Terminology

1. **Random experiment** : any operation with well defined set of outcomes but it is impossible to predict the outcome.

2. **Sample space** : set of all possible outcomes.

ex tossing a coin :- $\{H, T\}$
rolling a dice :-
$\{1, 2, 3, 4, 5, 6\}$

3. **Event** :- subset of a sample space.

ex A : odd number occurs
$= \{1, 3, 5\}$

4. **compound event** :- event formed by combining several events.

event A or B :- $A \cup B$
(atleast one of A, B)

event A and B :- $A \cap B$
" A but not B :- $A - B$

5. equally likely events :-

6. Exhaustive events

$E_1, E_2, \dots, E_n$ are exhaustive if $E_1 \cup E_2 \cup \dots \cup E_n = S$.

ex A : odd number appears
B : number ≥ 4 "
C : " ≤ 2 "

7. Mutually exclusive events

$A \cap B = \emptyset$

8. Probability of an event A,

$$\boxed{P(A) = \frac{|A|}{|S|}}$$

$|A| \to$ number of outcomes in A

assumption :- individual outcomes are equally likely.

ex A : odd number turns up

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

* $0 \leq P(A) \leq 1$

impossible event

sure event

$$P(A) = \frac{\text{favourable outcomes}}{\text{total outcomes.}}$$

* odds in favour of A

$$= \frac{|A|}{|A'|} = \frac{P(A)}{P(A')}$$

ex A : multiple of 3

$$P(A) = \frac{1}{3}$$

odds in favour of A $= \frac{1}{2}$

* odds against A $= \frac{|A'|}{|A|}$

$$= \frac{P(A')}{P(A)}$$

Q/ 1. 2 dice are rolled. Find prob of getting a sum more than 7. $\left(\frac{5}{12}\right)$

$$\{\underbrace{2, 3, 4, \ldots, 12}\}$$

$\frac{1}{11}$ ✗

not equally likely.

2\. i) P(larger number than the previous number each time), dice rolled 3 times. $\left(\frac{5}{54}\right)$

ii) number $\geq$ previous number each time

$$\frac{{}^6C_3 + 2\cdot{}^6C_2 + {}^6C_1}{216.}$$

$$x_1 + x_2 + \dots + x_6 = 3$$

$${}^8C_5 = \frac{8\cdot 7\cdot \cancel{6}}{\cancel{6}} = 56$$

3\. 4 dice.
P(highest number is 4).

4\. find probability that birthdays of six people will fall in exactly two months.

$$\frac{{}^{12}C_2\cdot(2^6-2)}{12^6}$$

3\. 4 exactly once :- ${}^4C_1 \times 3^3$
$= 108$

4 " twice $= {}^4C_2 \times 3^2$

$= 54$

4 " thrice $= {}^4C_3 \times 3$

$= 12$

4 " 4 times $= 1.$

M-2 $\dfrac{4^4 - 3^4}{1296} = \dfrac{175}{1296}.$

5. $\omega^{r_1} + \omega^{r_2} + \omega^{r_3} = 0$

A. $\dfrac{1}{18}$ B. $\dfrac{1}{9}$ C. $\dfrac{2}{9}$ D. $\dfrac{1}{36}$

6. Balls are drawn one-by-one without replacement from a box containing 2 black, 4 white and 3 red balls till all the balls are drawn. Find the probability that the balls drawn are in the order 2 black, 4 white and 3 red? $\left(\dfrac{1}{1260}\right)$

$\omega^{r_1} + \omega^{r_2} + \omega^{r_3}$

$r_1 \to \{3, 6\}$ $r_2 \to \{1, 4\}$ $r_3 \to \{2, 5\}$

$\dfrac{8 \times 3!}{216} = \dfrac{2}{9}$

6. $\underbrace{\_\ \_}_{B}\ \underbrace{\_\ \_\ \_\ \_}_{W}\ \underbrace{\_\ \_\ \_}_{R}$

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

7. (i) 53 Sundays $\frac{2}{7}$

(ii) 53 " & Mondays $\frac{1}{7}$

(iii) " " or " $\frac{3}{7}$

$52 \times 7 = 364$

leap $= 366$

Probability of compound events

* $P(A \cup B) = P(A) + P(B) - P(A \cap B)$
* $P(A') = 1 - P(A)$

Q/1. $\{1, 2, 3, \ldots, 10\}$

3 numbers $\left(\frac{11}{40}\right)$

P(smallest is 3 or greatest is 7)

2. A, B are events such that

$P(A' \cup B') = \frac{3}{4}$, $P(A' \cap B') = \frac{1}{4}$,

$P(A) = \frac{1}{3}$, find $P(A' \cap B)$ $\left(\frac{5}{12}\right)$

1. $A \rightarrow$ 3 is smallest
$B \rightarrow$ 7 is greatest

$$P(A \cup B) = P(A) + P(B) - P(A \cap B)$$

$$\frac{^{7}C_2}{^{10}C_3} + \frac{^{6}C_2}{^{10}C_3} - \frac{3}{^{10}C_3}$$

$=$

3. P(exactly one of A or B occurs)

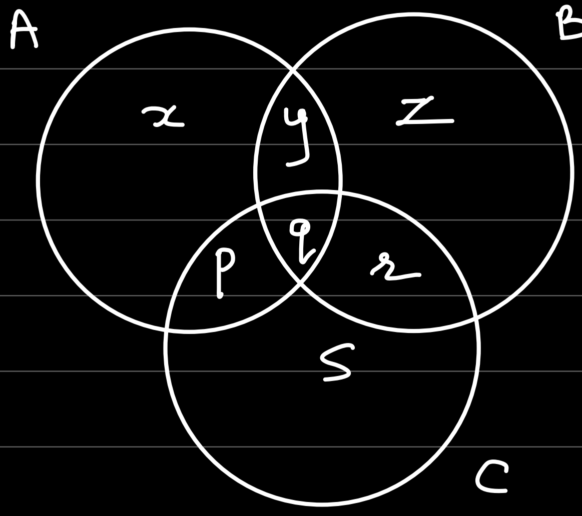
= P(" " " B " C ")

= P(" " " C " A ")

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

P(all three occur simultaneously) $= 1/16$.

P(at least one of the events occur) = ?



