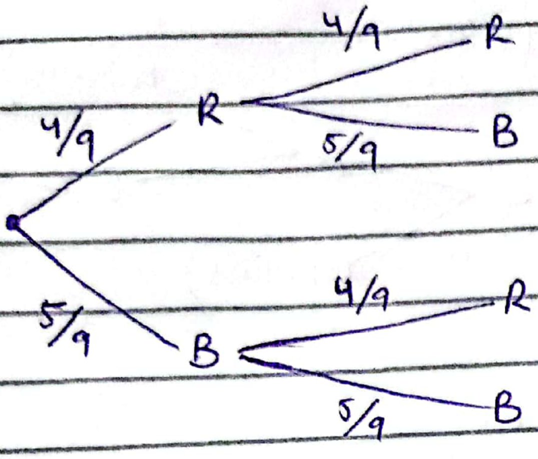
Possibility tree :-

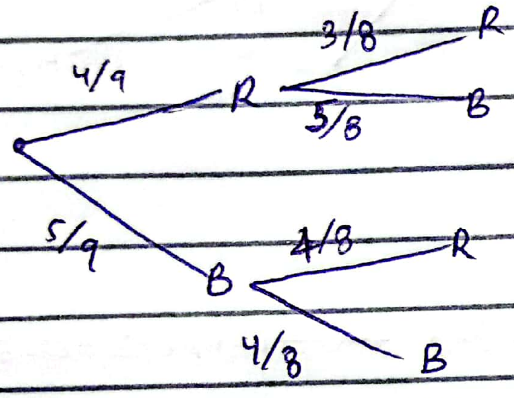
1st Selection   2nd Selection (with replacement)



Total balls = 9
Red = 4
Blue = 5
Randomly two balls are pickedup

1st Selection   2nd Selection (without replacement)

