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ULTIMATE MATHEMATICS: BY AJAY MITTAL

CHAPTER

PROBABILITY

Class No: 1

(i) Trial / experiment : Tossing a coin

(ii) Event : getting head / tail

(iii) Event A, B, C, \dots

(iv) $P(A)$ = prob of occurrence of event A

(v) $P(A')$ = prob of not occurrence of event A

(vi) $P(A) + P(A') = 1$

(vii) Mutually exclusive events:

$$A \cap B = \phi \quad ; \quad P(A \cap B) = 0$$

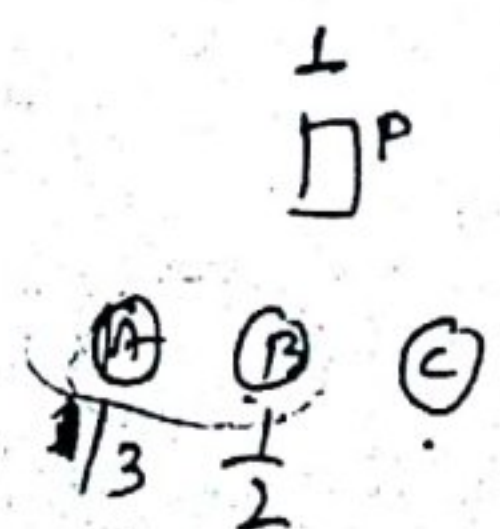
(viii) Exhaustive events

$$A \cup B = S \quad ; \quad P(A \cup B) = 1$$

(ix) Mutually exclusive and exhaustive events:

$$P(A) + P(B) + \dots = 1$$

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$$S = \left\{ \begin{array}{cccc} SH & 4H & 2H & 1H \\ ST & 4T & 2T & 1T \end{array} \right\}$$

Dice

2 dice : 6^2 $S = \{ (1,1), (1,2) \dots (6,6) \}$

3 dice : 6^3 $S = \{ (1,1,1), (1,1,2) \dots (6,6,6) \}$

Card - total cards = 52

✓ 2 colour ~~Red~~ Red = 26
Black = 26

✓ 4 Suits

diamond (R)	= 13
Heart (R)	= 13
Club (B)	= 13
Spade (B)	= 13
	52

✓ face card = 12

J Q K
(4) (4) (4)

