Probability Basics

Lecture 1

Unit 1: Basics of Probability

Tossing a win

Random Experiment: If in each trial of an experiment conducted under identical conditions, the outcome is not unique, but may be any one of the possible outcomes.

Outcome: The result of an random experiment will be called an outcome.

Event: The combination of outcomes are termed as events.

• Trial: Any particular performance of an random experiment is called trial.

Exhaustive Events: The total number of possible outcomes of a random experiment is known as the exhaustive events or cases.

Favourable Events: The number of outcomes which entail the happening of the

Rolling a die
$$E = \text{getting even no}$$

$$= \{2,4,6\}$$

$$= \{2,4\}$$

$$= \{2,4\}$$

event.

1

1

$$\varepsilon' = \{2,4\}$$

$$\varepsilon'' = \{1,2\}$$

• **Equally likely Events:** When there is no reason to expect one event in preference of other, taking into consideration all relevant evidences.

H, T -> equally likely events

• Mutually Exclusive Events: If happening of any one of events precludes the

happening of all others.

Coin Head

1, 2, 3, 4, 5, 6

• **Independent Events:** If occurrence or non-occurrence of an event is not affected by the supplementary knowledge concerning the occurrence of any other remaining events.

 $\overset{\circ}{\lambda} \overset{\circ}{\longleftarrow} \overset{\circ}{\mathcal{B}}$

eg: Tossing 2 coins. A = getting + 1 on lst coin 3 B = n + 1 on 2nd coin

ig: Rolling a pair of die B= 4 6 on 2nd die.

Rolling a pair of die $S = \{(1,1), (1,2), \dots\}$ ($\varepsilon' = \text{getting the sum to be 5.}''$ ($\varepsilon'' = \text{getting ... to be 10.}''$ (1,4), (2,3), (3,2), (4,1)

• Mathematical or Classical definition of Probability: If a random experiment or a trial results in n exhaustive mutually exclusive and equally likely events outcomes, out of which m are favourable to the occurrence of an Event E, then

a trial results in
$$n$$
 exhaustive mutually exclusive and equally likely events outcomes out of which m are favourable to the occurrence of an Event E , then

$$P(E) = \frac{Number\ of\ favourable\ cases}{Total\ number\ of\ exhaustive\ cases} = \frac{m}{n}$$

$$P(\bar{E}) = \frac{n-m}{n}$$

$$P(\bar{E}) = \frac{1}{n}$$

$$P(\bar{E}) = \frac{1}{n}$$

 $\begin{array}{c}
\rho(\varepsilon) > 0 \\
\rho(\varepsilon) < 0
\end{array}$ $\begin{array}{c}
\varepsilon_1 \cup \varepsilon_2 \cup \dots \cup \varepsilon_m = S \\
\varepsilon_1 \cap \varepsilon_2 \cap \dots \cap \varepsilon_m = \emptyset
\end{array}$ $\begin{array}{c}
\varepsilon_1 \cap \varepsilon_1 = \emptyset \\
\rho(\varepsilon_1 \cup \varepsilon_2 \cup \dots \cup \varepsilon_m) = \rho(s)
\end{array}$ $\begin{array}{c}
\rho(\varepsilon_1) + \rho(\varepsilon_2) + \dots + \rho(\varepsilon_m) = L
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\end{array}$

$$=) \underbrace{\rho(\xi_1) + \rho(\xi_2) + \dots + \rho}_{\text{g}}$$

• Statistical or Empirical definition of Probability: If an experiment is performed repeatedly under essentially homogeneous and identical conditions, then the limiting value of the ratio of the number of times the event occurs to the number of trials, as the number becomes indefinitely large, is called the probability of happening of the event, it being assumed that the limit is unique.

Q1: Two unbiased dice are thrown. Find the probability that total of the number on the dice is greater than 8.

$$S = d(1,1), (1,2), \dots, (6,6).$$

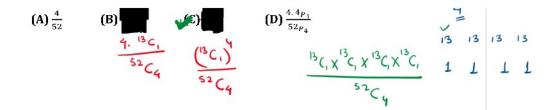
$$E = d(1,1), \dots, (6,6).$$

$$E = d(1,1)$$

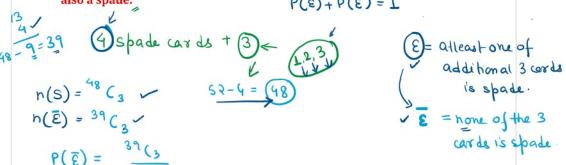
(A)
$$\frac{1}{9}$$
 (B) $\frac{5}{18}$ (C) $\frac{4}{9}$ (D) $\frac{11}{18}$

$$\phi = \frac{5}{18}$$

Q2. In shuffling a pack of cards, four are accidentally dropped, find the chance that the missing cards should be one from each suit.



