Experiment-1

Aim :-To calculate the Mean height of the students of class.

Introduction :-

The tendency of the distribution is known as its Central tendency and the measures devised to consider this tendency are known as measures of Central tendency.

The most familiar and widely used measure of Central tendency is the arithmetic mean . It represents the entire data by one value which is obtained by adding together all the values and dividing this by the number of observations.

$$\text{Arithmetic Mean} = \frac{\text{Sum of all observations}}{\text{Total number of observation}}$$

Procedure :-

Step 1 - Gather all the height measurements for all the students in the class.

Step-2 - Sum all the height measurements. (Variates -X)

Sum = (X1 + X2 + X3 +……+ Xn)

Step-3 - Divide the sum by the total number of observations.

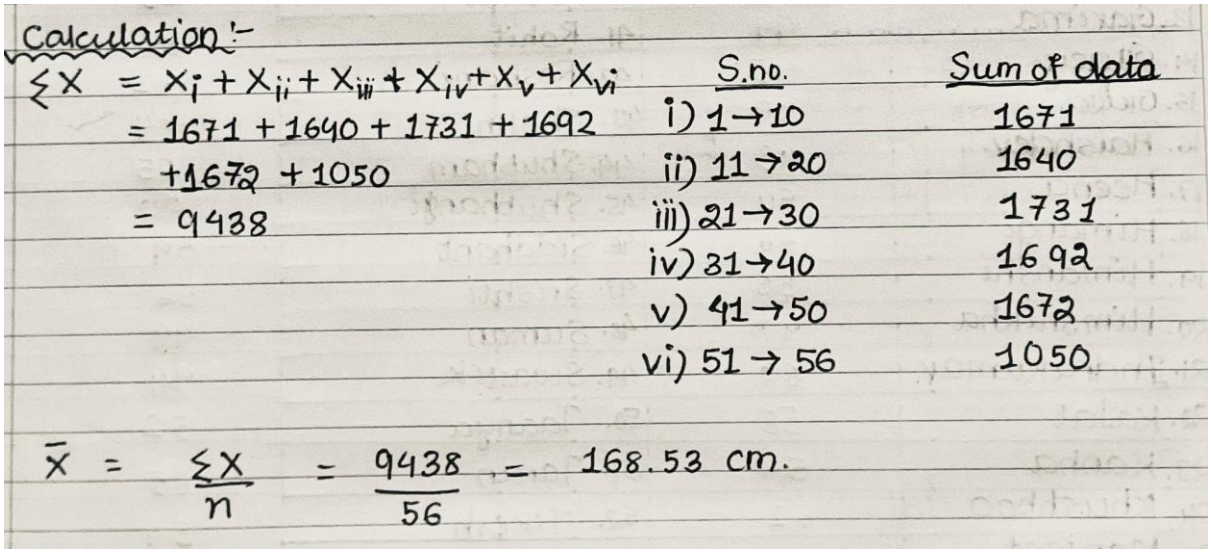
$$\text{Mean } (\bar{X}) = \frac{x_1 + x_2 + x_3 + \cdots\cdots + x_n}{n} = \frac{\Sigma x}{n}$$

Observation :-

Observation :-

S. No.	Name of the students	Height (in cm)	S. No.	Name of the students.	Height (in cm)
1	Aadya	165	29	Nikesh	175
2	Aakash	170	30	Nilesh	170
3	Abhay	165	31	Onkar	171
4	Abhishek	168	32	Pallavi	168
5	Akansha	165	33	Prashant	177
6	Alka	165	34	Purbasha	168
7	Anuradha	164	35	Purvi	166
8	Arun	178	36	Rahul	168
9	Aryan	162	37	Rajesh	170
10	Deepshikha	169	38	Rectika	164
11	Farhat	162	39	Rhitu	172
12	Gajendra	170	40	Ritika	168
13	Garima	168	41	Rohit	185
14	Gracy	156	42	Roshani	165
15	Gunja	156	43	shalini	160
16	Harshdev	165	44	Shubham	174
17	Heena	168	45	Shubhangi	162
18	Himangi	165	46	Siddhant	171
19	Himanshi	166	47	Srishti	158
20	Himshikha	164	48	Suman	158
21	Indra Kumar	182	49	Swastik	171
22	Kajal	168	50	Taanya	168
23	Kanha	165	52	Tarun	175
24	Khushboo	168	52	Tikesh	174
25	Manjeet	182	53	Vasundhara	172
26	Mansi	162	54	Vikash	175
27	Michael	176	55	Vinay	178
28	Mihir	165	56	Yash.	176.

Calculation :-



Result :-

So the calculated mean height of the students of the class is 168.53 cm.

Experiment- 2

Aim :-To calculate the Mean weight of the students of class.

Introduction :-

The tendency of the distribution is known as its Central tendency and the measures devised to consider this tendency are known as measures of Central tendency.

The most familiar and widely used measure of Central tendency is the arithmetic mean . It represents the entire data by one value which is obtained by adding together all the values and dividing this by the number of observations.

$$\text{Arithmetic Mean} = \frac{\text{Sum of all observations}}{\text{Total number of observation}}$$

Procedure :-

Step 1 - Gather all the weight measurements for all the students in the class.