$q = \frac{1}{16}$

$x + p + z + r = \frac{1}{4}$

$$z + y + s + p = \frac{1}{4}$$

$$P(A) + P(B) - 2P(A \cap B) = \frac{1}{4}$$

$$P(A \cup B \cup C) = ?$$

* if A, B, C are mutually exclusive $P(A \cup B \cup C)$
$= P(A) + P(B) + P(C)$

3. $P(A) = \frac{1}{2}$, $P(B) = \frac{2}{3}$, p.T:-

i) $P(A \cup B) \geq \frac{2}{3}$

ii) $\frac{1}{6} \leq P(A \cap B) \leq \frac{1}{2}$

iii) $P(A \cap \overline{B}) \leq \frac{1}{3}$

iv) $\frac{1}{6} \leq P(\overline{A} \cap B) \leq \frac{1}{2}$

$\longrightarrow$ $|A \cup B| \geq \max\{|A|, |B|\}$

$\longrightarrow$ $|A \cap B| \leq \min\{|A|, |B|\}$

$P(A \cup B) \geq \max\{P(A), P(B)\}$

$$\geq \frac{2}{3}$$

$$\frac{2}{3} \leq P(A \cup B) \leq 1$$

$$\frac{2}{3} \leq \frac{7}{6} - P(A \cap B) \leq 1$$

$$\frac{1}{6} \leq P(A \cap B) \leq \frac{1}{2}$$

$$P(A \cap \overline{B}) = P(A) - P(A \cap B)$$

4. if $\frac{1+3p}{3}, \frac{1-p}{4}, \frac{1-2p}{2}$ are probabilities of 3 mutually exclusive events, then find set of all values of p.

$$p \in \left[\frac{1}{3}, \frac{1}{2}\right]$$

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5. A dice is loaded so that the probability of a face i is proportional to i^2, $i = 1, 2, \ldots, 6$. Then find the probability of showing a prime number when the dice is rolled.

Conditional Probability

$\{1, 3, 5\}$

ex A : getting an odd number

B : " number ≥ 4.

$\{4, 5, 6\}$

$P(A|B)$ or $P(A/B)$ or $P\left(\frac{A}{B}\right)$

A given B.

$$= \frac{n(A\cap B)}{n(B)} = \frac{\frac{n(A\cap B)}{n(S)}}{\frac{n(B)}{n(S)}}$$

$$\boxed{P(A|B) = \frac{P(A\cap B)}{P(B)}}$$

$$P(A\cap B) = P(B)\cdot P(A|B)$$
$$= P(A)\cdot P(B|A)$$

Q/1. tossed thrice.

E : atleast two heads

F : 1^{st} throw is head.

$P(E|F)$ and $P(F|E)$

$$\hookrightarrow = \frac{P(E\cap F)}{P(F)} = \frac{3/8}{1/2}$$
$$= 3/4.$$

H T H
H H T
H H H

$$P(F|E) = \frac{3/8}{\frac{1}{8}+\frac{3}{8}} = \frac{3}{4}$$

HHT
HTH
THH
HHH

2. 1 to 11. if sum is even find prob that both numbers are odd.

A → both are odd
B → sum is even

$$P(A|B) = \frac{P(A\cap B)}{P(B)}$$

$$= \frac{{}^6C_2 / \cancel{{}^{11}C_2}}{\frac{{}^6C_2 + {}^5C_2}{\cancel{{}^{11}C_2}}}$$

$$= \frac{15}{25} = \frac{3}{5}$$

Multiplication Theorem

$$2x_1 + 3x_2 = 12$$
$$x_1 + x_2 + x_3 = 5.$$

$$x_1 = 3, \ x_2 = 2$$

$$2\ 2\ 2\ 3\ 3 \longrightarrow \frac{5!}{3!\,2!} \times \frac{1}{6^5}$$

$$3\ 3\ 3\ 3\ \underline{\underline{0}} \longrightarrow \frac{5 \times 4}{6^5} = \frac{20}{6^5}$$

$\downarrow$

4

Q/ 1. $P(A) = 0.8$, $P(B) = 0.5$,
$P(B|A) = 0.4$, find :-

i) $P(A \cap B)$ (0.32) ii) $P(A|B)$ (0.64)
iii) $P(A \cup B)$ (0.98)

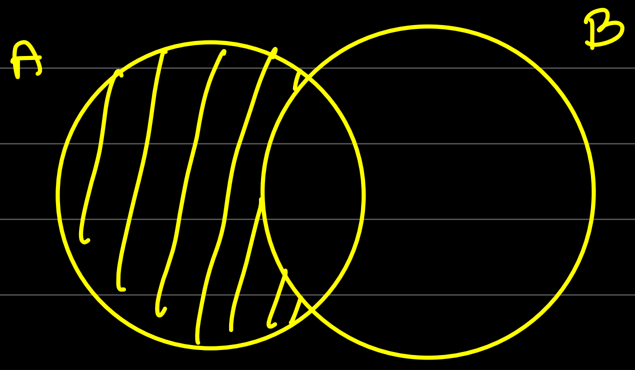
2. $P(A) = 0.3$, $P(B) = 0.4$ and
$\underbrace{P(A' \cap B')}$ $= 0.5$ then find
$P(B | \underline{\underline{A \cup B'}}_{E})$. $(1/4)$

3. A box contains 10 mangoes out of which 4 are rotten. Two mangoes are taken out together. If one of them is found to be good, then find the probability that the other is also good.

2. $\dfrac{P(B \cap E)}{P(E)}$

$$P(A \cup B') = P(A) + P(B') - P(A \cap B')$$

$$= 0.3 + 0.6 - (\underbrace{P(A) - P(A \cap B)})$$



$$P(A \cup B) = 0.5$$

$$B \cap (A \cup B')$$
$$= (B \cap A) \cup (\underbrace{B \cap B'})$$
$$= A \cap B$$

3. A :- one of the mangoes is good

B :- other one is good.

$$P(B|A) = \frac{P(A \cap B)}{P(A)}$$

$$P(A \cap B) = \frac{{}^6C_2}{{}^{10}C_2}$$

$$\frac{{}^6C_1 \cdot {}^4C_1}{{}^{10}C_2} + \frac{{}^6C_2}{{}^{10}C_2}$$

$$= \frac{15}{24 + 15} = \frac{15}{39}$$

$$= \frac{5}{13}$$

Multiplication Theorem

$$\boxed{P(A \cap B) = P(A) \cdot P(B|A)}$$

eg urn $\longrightarrow$ 10 B, 5 W

2 balls $\longrightarrow$ one after other

$\longrightarrow$ without replacement

$$P(\underbrace{1^{st} \text{ black}}_{A} \text{ and } \underbrace{2^{nd} \text{ white}}_{B})$$

$$P(A \cap B) = P(A) \cdot P(B|A) \checkmark$$

$$= \frac{2}{3} \times \frac{5}{14} = \frac{5}{21}$$

$$* \quad P(A \cap B \cap C) = P(A) \cdot P\left(\frac{B}{A}\right) \cdot P\left(\frac{C}{A \cap B}\right)$$