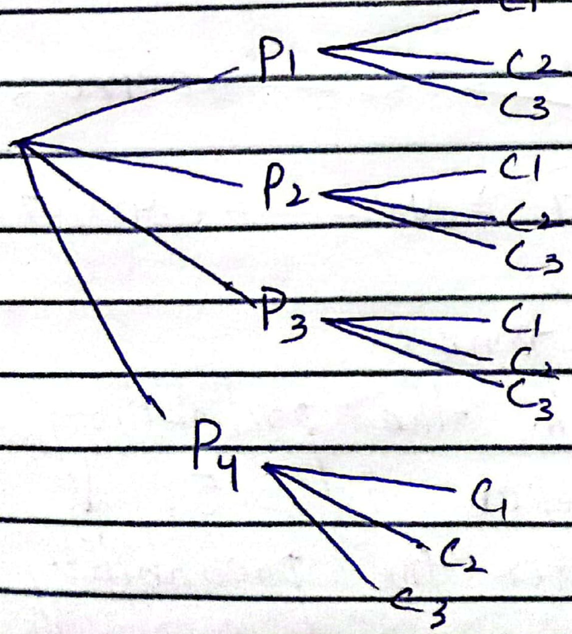
Same color balls



$\frac{4}{9} \times \frac{3}{8}$

$\frac{5}{9} \times \frac{4}{8}$

4 Players 3 face cards

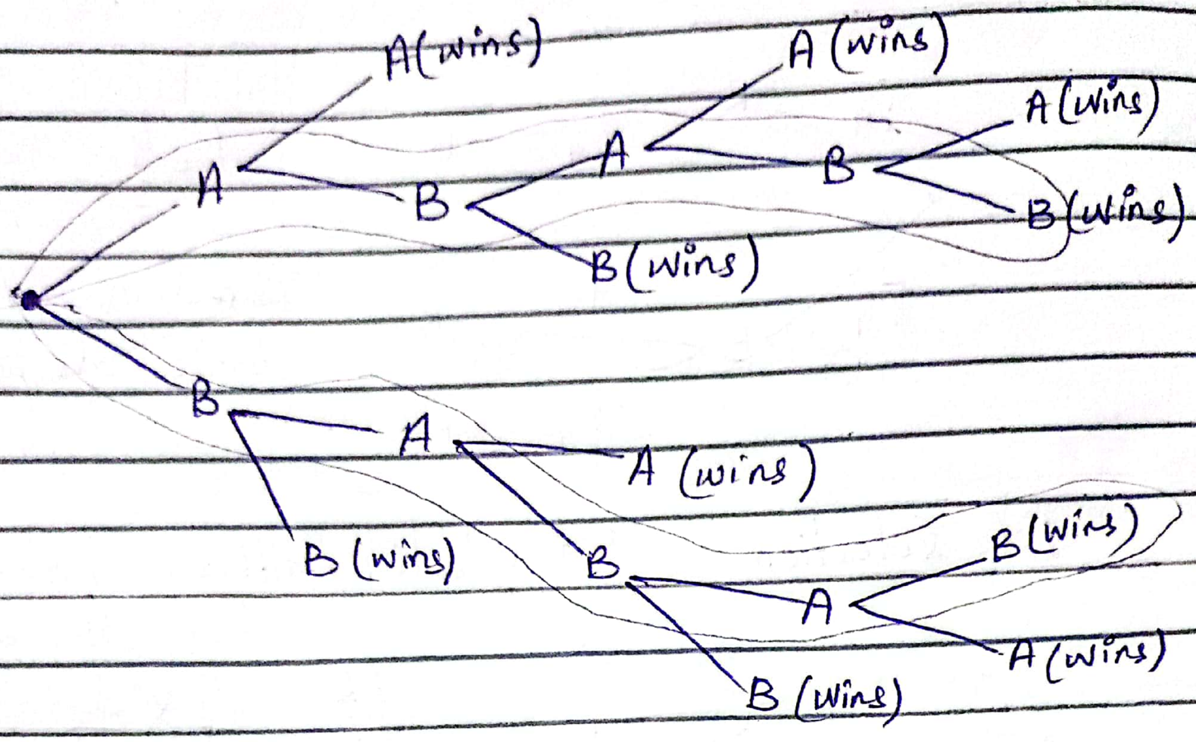


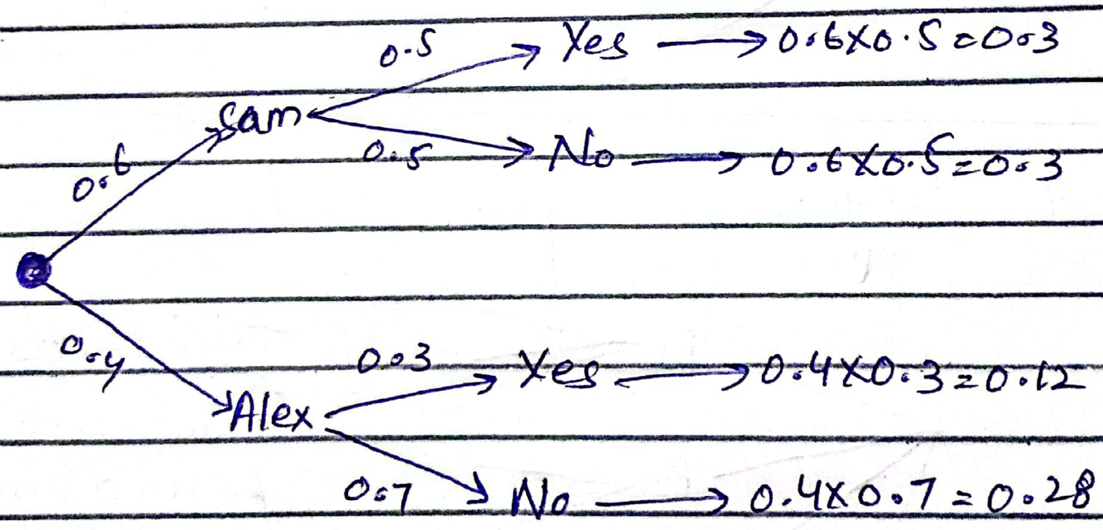
Total Cards = 52
There are four players

Every player have 3 face cards

4X3 = 12

A team wins two consecutive matches or three matches.



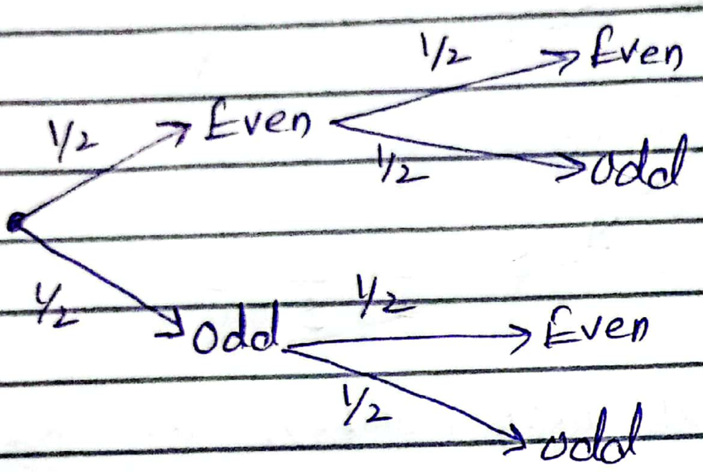


In a Soccer Game,

1. With Coach Sam the probability of being Goalkeeper is 0.5,
2. With Coach Alex the probability of being Goalkeeper is 0.3.

