

Answer Key Table

Dhruv Parashar - EE22BTECH11019*

Question:- If the letters of the word ASSASSINATION are arranged at random. Find the Probability that

- (a) Four $S's$ come consecutively in the word
- (b) Two $I's$ and two $N's$ come together
- (c) All $A's$ are not coming together
- (d) No two $A's$ are coming together

Solution: Number of letters in word 'ASSASSINATION' = 13

Letter's are $3A's, 4S's, 2I's, 2N's, 1T's$ and $1O's$

$$\text{Total ways of arranging letters} = \frac{13!}{3!4!2!2!} \quad (1)$$

| Random variable | values | Events |
|-----------------|--------|------------------------------------|
| X | 0 | All $S's$ are together |
| | 1 | All $S's$ are not together |
| Y | 0 | $2I's$ and $2N's$ are together |
| | 1 | $2I's$ and $2N's$ are not together |
| Z | 0 | All $A's$ together |
| | 1 | Only $2A's$ are together |
| | 2 | No $2A's$ are together |

(a)

$$p_X(0) = \frac{\frac{10!}{3!2!2!}}{\frac{13!}{3!4!2!2!}} \quad (2)$$

$$= \frac{2}{143} \quad (3)$$

(b)

$$p_Y(0) = \frac{\frac{10!4!}{3!4!2!2!}}{\frac{13!}{3!4!2!2!}} \quad (4)$$

$$= \frac{2}{143} \quad (5)$$

(c)

$$p_Z(0) = \frac{\frac{11!}{4!2!2!}}{\frac{13!}{3!4!2!2!}} \quad (6)$$

$$= \frac{1}{26} \quad (7)$$

Probability of all A 's not coming together:

$$p_Z(1) + p_Z(2) = 1 - p_Z(0) \quad (8)$$

$$= 1 - \frac{1}{26} \quad (9)$$

$$= \frac{25}{26} \quad (10)$$

(d)

$$p_Z(2) = \frac{\frac{11!10!}{3!8!4!2!2!}}{\frac{13!}{3!4!2!2!}} \quad (11)$$

$$= \frac{15}{26} \quad (12)$$