Q/ 1. 10 Keys

i) 1^{st} attempt :- $\frac{1}{10}$

ii) 2^{nd} " :- $\frac{9}{10} \times \frac{1}{9} =$

A :- not opened in 1^{st} attempt

B :- open in 2^{nd}

$$P(A \cap B) = P(A) \cdot P(B|A)$$
$$= \frac{9}{10} \times \frac{1}{9} = \frac{1}{10}$$

2. 3 cards , wO replacement

$1^{st} \rightarrow J$
$2^{nd} \rightarrow Q$
$3^{rd} \rightarrow K$

$$\frac{1}{13} \times \frac{4}{51} \times \frac{2}{25}$$

3. Cards are drawn one by one at random from a well shuffled full pack of 52 playing cards until 2 aces are obtained for the first time. Prove that the probability that exactly n cards are drawn is

$$\frac{(n-1)(52-n)(51-n)}{50 \times 49 \times 17 \times 13}$$

where $2 < n < 50$.

$$\underbrace{\_\ \_\ \_\ \_\ \ldots\ \_}_{n-1 \text{ cards}}\ \underset{\text{ace}}{\_}$$

A : exactly 1 ace in first n-1 draws.

B : ace at the n^{th} draw

$$P(A \cap B) = P(A) \cdot P(B|A)$$

$$\frac{{}^{4}C_1 \times {}^{48}C_{n-2} \times \cancel{(n-1)}!}{{}^{52}C_{n-1} \times \cancel{(n-1)}!}$$

$$= \frac{4 \times \dfrac{48!}{(50-n)!\,(n-2)!}}{\dfrac{52!}{(53-n)!\,(n-1)!}}$$

$$= \frac{4 \times 48! \times (53-n)!\,(n-1)!}{52!\,(50-n)!\,(n-2)!}$$

$$= \frac{4(n-1)(53-n)(52-n)(51-n)}{52 \times 51 \times 50 \times 49}$$

$$P(B|A) = \frac{{}^{3}C_1}{{}^{53-n}C_1} = \frac{3}{53-n}$$

$$52-(n-1) = 53-n$$

(HW)

4. W white, 3 black balls.
till all the black balls are drawn.
P(ends at r^{th} draw) = ?

$$\frac{3(r-1)(r-2)}{(W+3)(W+2)(W+1)}$$

Independent Events

$$P(A|B) = P(A)$$

$$\frac{P(A\cap B)}{P(B)} = P(A)$$

defn :- Two events A and B are said to be independent of each other iff $\boxed{P(A\cap B) = P(A) \cdot P(B)}$

Properties

if A, B are independent, then

i) A', B

ii) A, B'

iii) A', B' are also independent.

$$P(A'\cap B) = P(B) - P(A\cap B)$$
$$= P(B) - P(A)\cdot P(B)$$
$$= P(B)(1 - P(A))$$
$$= P(B)\cdot P(A')$$

Q/1. $\frac{1}{2}, \frac{1}{3}, \frac{1}{4}$

$\downarrow$ A, $\downarrow$ B, $\downarrow$ C.

i) exactly one hits the target $\rightarrow \frac{11}{24}$

ii) " two " " " $\frac{1}{4}$

iii) the target is hit $\frac{3}{4}$

iv) none hits the target. $\frac{1}{4}$

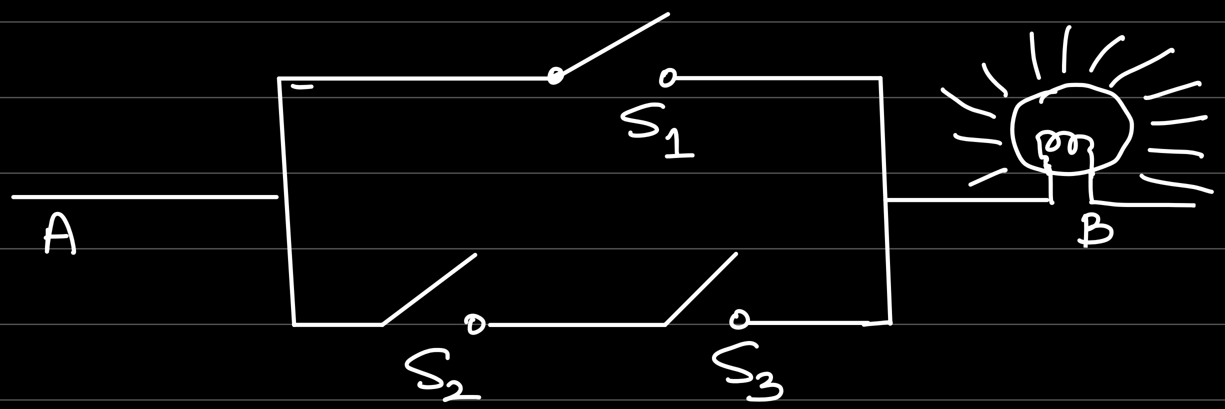
$P(A \cap B' \cap C')$

i) $P(A) \cdot P(B') \cdot P(C')$

$+ P(A') \cdot P(B) \cdot P(C')$

$+ P(A') \cdot P(B') \cdot P(C)$

2.



$$P(S_1) = P(S_2) = P(S_3) = \frac{1}{2}$$

3. An unbiased dice is rolled until a number greater than 4 appears. Find P(even number of tosses are needed).

(HW)

4. A pair of unbiased dice are rolled together till a sum of either 5 or 7 is obtained. Then find probability that 5 comes before 7.

5. An unbiased normal coin is tossed n times. Let

E_1: both head and tail are present in n tosses

E_2: coin shows head atmost once.

Find n for which E_1 and E_2 are independent.

3. A : number > 4, $P(A) = \frac{1}{3}$

$$\frac{2}{3} \times \frac{1}{3} + \left(\frac{2}{3}\right)^3\left(\frac{1}{3}\right) + \left(\frac{2}{3}\right)^5\left(\frac{1}{3}\right) + \cdots$$

5. $P(E_1) = 1 - \frac{1}{2^n} - \frac{1}{2^n} = 1 - \frac{1}{2^{n-1}}$

$P(E_2) = \frac{1}{2^n} + {}^nC_1 \cdot \frac{1}{2} \cdot \frac{1}{2^{n-1}}$

— — — — ... — —

$$= \frac{1+n}{2^n}$$

$P(E_1 \cap E_2) = P(E_1) \cdot P(E_2)$.

