Session 9

Assignment 1

Task 1:

1. You survey households in your area to find the average rent they are paying. Find the standard deviation from the following data:

$1550, $1700, $900, $850, $1000, $950

Solution:

Step 1: Calculate Mean of sample
Mean = (1550+1700+900+850+1000+950) / 6 = **$1,158.33**
Step 2: Calculate X_i – Mean
Step 3: Calculate $(X_i – Mean)^2$
Step 4: Calculate Sum $([X_i – Mean]^2)$
Step 5: Calculate Sum $([X_i – Mean]^2) / [n – 1])$

$$s^2 = \frac{\sum (X - \bar{X})^2}{N-1}$$
$s^2 \rightarrow$ Variance

(This is the **Variance**)

Step 6: Calculate SQRT {Sum $([X_i – Mean]^2) / [n – 1])$}

$$s = \sqrt{\frac{\sum (x - \bar{x})^2}{n-1}}$$
$s \rightarrow$ Standard Deviation

(This is the **Standard Deviation**)

As per the sample,

Mean = $1,158.33
Standard Deviation = $367.99

X_i (Rent)	X_i – Mean	$(X_i - Mean)^2$
$1,550.00	$391.67	$153,405.39
$1,700.00	$541.67	$293,406.39
$900.00	– $258.33	$66,734.39
$850.00	– $308.33	$95,067.39
$1,000.00	– $158.33	$25,068.39
$950.00	– $208.33	$43,401.39

Mean	**$1,158.33**
Sum$((X_i - Mean)^2)$	$677,083.34
Sum$((X_i - Mean)^2)$/(n-1) **Variance**	**$135,416.67**
SQRT(Sum$((X_i - Mean)^2)$/(n-1)) **Standard Deviation**	**$367.99**

2. Find the variance for the following set of data representing trees in California (heights in feet):

3, 21, 98, 203, 17, 9

Solution:

Step 1: Calculate Mean for sample data
(3+21+98+203+17+9) / 6 = **58.5**

Step 2: Calculate X_i – Mean
Step 3: Calculate $(X_i - Mean)^2$
Step 4: Calculate Sum $([X_i - Mean]^2)$
Step 5: Calculate Sum $([X_i - Mean]^2 / [n - 1])$

$$s^2 = \frac{\sum (X - \bar{X})^2}{N-1}$$
$$S^2 = \text{Variance}$$

(This is the **Variance** of the sample)

As per the sample,

Mean = 58.5
Variance = 6219.9

X$_i$ (Height)	X$_i$ – Mean	(X$_i$ – Mean)^2
3	-55.5	3080.25
21	-37.5	1406.25
98	39.5	1560.25
203	144.5	20880.25
17	-41.5	1722.25
9	-49.5	2450.25

Mean	**58.5**
Sum((X$_i$ – Mean)^2)	31099.5
Sum((X$_i$ – Mean)^2) / (n-1) **Variance**	**6219.9**

3. In a class on 100 students, 80 students passed in all subjects, 10 failed in one subject, 7 failed in two subjects and 3 failed in three subjects. Find the probability distribution of the variable for number of subjects a student from the given class has failed in.

Solution:

For a random student,

The probability of failing in 0 subjects, P(X=0) = 0.8

The probability of failing in 1 subjects, P(X=1) = 0.1

The probability of failing in 2 subjects, P(X=2) = 0.07

The probability of failing in 3 subjects, P(X=3) = 0.03

The probability distribution can be shown as:

X	0	1	2	3
P(X)	0.8	0.1	0.07	0.03

Task 2:

1. A test is conducted which is consisting of 20 MCQs (multiple choices questions) with every MCQ having its four options out of which only one is correct. Determine the probability that a person undertaking that test has answered exactly 5 questions wrong.

Solution:

n = 20
k = 20 - 5 = 15
n – k = 5

The probability of success = probability of giving a right answer = s = 1/4

Hence, probability of failure = probability of giving a wrong answer
= 1 – s
= 1 – 1/4
= 3/4

Substitute the values in the formula for Binomial distribution,

So, P (exactly 5 out of 20 answers incorrect) = C (20, 5) * (1 / 4) 15 * (3 / 4) 5

P (5 out of 20) = ((20 * 19 * 18 * 17 * 16) / (5 * 4 * 3 * 2 * 1)) * (1 / 4) 15 * (3 / 4) 5

= 0.0000034

Therefore, the required probability is **0.0000034** approximately.

2. A die marked A to E is rolled 50 times. Find the probability of getting a "D" exactly 5 times.

Solution:

n = 50, k = 5, n - k = 45

The probability of success = probability of getting a "D" = s = 1/5

Hence, the probability of failure = probability of not getting a "D" = 1 – s = 4/5

C (50, 5) * (1/5) 5 * (4/5)45 = **0.0295** times approximately

3. Two balls are drawn at random in succession without replacement from an urn containing 4 red balls and 6 black balls.
Find the probabilities of all the possible outcomes.

Solution:

Given,

Total number of black balls = 6

Total number of red balls = 4

P (drawing a black ball) = 6/10 = 3/5

P (drawing a red ball) = 4/10 = 2/5

Probability of all possible outcomes = 3/5*2/5+3/5*3/5+2/5*2/5 = **0.76**