nCr

Shortcuts

$nC_0 = 1$

$nC_1 = n$

$nC_2 = \frac{n(n-1)}{2}$

$nC_3 = \frac{n(n-1)(n-2)}{6}$

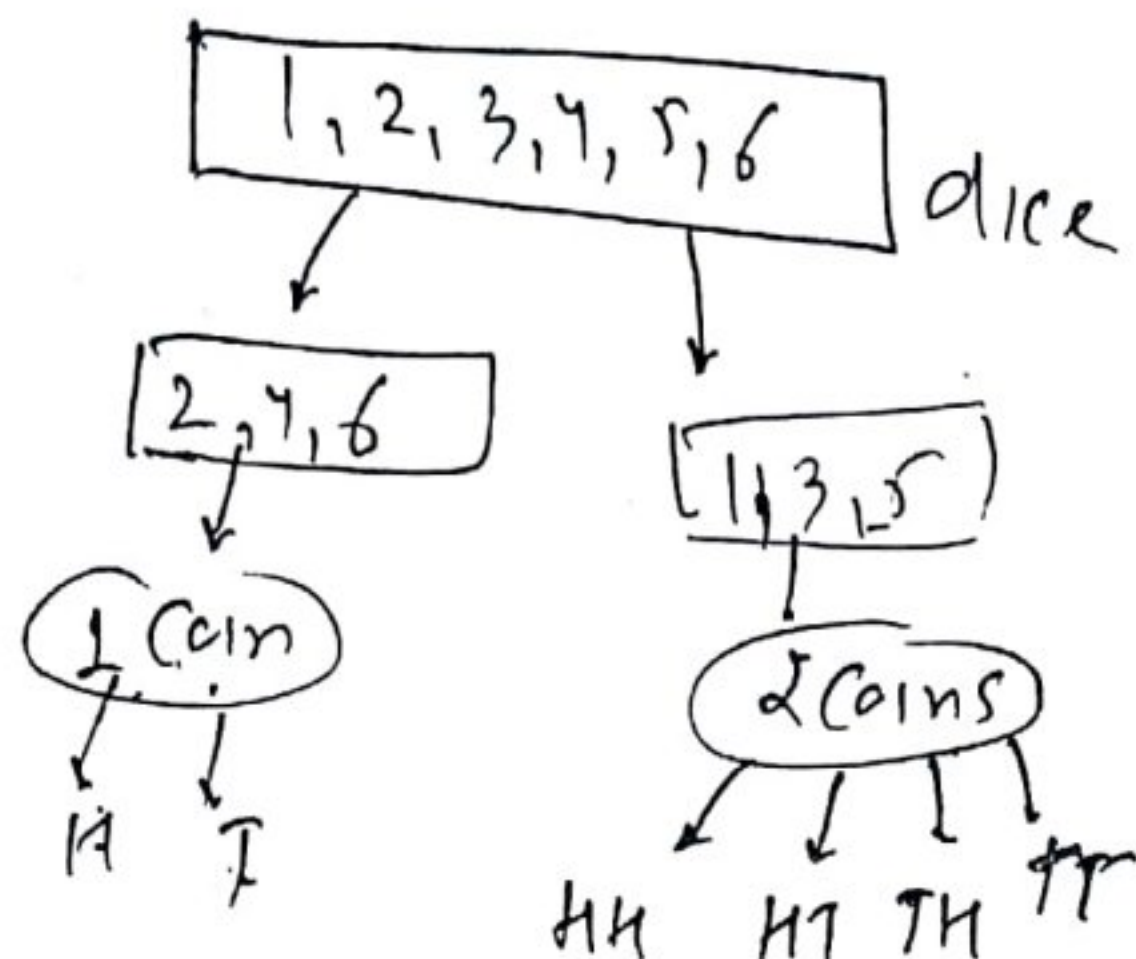
$nC_n = 1$

$nC_1 = nC_{n-1}$

$10C_8 = 10C_2$

Ques 1 An experiment consists of rolling a die and then tossing a coin once if the number on the die is even - if the number on the die is odd, the coin is tossed twice. Write the sample space. (3)

Soln



$$S = \{ (2, H), (2, T), (4, H), (4, T), (6, H), (6, T), (1, HH), (1, HT), (1, TH), (1, TT), (3, \dots), (5, \dots) \}$$

Ques 2 → A coin is tossed repeatedly until a head comes for the first time. Describe the sample space

Soln $S = \{ H, TH, TTH, TTTH, \dots \}$

Ques 3 A die is thrown repeatedly until a six comes up. Describe sample space

Soln $S = \{ 6, (1, 6), (2, 6), (3, 6), (4, 6), (5, 6), (1, 1, 6), (1, 2, 6), (1, 3, 6), (1, 4, 6), (1, 5, 6), (2, 1, 6), \dots \}$

(4)

Ques: 4 → From a group of 2 boys and 3 girls, two children are selected at random. Describe the events

- (i) A = both selected children are girls
- (ii) B = selected group consists of one boy & one girl
- (iii) C = at least one is boy

which pair(s) of events is (are) mutually exclusive?