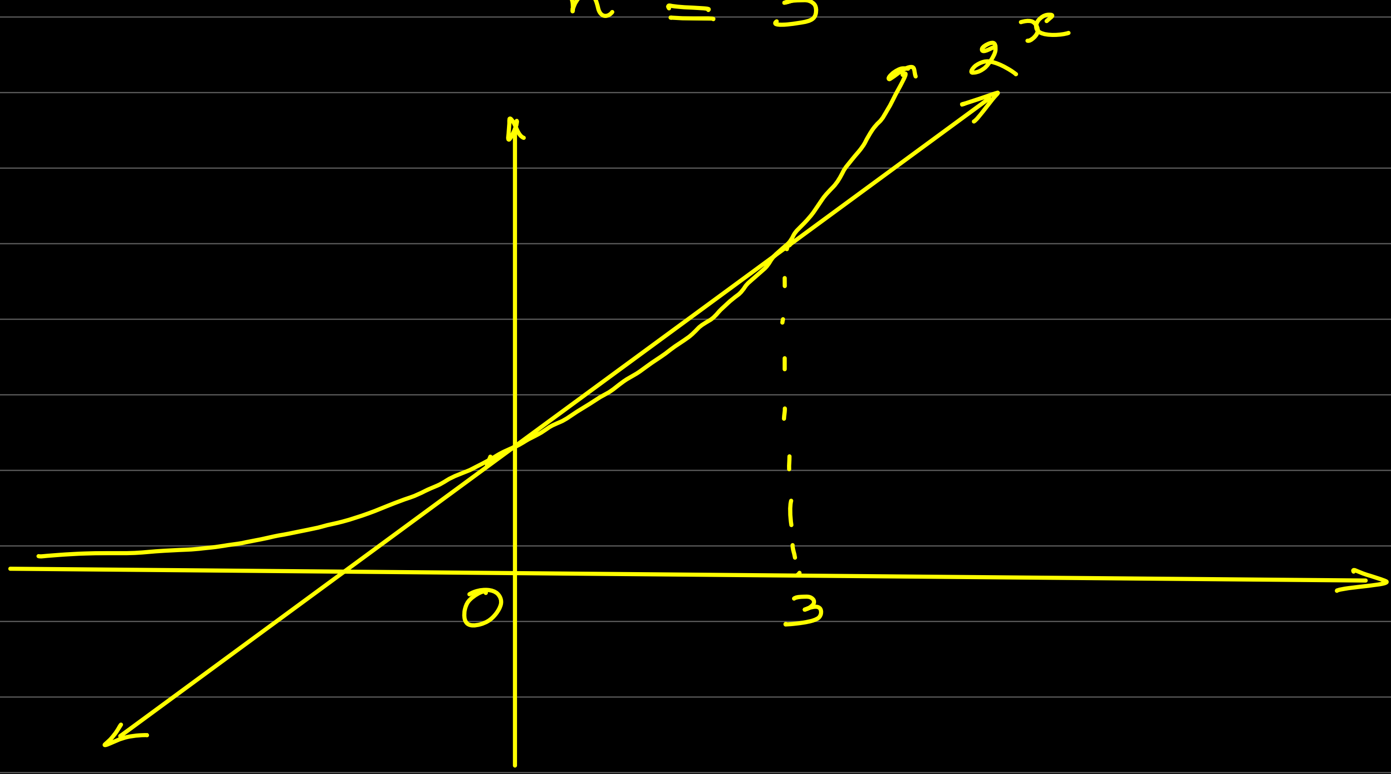
$$\frac{n}{\cancel{2^n}} = \left(1 - \frac{1}{2^{n-1}}\right)\left(\frac{n+1}{\cancel{2^n}}\right)$$

$$\frac{n}{n+1} = 1 - \frac{1}{2^{n-1}}$$

$$\frac{1}{2^{n}-1} = \frac{1}{n+1}$$

$$\Rightarrow \quad n+1 = 2^{n-1}$$

$$n = 3$$



$*$ events $E_1, E_2, \ldots, E_n$ are said to be independent (or collectively independent) if

$$P(E_1 \cap E_2 \cap \cdots \cap E_n) = P(E_1) \cdot P(E_2) \cdots P(E_n)$$

they are pairwise independent if $P(E_i \cap E_j) = P(E_i) \cdot P(E_j)$
$i, j \in \{1, 2, \ldots, n\}, \; i \neq j.$

pairwise independence $\not\Rightarrow$ collective independence.

Q/1. 50 → defective
50 → non-defective bulbs
with replacement

A : 1^{st} bulb is defective
B : 2^{nd} " " non- "
C : both are defective or
" " non- "

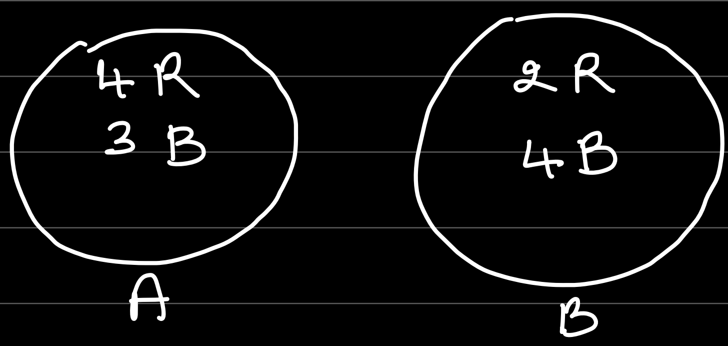
are A, B, C
i) pairwise independent?
ii) independent

$$P(A) = \frac{1}{2}, \quad P(B) = \frac{1}{2}, \quad P(C) = \frac{1}{2}$$

(HW)
2. if $P(A|B) = P(A|B')$, then
PT:- A, B are independent.

Total probability theorem

ex



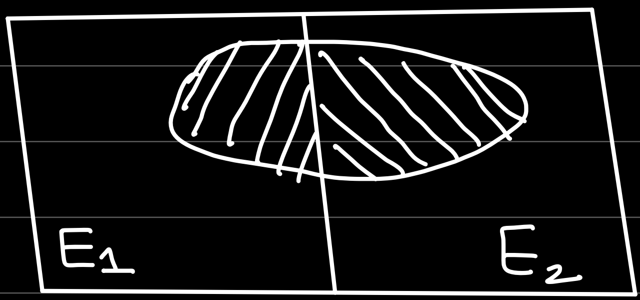
P(drawn ball is red) = ?

