Assignment: Probability

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13.4.3 [1]Let X represent the difference between the number of heads and the number of tails obtained when a coin is tossed 6 times. What are possible values of X?

Solution:

Variable	Value	Description
n	6	Number of trails
p_1	$\frac{1}{2}$	Probability of getting a head
q_1	$1-p_1$	Probability of not getting a head
p_2	$\frac{1}{2}$	Probability of getting a tail
q_2	$1-p_2$	Probability of not getting a tail
X	$\{0,1,2,3,4,5,6\}$	No.of heads in 6 tosses of a coin

Table 13.4.3.2: Variable description.

(a) Number of heads in 6 tosses of a coin.
By using Binomial distribution

$$\Pr(X) = {}^{n}C_X p_1^X q_1^{n-X} \tag{13.4.1.1}$$

X	0	1	2	3	4	5	6
$\Pr(X)$	$\frac{1}{64}$	$\frac{6}{64}$	$\frac{15}{64}$	$\frac{20}{64}$	$\frac{15}{64}$	$\frac{6}{64}$	$\frac{1}{64}$

Table 13.4.1.4: Probability distribution of X.

(b) Number of tails in 6 tosses of a coin.
By using Binomial distribution

$$\Pr(X) = {}^{n}C_X p_2^X q_2^{n-X} \tag{13.4.2.2}$$

X	0	1	2	3	4	5	6
$\Pr(X)$	$\frac{1}{64}$	$\frac{6}{64}$	$\frac{15}{64}$	$\frac{20}{64}$	$\frac{15}{64}$	$\frac{6}{64}$	$\frac{1}{64}$

Table 13.4.2.6: Probability distribution of X.

$\implies$ A coin is tossed 6 times and X represents the difference between the number of heads and the number of tails.Y $= \{0, 1\}$ represents the head and tail.

Random Variable	**Outcome**
Y = 0	Head
Y = 1	Tail

Table 13.4.2.8: Outcomes of Random Variable.

$$X(60, 01) = |6 - 0| = 6 \tag{13.4.2.3}$$
$$X(50, 11) = |5 - 1| = 4 \tag{13.4.2.4}$$
$$X(40, 21) = |4 - 2| = 2 \tag{13.4.2.5}$$
$$X(30, 31) = |3 - 3| = 0 \tag{13.4.2.6}$$
$$X(20, 41) = |2 - 4| = 2 \tag{13.4.2.7}$$
$$X(10, 51) = |1 - 5| = 4 \tag{13.4.2.8}$$
$$X(00, 61) = |0 - 6| = 6 \tag{13.4.2.9}$$

Thus, the possible values of X are 0,2,4 and 6.

[1]Read question numbers as (CHAPTER NUMBER).(EXERCISE NUMBER).(QUESTION NUMBER)