Sol: $S = \{B_1 B_2, G_1 G_2, G_1 G_3, G_2 G_3, B_1 G_1, B_1 G_2, B_1 G_3, B_2 G_1, B_2 G_2, B_2 G_3\}$

$$A = \{G_1 G_2, G_2 G_3, G_1 G_3\}$$

$$B = \{B_1 G_1, B_1 G_2, B_1 G_3, B_2 G_1, B_2 G_2, B_2 G_3\}$$

$$C = \{B_1 G_1, B_1 G_2, B_1 G_3, B_2 G_1, B_2 G_2, B_2 G_3, B_1 B_2\}$$

$$A \cap B = \{ \} = \phi \quad \therefore A \& B \text{ are M-E events}$$

$$B \cap C = \{B_1 G_1, \dots\} \neq \phi \quad \therefore B \& C \text{ not M-E event.}$$

$$A \cap C = \{ \} = \phi \quad \therefore A \& C \text{ are M-E. events.}$$

Ques 5 → Three coins are tossed

A = getting three heads

B = getting two heads & one tail

C = getting three tails

D = getting a head on the first coin

- (1) which pairs of events are mutually exclusive?
- (2) which events are elementary events?
- (3) which events are compound events?

Soln $S = \{HHH, \dots, TTT\}$

$$A = \{HHH\}$$

$$B = \{HHT, HTH, THH\}$$

$$C = \{TTT\}$$

$$D = \{HHH, HTH, HTT, HHT\}$$

$$A \cap B = \emptyset$$

$$B \cap C = \emptyset$$

$$C \cap D = \emptyset$$

$$A \cap C = \emptyset$$

⋮

(2) A & C are elementary events

(3) B & D are compound events.

Qm 5 → A fair coin is tossed four times, and a person wins Rs 1 for each head and loses Rs 1.50 for each tail that turns up. From the sample space calculate how many different amounts of money you can have after four tosses and the probability of having each of these amounts.

Sam

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				Amount
H	H	H	H	+4
H	H	H	T	+1.5
H	H	T	H	+1.5
H	H	T	T	-1
H	T	H	H	+1.5
H	T	H	T	-1
H	T	T	H	-1
H	T	T	T	-3.5
T	H	H	H	+1.5
T	H	H	T	-1
T	H	T	H	-1
T	H	T	T	-3.5
T	T	H	H	-1
T	T	H	T	-3.5
T	T	T	H	-3.5
T	T	T	T	-6

$$S = \{ +4, +1.5, -1, -3.5, -6 \}$$

$$P(R \text{ 4 gain}) = 1/16$$

$$P(R \text{ 1.5 gain}) = 4/16$$

$$P(R \text{ 1 loss}) = 6/16$$

$$P(R \text{ 3.5 loss}) = 4/16$$

$$P(R \text{ 6 loss}) = 1/16$$

Ans

WORKSHEET NO: 1 (PROBABILITY) 11th May

Qns 1 A coin is tossed. If the result is a head, a die is thrown. If the die shows up an even number, the die is thrown again. What is the sample space of this experiment?

Qns 2 → An experiment consists of rolling a die and then tossing a coin once if the number on the die is even. If the number on the die is odd, the coin is tossed twice. Write sample space

Qns 3 → 2 boys and 2 girls are in room P and 1 boy 3 girls are in room Q. Write the sample space for the experiment in which a room is selected and then a person.

Qns 4 → An experiment consists of boy-girl composition of families with 2 children

(i) What is the sample space if we are interested in knowing whether it is a boy or girl in the order of their births?

(2) What is the sample space if we are interested in the number of boys in a family?

Qns 5 → A box contains 1 red and 3 black balls. Two balls are drawn at random in succession without replacement. write the sample space

Qns 6 → Two dice are thrown and the sum of the numbers which comes up on the dice is noted

A = the sum is even

B = sum is multiply 3

C = sum is less than 4

D = sum is greater than 11

which pairs of these events are mutually exclusive?

Qns 7 → Three coins are tossed. Describe

(i) two events A & B which are mutually exclusive

(ii) three events A, B & C which are mutually exclusive and exhaustive

(iii) two events A & B which are mutually exclusive but not exhaustive

Qns 8 → find the probability that a leap year, selected at random, will contain

(i) 53 Sundays

(ii) 53 Sundays & 53 Mondays