E_1 : bag A is selected
E_2 : " B " "

E : drawn ball is red.

$$E = E \cap (E_1 \cup E_2)$$

$$= (E \cap E_1) \cup (E \cap E_2)$$

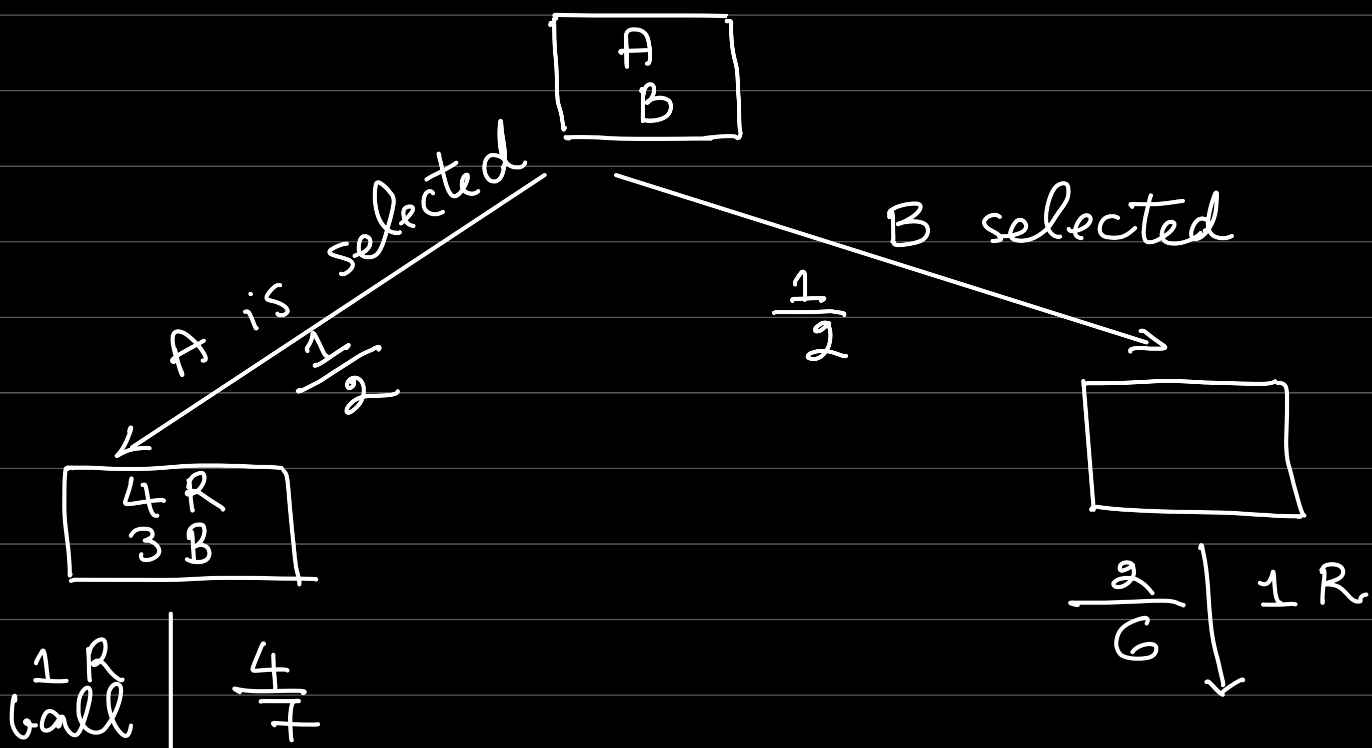


$$P(E) = P(E \cap E_1) + P(E \cap E_2)$$

$$= P(E_1) \cdot P(E \mid E_1) + P(E_2) \cdot P(E \mid E_2)$$

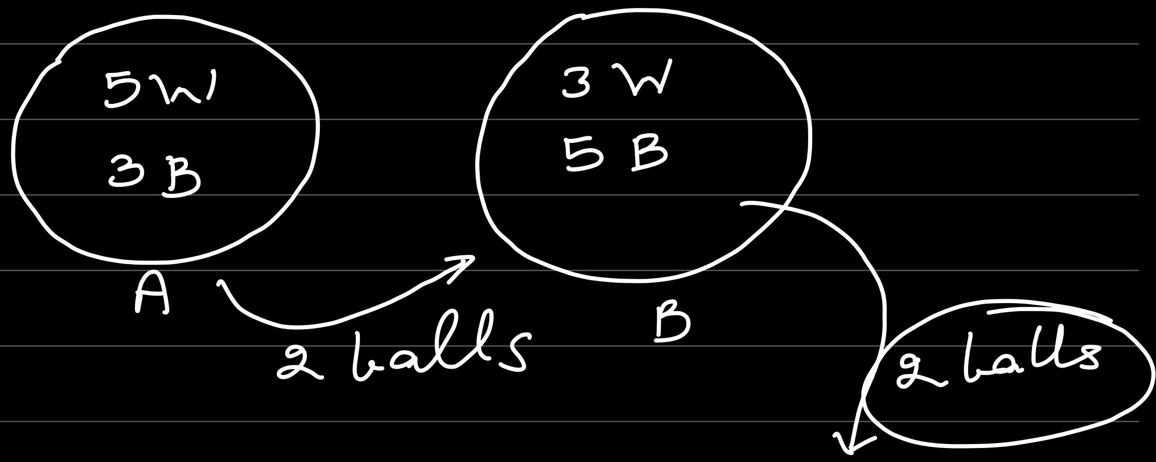
$$= \frac{1}{2} \times \frac{4}{7} + \frac{1}{2} \times \frac{2}{6}$$

$$= \frac{2}{7} + \frac{1}{6} = \frac{19}{42}.$$



$$\frac{1}{2}\cdot\frac{4}{7}+\frac{1}{2}\cdot\frac{2}{6} = \frac{2}{7}+\frac{1}{6}$$

Q/1.



2.

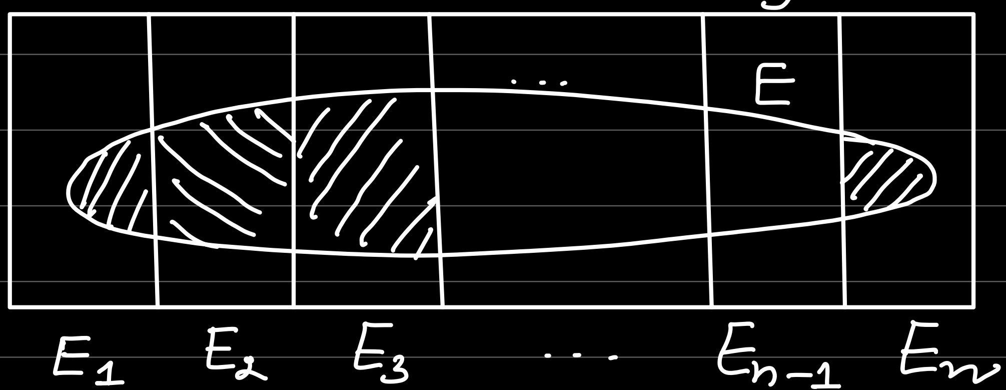
An urn contains m white and n black balls. A ball is drawn at random and is put back into the urn along with k additional balls of the same color as that of the ball drawn. A ball is again drawn at random. What is the probability that the ball drawn now is white? (2001)

$$\frac{m}{m+n}$$

3.