Q3. A man is dealt 4 spade card from an ordinary pack of 52 cards. If he is given three more cards, find the probability that at least one of the additional cards is also a spade. L = (3) + (3) = L



$$\frac{\zeta_8(3)}{\zeta_8(3)} = 1 - \frac{39\zeta_3}{\zeta_8(3)} = 0.4718.$$

Q4. A committee of 4 people is to be appointed from 3 officers of the production department, 4 officers of the purchase department, 2 officers of sales department and 1 chartered accountant. Find the probability that the chartered accountant must be in the committee.

$$(A)^{\frac{2}{5}}$$
 $(B)^{\frac{13}{14}}$ $(C)^{\frac{4}{35}}$ $(D)^{\frac{1}{30}}$

(B)
$$\frac{13}{14}$$

(C)
$$\frac{4}{35}$$

(D)
$$\frac{1}{30}$$

$$h(\xi) = {}^{1}C_{1} \times {}^{9}C_{3}$$

$$= 1 \times \frac{91}{3161}$$

$$= {}^{3}9(...9.7)$$

$$= {}^{3}9(...9.7)$$

:.
$$P(E) = \frac{84}{210} = \frac{2}{5}$$

Q5. While naming of sections of CSE school of 2019 batch, find the following probabilities.

P(Both vowels):

(A)
$$\frac{5}{676}$$

(B)
$$\frac{25}{676}$$

(C)
$$\frac{235}{676}$$

(A)
$$\frac{5}{676}$$
 (B) $\frac{25}{676}$ (C) $\frac{235}{676}$ (D) $\frac{210}{676}$

P(Only one is vowel):

(A)
$$\frac{5}{676}$$

(B)
$$\frac{25}{676}$$

(A)
$$\frac{5}{676}$$
 (B) $\frac{25}{676}$ (C) $\frac{235}{676}$ (D) $\frac{210}{676}$

(D)
$$\frac{210}{676}$$

P(None is consonant):

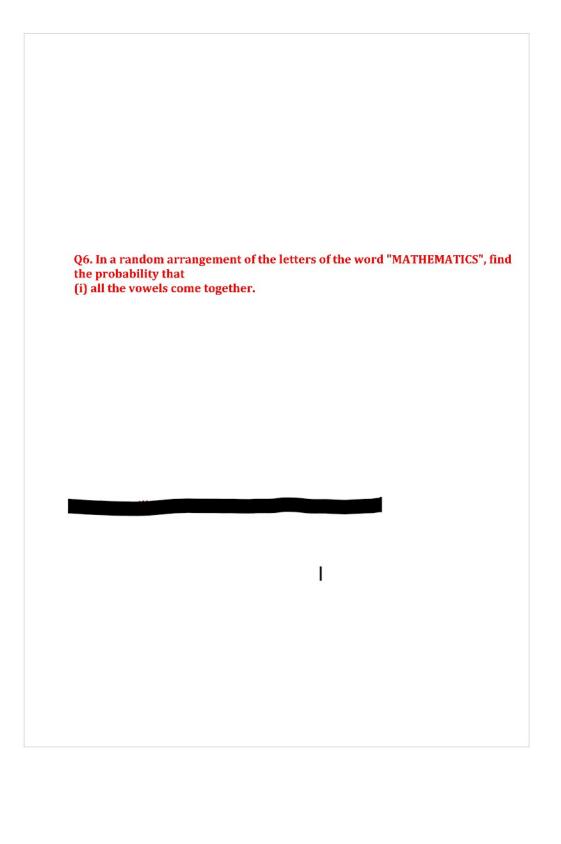
(A)
$$\frac{441}{676}$$

(A)
$$\frac{441}{676}$$
 (B) $\frac{348}{676}$ (C) $\frac{25}{676}$ (D) $\frac{210}{676}$

(C)
$$\frac{25}{676}$$

(D)
$$\frac{210}{676}$$

P(Both are consonants):



Q7. 10 gifts are to b first child should go (ii) One child shoul	oe distributed among 4 et exactly 3 gifts. d get exactly 3 gifts.	4 children. Find the	e probability that (