarrow (1,1) & (1) \\ 4 \rightarrow (1,3)(3,1)(2,2) & (3) \\ 6 \rightarrow (1,5)(5,1)(2,4)(4,2)(3,3) & (5) \\ 8 \rightarrow (2,6)(6,2)(3,5)(5,3)(4,4) & (5) \\ 10 \rightarrow (4,6)(6,4)(5,5) & (3) \\ 12 \rightarrow (6,6) & (1) \end{array} = \left(\frac{1}{2}\right) \cancel{\times} = 18$$

- 17) If from each of the three boxes containing 3 white and 1 black, 2 white and 2 black, 1 white and 3 black balls, one ball is drawn at random, then the probability that 2 white and 1 black ball will be drawn is.

$\rightarrow ① \rightarrow 3W \quad 1B$	$ $	$W \text{ or } W \text{ or } B$
$\rightarrow ② \rightarrow 2W \quad 2B$	$ $	$W \quad B \quad W$
$\rightarrow ③ \rightarrow 1W \quad 3B$	$ $	$B \quad W \quad W$

$$\frac{3}{4} \times \frac{2}{4} \times \frac{3}{4} + \frac{3}{4} \times \frac{2}{4} \times \frac{1}{4} + \frac{1}{4} \times \frac{2}{4} \times \frac{1}{4}$$

$$\frac{18}{64} + \frac{6}{64} + \frac{2}{64} = \frac{26}{64} = \left(\frac{13}{32}\right) \cancel{\times}$$

18) An urn contains 18 green, 12 yellow and 11 white balls. what is the Probability that;

1) when 2 balls are selected, both are green

$$10G, 12Y, 11W \Rightarrow 33$$

$$\frac{10C_2}{33C_2} = \frac{\frac{10 \times 9}{2 \times 1}}{\frac{33 \times 32}{2 \times 1}} = \frac{45}{33 \times 16} = \frac{45}{528} \rightarrow \text{divide by } 3$$

$$= \left(\frac{15}{176} \right)$$

2) when 2 balls are selected, none is white.

$$10G, 12Y, 11W \times$$

$$\frac{22C_2}{33C_2} = \frac{\frac{22 \times 21}{2 \times 1}}{\frac{33 \times 32}{2 \times 1}} = \frac{231}{33 \times 16} = \frac{231}{528} \xrightarrow{\text{divide by 33}} = \left(\frac{7}{16} \right)$$

3) when 2 balls are selected, at least one is white.

$$10G, 12Y, 11W$$

$$P(\text{Atleast 1}) = 1 - P(\text{none})$$

$$= 1 - \frac{22C_2}{33C_2}$$

$$= 1 - \frac{\frac{22 \times 21}{2 \times 1}}{\frac{33 \times 32}{2 \times 1}} = 1 - \frac{231}{33 \times 16}$$

$$= 1 - \frac{231}{528}$$

$$= \frac{528 - 231}{528}$$

$$= \frac{297}{528}$$

$$= \left(\frac{9}{16} \right)$$