An urn contains 2 white and 2 black balls. A ball is drawn at random. If it is white, it is not replaced into the urn. Otherwise it is replaced along with another ball of the same color. The process is repeated. Find the probability that the third ball drawn is black. (1987)

Thm :- $E_1, E_2, \ldots, E_n \rightarrow$ exhaustive and mutually exclusive events

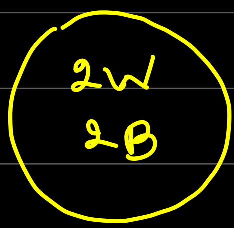


$$E = E \cap (E_1 \cup E_2 \cup \ldots \cup E_n)$$

$$= \bigcup_{i=1}^{n} (E \cap E_i)$$

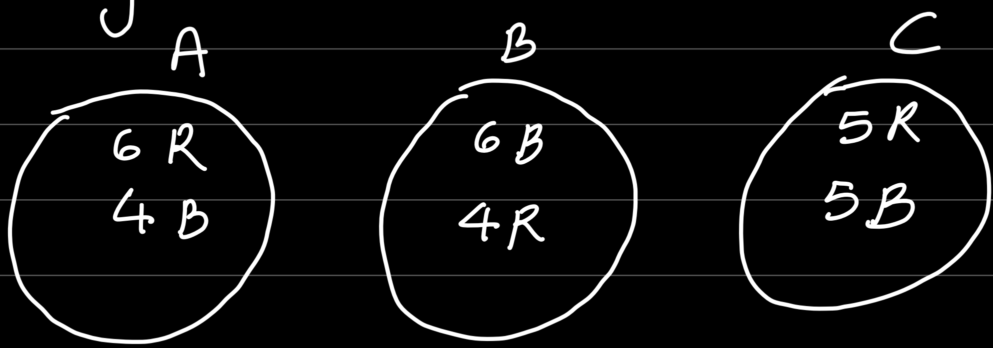
$$\boxed{\begin{aligned} P(E) &= \sum_{i=1}^{n} P(E \cap E_i) \\ &= \sum_{i=1}^{n} P(E_i) \cdot P(E \mid E_i) \end{aligned}}$$

3.



Bayes' theorem

ex

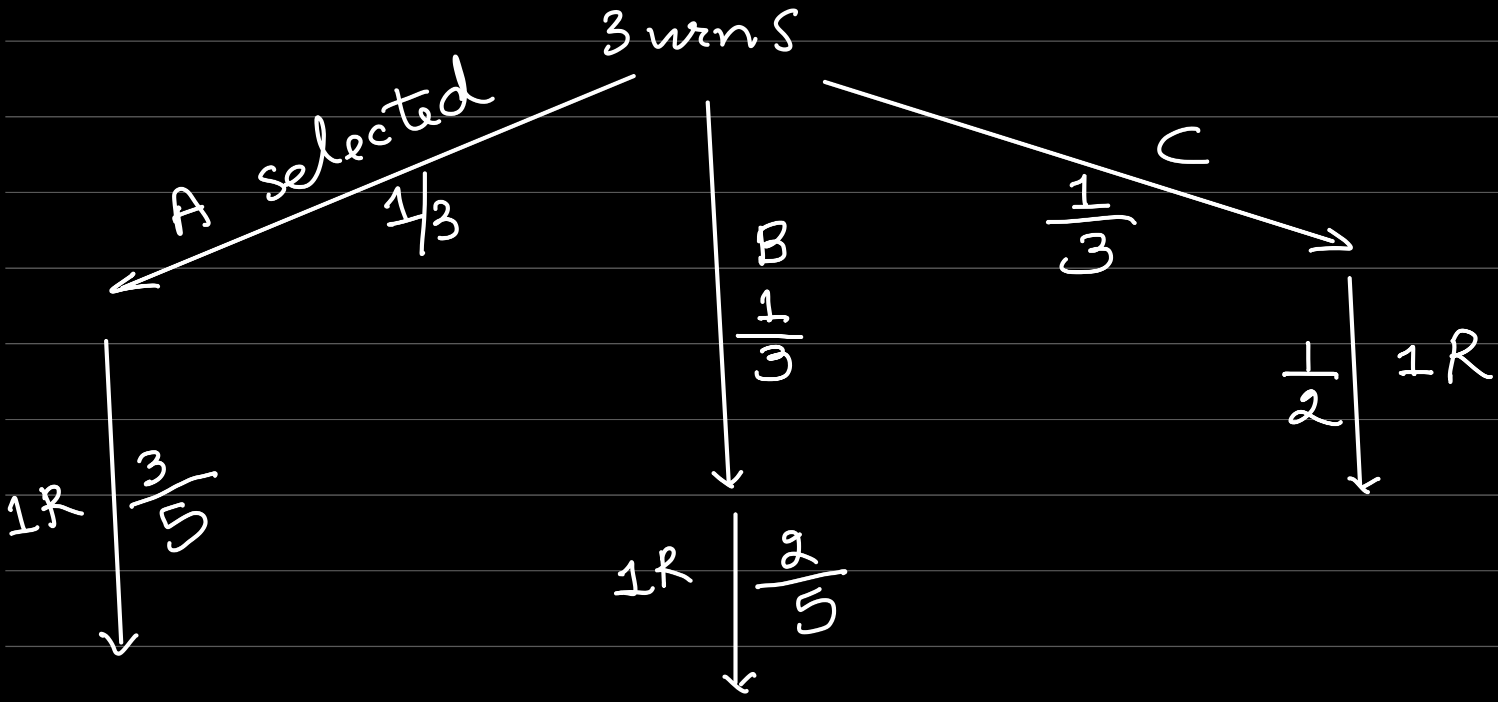


P(1st urn was selected if ball drawn is red) =

E_1 : bag A selected, E_2, E_3

E : ball drawn is red.