Two dice

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



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

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

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

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

Even = 3 ⇒ (2, 4, 6)
Odd = 3 ⇒ (1, 3, 5)

Even probability $= \frac{3}{6} = \frac{1}{2}$

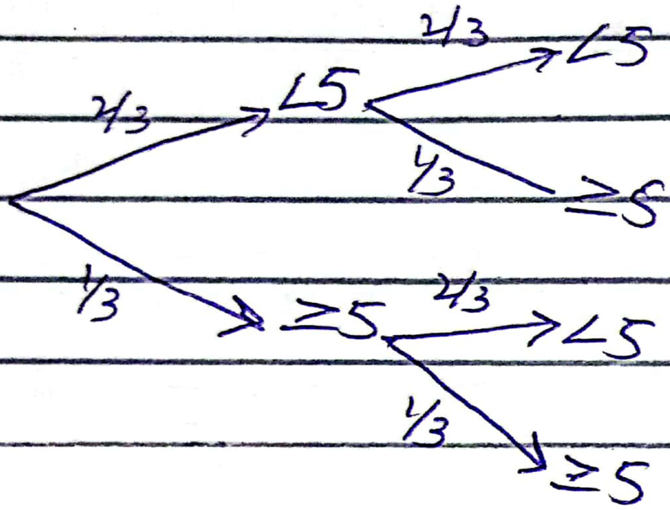
Odd probability $= \frac{3}{6} = \frac{1}{2}$

Probability that one number is even and other is odd $= \frac{1}{4} + \frac{1}{4}$

Both dice have less than 5 values
Numbers less than 5 = 1, 2, 3, 4
Numbers greater than or equal to 5 = 5, 6

Probability of Scores less than 5 $= \frac{4}{6} = \frac{2}{3}$

Probability of Scores greater than or equal to 5 $= \frac{2}{6} = \frac{1}{3}$



$\frac{2}{3} \times \frac{2}{3} = \frac{4}{9}$

$\frac{2}{3} \times \frac{1}{3} = \frac{2}{9}$

$\frac{1}{3} \times \frac{2}{3} = \frac{2}{9}$

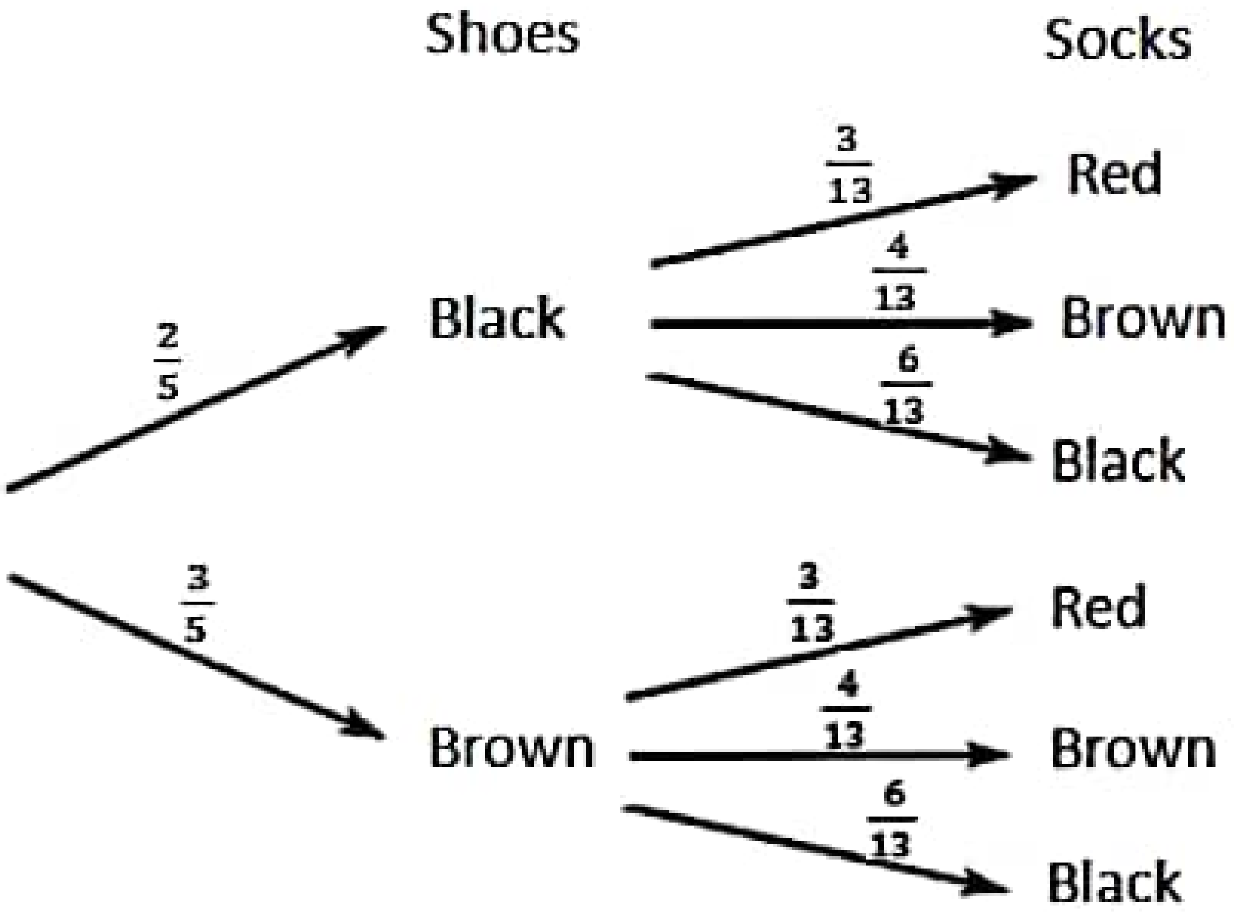
$\frac{1}{3} \times \frac{1}{3} = \frac{1}{9}$

