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CS-355

HW #4

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1. Ans:- Those rolls with a sum of 11 are:-

1, 5, 5 [with 3 permutations]
1, 4, 6 [with 6 permutations]
2, 3, 6 [with 6 permutations]
2, 4, 5 [with 6 permutations]
3, 3, 5 [with 3 permutations]
3, 4, 4 [with 3 permutations]

Thus, there are $\overset{(3+6+6+6+3+3)}{27}$ ways to produce a sum of 11.

Those rolls with a sum of 12 are:-

1, 5, 6 [with 6 permutations]
2, 5, 5 [with 3 permutations]

2, 4, 6 [with 6 permutations]
3, 4, 5 [with 6 permutations]
3, 3, 6 [with 3 permutations]
4, 4, 4 [with 1 permutation]

∴ There are (6+3+6+6+3+1) = 25 ways to produce a sum of 12.

Since, 27 > 25, a sum of 11 is more probable.

2. Ans:-
```
import math
def f(x):
    return math.sin(x) * math.cos(x)

def num_integra(f, a, b, num):
    h = (b-a)/num
    x = [a+ i*h for i in range(num+1)]
    y = [f(x[i]) for i in range(num+1)]
    return h * (sum(y) - 0.5 * (y[0] + y[num]))

a = 0
b = 4 * math.pi
num = 1000
area = num_integra(f, a, b, num)
if area < 0:
    area = -area
print("Approximate area:", area)
```

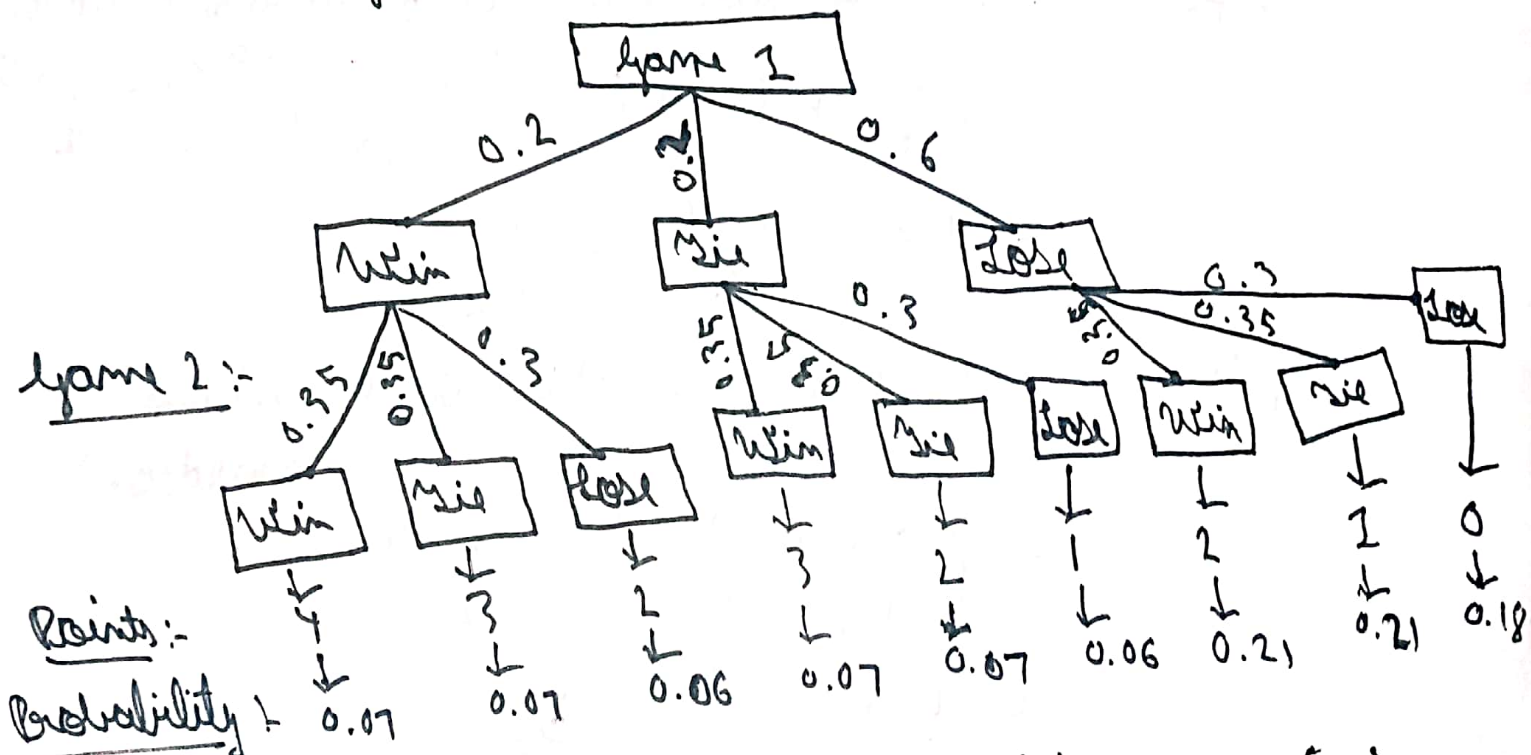
3. Ans:- Probability of not ~~l~~ losing the first game = 0.4
Probability of not losing the second game = 0.7

So, probability of losing the first game and second game is $(1-0.4) = 0.6$ and $(1-0.7) = 0.3$ respectively.