$$P(E_1 \mid E) = \frac{P(E_1 \cap E)}{P(E)}$$

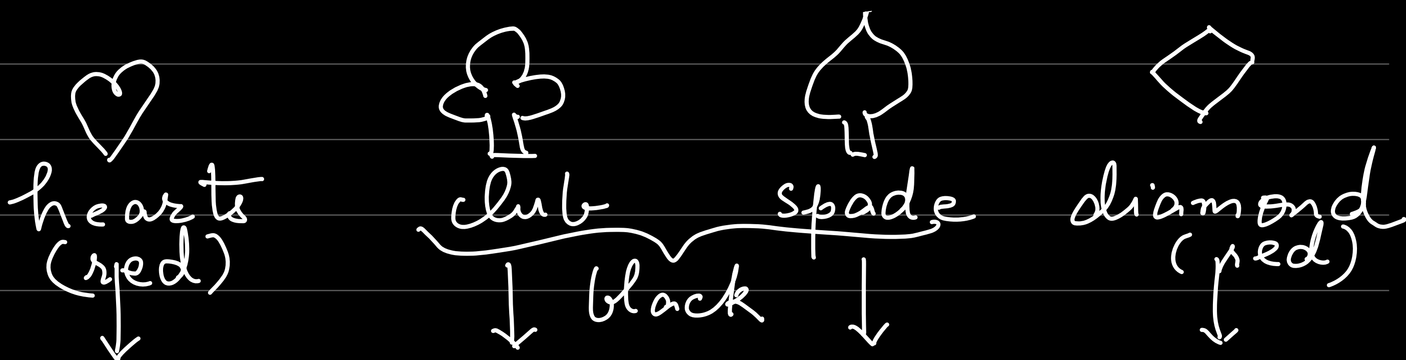


$$P(E) = \frac{3}{15} + \frac{2}{15} + \frac{1}{6} = \frac{1}{2}$$

$$\frac{1/5}{1/2} = \frac{2}{5}$$

Q/1. 52 cards

4 suits



13 denominations.

A, 2 – 10, K, Q, Jack.

a card is lost.
2 cards drawn and are hearts
P(missing card is a heart).

1. A person goes to office by a car, a scooter, a bus or a train with probabilities $\frac{1}{7}, \frac{3}{7}, \frac{2}{7}, \frac{1}{7}$ respectively. The probability of his reaching late if he takes a car, a scooter, a bus or a train are respectively $\frac{2}{9}, \frac{1}{9}, \frac{4}{9}, \frac{1}{9}$. Given that he reaches the office on time, find the probability that he traveled by a car. $(\frac{1}{7})$ (2005)

2. A box contains N coins, m of which are fair and the rest are biased. The probability of getting a head when a fair coin is tossed is $\frac{1}{2}$ while it is $\frac{2}{3}$ when a biased coin is tossed. A coin is drawn from the box at random and is tossed twice. The first time it shows head and the second time it shows tail. What is the probability that the coin drawn is fair? $(\frac{9m}{m+8N})$

1.

cards

1 heart $\frac{1}{4}$

non-heart $\frac{3}{4}$

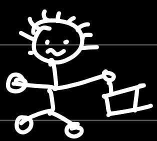
2 hearts $\frac{{}^{12}C_2}{{}^{51}C_2}$

$\frac{{}^{13}C_2}{{}^{51}C_2}$

ans: $\frac{11}{50}$

2.