Probability that both numbers are less than five $= \frac{4}{9}$

Teddy has a two pairs of black shoes and three pairs of brown shoes. He also has three pairs of red socks. four pairs of brown socks and six pairs of black socks.

If Teddy chooses a pair of shoes at random and a pair of socks at random. what is the probability that he chooses shoes and socks of the same color?

(Hint: draw a tree diagram.)



$$\frac{2}{5} \times \frac{3}{13} = \frac{6}{65}$$

$$\frac{2}{5} \times \frac{4}{13} = \frac{8}{65}$$

$$\frac{2}{5} \times \frac{6}{13} = \frac{12}{65}$$

$$\frac{3}{5} \times \frac{3}{13} = \frac{9}{65}$$

$$\frac{3}{5} \times \frac{4}{13} = \frac{12}{65}$$

$$\frac{3}{5} \times \frac{6}{13} = \frac{18}{65}$$

Therefore $\mathrm{P(He\ chooses\ shoes\ and\ socks\ of\ the\ same\ color)} = \frac{12}{65} + \frac{12}{65} = \frac{24}{65}$

Counting :-

Probability of getting two digit numbers that are divisible by 3?

$S = \{10, 11, 12, 13, 14, \text{———}, 99\}$

$N(S) = n - m + 1$

$= 99 - 10 + 1$

$= 90$

$E(S) = \{4, 5, \text{———}, 33\}$

$N(E) = n - m + 1$

$= 33 - 4 + 1$

$= 30$

$P = \dfrac{N(E)}{N(S)}$

$= \dfrac{30}{90}$

$P = \dfrac{1}{3}$

Prove that $7^{n+2} + 8^{2n+1}$ is divisible by 57.

Basis Step:-

Put $n = 0$ $\quad 7^{0+2} + 8^{2(0)+1} = 7^2 + 8 = 57$

Inductive Step:-

Put $n = k$ $\quad 7^{k+2} + 8^{2k+1}$..

Put $n = k+1$ $\quad 7^{(k+3)} + 8^{(2k+3)}$

$$7^{k+2} \cdot 7^{1} + 8^{2k} \cdot 8^{3}$$

$$= 7^{k+2} \cdot 7 + 8^{2k} \cdot 8^{2} \cdot 8$$

$$= 7^{k+2} \cdot 7 + 64\, 8^{2k+1}$$

$$= 7^{k+2} \cdot 7 + 7 \cdot 8^{2k+1} + 57 \cdot 8^{2k+1}$$

$$= 7\left(7^{k+2} + 8^{2k+1}\right) + 57 \cdot 8^{2k+1}$$

$$1+2+3+\cdots+n = \frac{n(n+1)}{2}$$

Box

$$1+2+3+\cdots+n = \frac{n(n+1)}{2}$$

For $n=1$

$$\frac{1(1+1)}{2} = \frac{2}{2} = 1$$

For $n=k$

$$1+2+3+\cdots+k = \frac{k(k+1)}{2}$$

$$\underbrace{1+2+3+\cdots+k}+(k+1) = \frac{(k+1)(k+2)}{2}$$

L.H.S $\frac{k(k+1)}{2}+(k+1)$ L.H.S = R.H.S

$$\frac{k^2+k}{2}+k+1$$

$$\frac{k^2+k+2k+2}{2}$$

$$\frac{k^2+3k+2}{2}$$

$$\frac{k^2+2k+k+2}{2}$$

$$\frac{k(k+2)+1(k+2)}{2}$$

$$\frac{(k+1)(k+2)}{2}$$

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