Answer Key Table

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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 $1O's$

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

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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)

$$p_X(1) = \frac{\frac{10!}{3!2!2!}}{\frac{13!}{3!4!2!2!}} \tag{2}$$

$$= \frac{2}{143} \tag{3}$$

(b)

$$p_Y(1) = \frac{\frac{10!4!}{3!4!2!2!}}{\frac{13!}{3!4!2!2!}} \tag{4}$$

$$= \frac{2}{143} \tag{5}$$

(c)

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

$$= \frac{1}{26} \tag{7}$$

Probability of all $A's$ not coming together:

$$p_Z(1) + p_Z(2) = 1 - p_Z(0) \tag{8}$$

$$= 1 - \frac{1}{26} \tag{9}$$

$$= \frac{25}{26} \tag{10}$$

(d)

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

$$= \frac{15}{26} \tag{12}$$