person

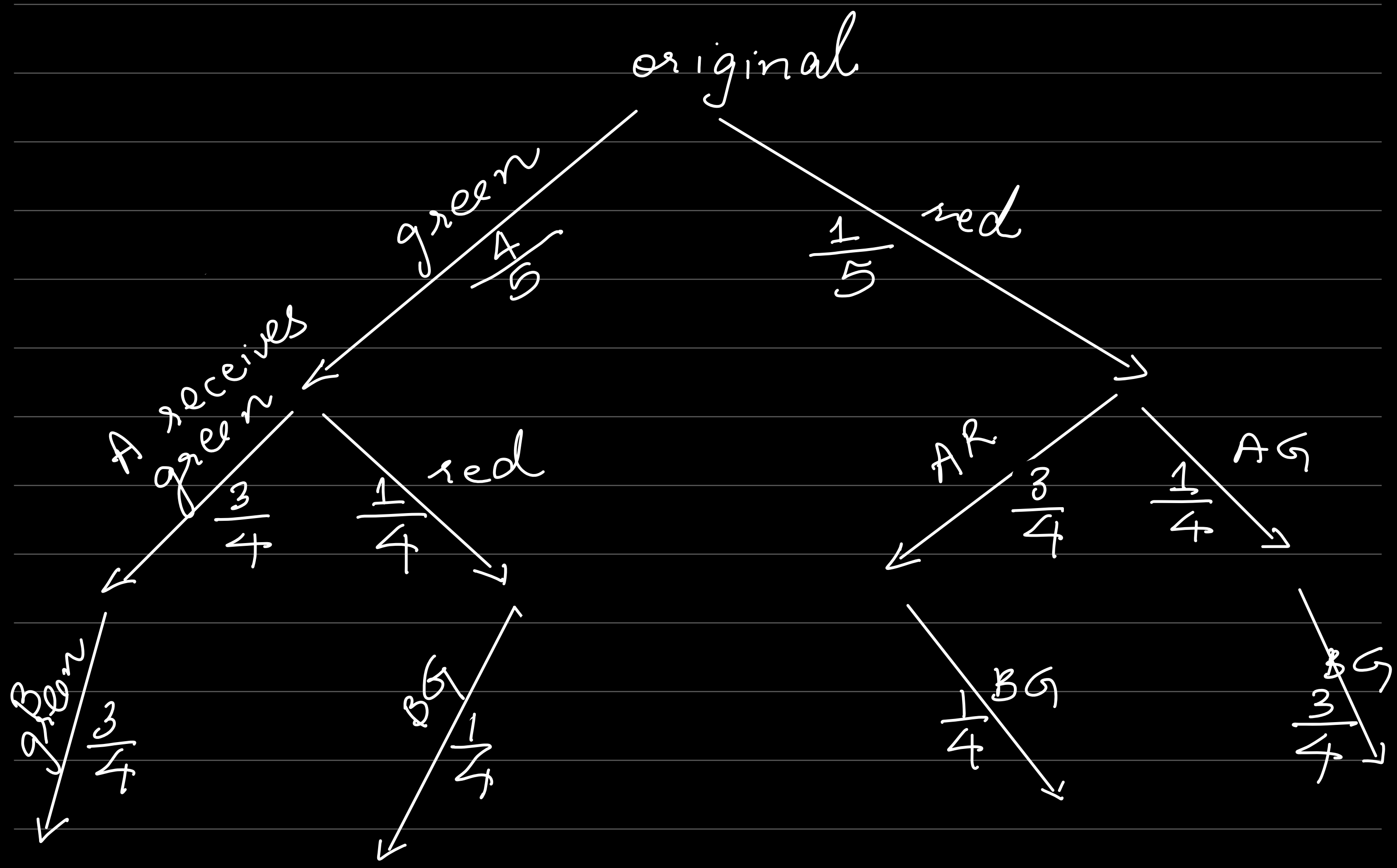


car $\frac{1}{7}$ scooter $\frac{3}{7}$ bus $\frac{2}{7}$ train $\frac{1}{7}$

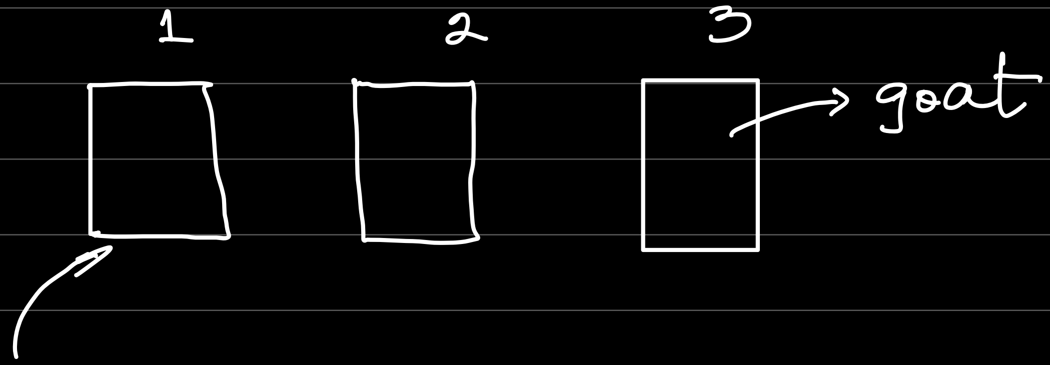
on time $\frac{7}{9}$ $\quad 8/9 \quad 5/9 \quad 8/9$

A signal which can be green or red with probability $\frac{4}{5}$ and $\frac{1}{5}$ respectively, is received by station A and then transmitted to station B. The probability of each station receiving the signal correctly is $\frac{3}{4}$. If the signal received at station B is green, then the probability that the original signal was green is [2010]

(a) $\frac{3}{5}$ (b) $\frac{6}{7}$ (c) $\frac{20}{23}$ (d) $\frac{9}{20}$



Monty Hall problem



C_1: car is behind door 1

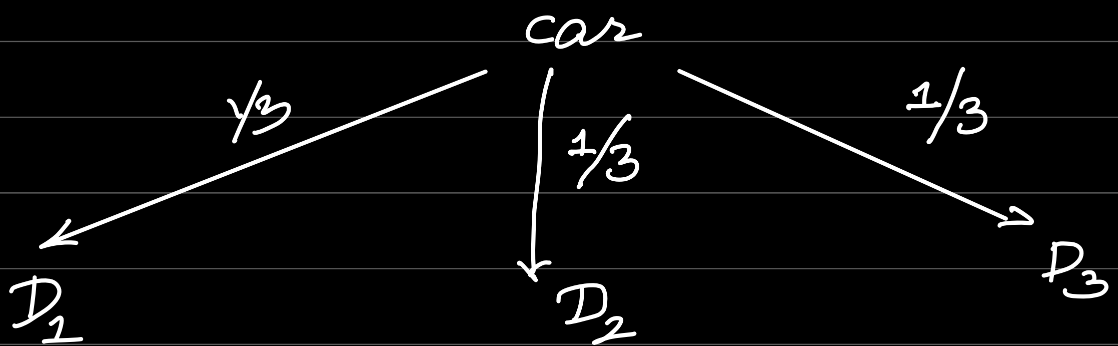
C_2 :

C_3 :

D_1: host opens door 1

D_2:

D_3 :



$$P(C_i) = \frac{1}{3}, \quad i = 1, 2, 3.$$

$P(C_2) \cdot P(D_3 | C_2)$

$$\underbrace{P(C_2 | D_3)}_{\text{find}} = \frac{P(C_2 \cap D_3)}{P(D_3)}$$

$$\frac{1/3}{1/2} = \frac{2}{3}$$

$$P(D_3) = P(C_1) \cdot P(D_3 | C_1) + P(C_2) \cdot P(D_3 | C_2) + P(C_3) \cdot P(D_3 | C_3)$$

$$= \frac{1}{3} \times \frac{1}{2} + \frac{1}{3} \times 1 + \frac{1}{3} \times 0$$

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

$P(C_1 | D_3) = \frac{1}{3}$

Bernoulli trial, binomial probability

characteristics

1. only 2 outcomes → may be labelled as success and failure

2. every trial is independent of previous trial.

3. number of trials is fixed.

Q/1. $n = 7$, P(odd number turns up)

i) exactly 4 times → $\frac{35}{128}$

ii) atleast " " → $\frac{1}{2}$

2. atleast 8/10 answers in a true-false exam? → $\frac{7}{128}$

3. 10% of hitting.

> 50% chance of hitting atleast once.

$$1 - \left(\frac{9}{10}\right)^n > \frac{1}{2}$$

$$\left(\frac{9}{10}\right)^n < \frac{1}{2}$$

$$2 \cdot 9^n < 10^n$$

4. A wins $= 0.4$

best of 3 ?

" " 5

$$\underbrace{{}^3C_2 \cdot (0.4)^2 (0.6) + (0.4)^3}$$

5. $p \rightarrow$ showing head.

$p_n \rightarrow$ no two (or more) consecutive heads occur.

P.T:- $p_1 = 1,\ p_2 = 1 - p^2$

and $p_n = (1-p)p_{n-1} + p(1-p)p_{n-2}$ for $n \geq 3$.

6. Football teams T_1 and T_2 have to play two games against each other. It is assumed that the outcomes of the two games are independent. The probabilities of T_1 winning, drawing and losing a game against T_2 are $\frac{1}{2}, \frac{1}{6}$ and $\frac{1}{3}$, respectively. Each team gets 3 points for a win, 1 point for a draw and 0 point for a loss in a game. Let X and Y denote the total points scored by teams T_1 and T_2 respectively after two games.

Q.51 $P(X > Y)$ is

(A) $\frac{1}{4}$ (B) $\frac{5}{12}$ (C) $\frac{1}{2}$ (D) $\frac{7}{12}$

4. $P(X=Y) = ?$

A. $\frac{11}{36}$ B. $\frac{1}{3}$ C. $\frac{13}{36}$ D. $\frac{1}{2}$.

5. $p_1 = 1, \quad p_2 = 1 - p^2$

$$T\ \underbrace{\_\ \_\ \_\ \cdots\ \_\ \_}_{n-1}$$

$$p_n = (1-p)\,p_{n-1} + p(1-p)\,p_{n-2}$$

$$\underline{H}\ \underline{T}\ \underbrace{\_\ \_\ \cdots\ \_}_{n-2}$$

6.

	T_1	T_2	T_1 pts	T_2 pts	prob
G1:-	W	L	3	0	$\frac{1}{3}$
	L	W	0	3	$\frac{1}{6}$
	D	D	1	1	$\frac{1}{2}$
G2:-			3	0	
			0	3	
			1	1	