As the team is equally likely to win or tie in any game, so:-

$P(\text{win}) = P(\text{tie}) = 0.2$ for first game
$P(\text{win}) = P(\text{tie}) = 0.35$ for second game

$\therefore$ We can create the following probability tree diagram:-



So, PMF of ~~x~~ the number of points earned 'X' is:-

$$P(X=x) = \begin{cases} 0.18 \ \dots\dots & \text{for } x=0 \\ 0.27 \ \dots\dots & \text{for } x=1 \\ 0.34 \ \dots\dots & \text{for } x=2 \\ 0.14 \ \dots\dots & \text{for } x=3 \\ 0.07 \ \dots\dots & \text{for } x=4 \end{cases}$$

- Supporting SharePoint And database Activities
- Worked on Incident Management and Change Management through service now.

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4. Ans:- Total number of children in the family = 7
Let X be a random variable denoting the number of girl children in the family.
Then the sample space of the random variable X is given by $R_X = \{2, 3, 4, 5, 6, 7\}$
Let p be the probability that each natural child is a girl. i.e. = $p = \frac{1}{2}$

$P(X=2) = P$ (no girl child in 5 natural children)

$$= \binom{5}{0} p^0 (1-p)^5 = \binom{5}{0}\left(\frac{1}{2}\right)^0\left(1-\frac{1}{2}\right)^5$$

$$= 1 \times 1 \times \left(\frac{1}{2}\right)^5 = \frac{1}{32}$$

$P(X=3) = P$ (one girl child in 5 natural children)

$$= \binom{5}{1}\left(\frac{1}{2}\right)^1\left(1-\frac{1}{2}\right)^4$$

$$= 5 \times \left(\frac{1}{2}\right)^5 = \frac{5}{32}$$

$P(X=4) = P$ (two girl children in 5 natural children)

$$= \binom{5}{2}\left(\frac{1}{2}\right)^2\left(1-\frac{1}{2}\right)^3$$

$$= 10 \times \left(\frac{1}{2}\right)^5 = \frac{10}{32}$$

$P(X=5) = P(\text{three girl children in 5 natural children})$

$= \binom{5}{3}\left(\frac{1}{2}\right)^3\left(1-\frac{1}{2}\right)^2$

$= 10 \times \left(\frac{1}{2}\right)^5 = \frac{10}{32}$

$P(X=6) = P(\text{four girl children in 5 natural children})$

$= \binom{5}{4}\left(\frac{1}{2}\right)^4\left(1-\frac{1}{2}\right)^1$

$= 5 \times \left(\frac{1}{2}\right)^5 = \frac{5}{32}$

$P(X=7) = P(\text{5 girl children in 5 natural children})$

$= \binom{5}{5}\left(\frac{1}{2}\right)^5\left(1-\frac{1}{2}\right)^0$

$= 1 \times \frac{1}{32} = \frac{1}{32}$

Thus, the pmf of the random variable X is given by

X	2	3	4	5	6	7
$P(X)$	$\frac{1}{32}$	$\frac{5}{32}$	$\frac{10}{32}$	$\frac{10}{32}$	$\frac{5}{32}$	$\frac{1}{32}$

5. Ans: Let Probability of X, $P(X=k) = \frac{1}{10}$

$= 0.1,\ k = 0, 1, 2, \ldots, 9$

X	0	1	2	3	4	5	6	7	8	9
$P(X)$	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1

(a) Let $Y = X \bmod (3)$

Hence the values of Y for all values of X is :-

X	0	1	2	3	4	5	6	7	8	9
Y	0	1	2	0	1	2	0	1	2	0

∴ Possible values of Y are 0, 1 & 2.

Finding the probability of Y for all its values :-

Let $Y = 0$,

$$P(Y=0) = P(X=0) + P(X=3) + P(X=6) + P(X=9)$$
$$= 0.1 + 0.1 + 0.1 + 0.1$$
$$= 0.4$$

Let $Y = 1$,

$$P(Y=1) = P(X=1) + P(X=4) + P(X=7)$$
$$= 0.1 + 0.1 + 0.1$$
$$= 0.3$$

Let $Y = 2$,

$$P(Y=2) = P(X=2) + P(X=5) + P(X=8)$$
$$= 0.1 + 0.1 + 0.1$$
$$= 0.3$$

Hence, Probability of mass function of Y is:-

Y	0	1	2
P(Y)	0.4	0.3	0.3

(b) Let $Y = 5 \bmod (X+1)$

Hence the values of Y for all values of X :-

X	0	1	2	3	4	5	6	7	8	9
$X+1$	1	2	3	4	5	6	7	8	9	10
Y	0	1	2	1	0	5	5	5	5	5

$\therefore$ Possible values of Y are 0, 1, 2 and 5.

[redacted] Finding the probability of Y for all its values :-

Let $Y=0$,

$$P(Y=0) = P(X=0) + P(X=4)$$
$$= 0.1 + 0.1$$
$$= 0.2$$

Let $Y=1$,

$$P(Y=1) = P(X=1) + P(X=3)$$
$$= 0.1 + 0.1$$
$$= 0.2$$

Let $Y=2$,

$$P(Y=2) = P(X=2)$$
$$= 0.1$$

Let $Y=5$,

$$P(Y=5) = P(X=5) + P(X=6) + P(X=7) + \text{[redacted]}\ P(X=8) + P(X=9)$$
$$= 0.1 + 0.1 + 0.1 + 0.1 + 0.1$$
$$= 0.5$$

Hence, Probability mass function of Y :-

Y	0	1	2	5
P(Y)	0.2	0.2	0.1	0.5