Step-2 - Sum all the height measurements. (Variates -X)

Sum = (X1 + X2 + X3 +……+ Xn)

Step-3 - Divide the sum by the total number of observations.

$$\text{Mean } (\bar{X}) = \frac{x_1 + x_2 + x_3 + \cdots\cdots + x_n}{n} = \frac{\Sigma x}{n}$$

Observation :-

Name of Students	Weight (in kg)	Name of students	Weight (in kg)
1. Aadya	45	29. Nikesh	65
2. Aakash	93	30. Nilesh	68
3. Abhay	72	31. Onkar	64
4. Abhishek	56	32. Pallavi	53
5. Akansha	50	33. Prashant	81
6. Alka	45	34. Purbasha	64
7. Anuradha	46	35. Purvi	48
8. Arun	76	36. Rahul	75
9. Aryan	50	37. Rajesh	52
10. Deepshikha	60	38. Reetika	54
11. Farhat	47	39. Rhitu	64
12. Gajendra	55	40. Ritika	65
13. Garima	99	41. Rohit	85
14. Gracy	45	42. Roshani	52
15. Gulja	39	43. Shalini	64
16. Harshdev	43	44. Shubham	65
17. Heena	60	45. Shubhangi	50
18. Himangi	46	46. Siddhant	59
19. Himanshi	56	47. Srishti	56
20. Himshikha	47	48. Suman	49
21. Indrakumar	62	49. Swastik	94
22. Kajal	58	50. Taanya	52
23. Kanha	54	51. Tarun	85
24. Khushboo	52	52. Tikesh	54
25. Manjeet	83	53. Vasundhara	68
26. Mansi	55	54. Vikash	60
27. Michael	87	55. Vinay	77
28. Mihir	53	56. Yash.	59

Calculation :-

Calculation :-

$\Sigma X = X_i + X_{ii} + X_{iii}$

$= 1080 + 1257 + 1029$

$= 3366$

S.No.	Sum of data
(i) 1 → 20	1080
(ii) 21 → 40	1257
(iii) 41 → 56	1029

$\bar{X} = \frac{\Sigma X}{n} = \frac{3366}{56} = 60.10 \text{ kg}$

Result :-

So the calculated mean weight of the students of the class is 60.10 kg .

Experiment- 3

Aim :-To calculate the Mean height of the students of class by using class intervals . (continuous series method)

Introduction :-

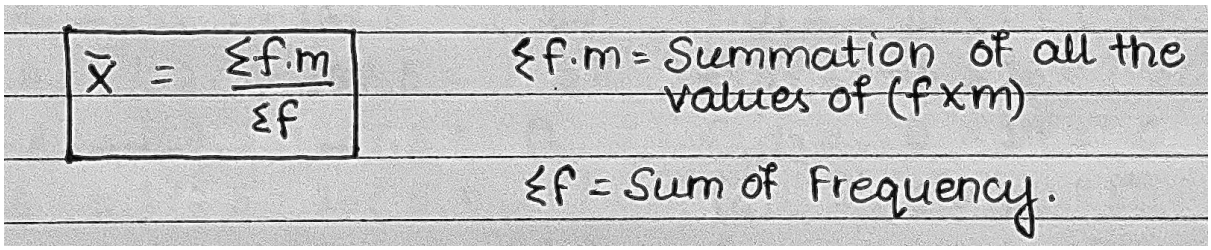
In a continuous series, the arithmetic mean may be calculated after taking into consideration the midpoint of various classes. However, the method will be the same for both inclusive class intervals and exclusive class intervals.

Procedure :-

There are two methods, i.e. direct method and shortcut method

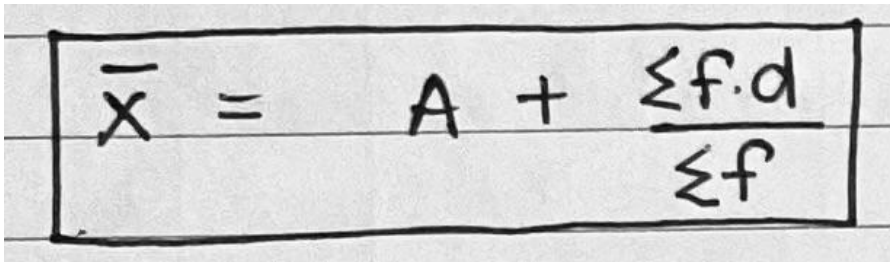
DIRECT METHOD

Step-1: Make class intervals from raw data and write their (f) frequencies also.
Step2 : Find the mid value of each class (m).
Step3: Individually multiple the Frequency with the respective mid value (f.m)
Step4: Find the product of the Frequency (sum of f).
Step-5: Find the product of the (f.m) [sum of f.m]
Step-6: By using formula, calculate the Mean



Shortcut Method

Step-1: Make class intervals from raw data and write their (f) frequencies.
Step-2: Find the mid value of each class (m).
Step-3: Calculate the deviation for each class .
[deviation (d) = Mid Value (m) - Assumed mean (A)]
(Assumed mean should be taken from mid value)
Step-4: Multiply the deviation with respective frequency (f.d)
Step-5: By using formula, calculate the Mean



Observation :-

* Observation Table :- (Direct Method).

S.no.	Class Interval (CI)	Frequency (f)	(m) Midvalue	f.m.
1.	155-160 cm.	4	157.5	630
2.	160-165 cm.	16	162.5	2600
3.	165-170 cm.	19	167.5	3182.5
4.	170-175 cm.	10	172.5	1725
5.	175-180 cm.	4	177.5	710
6.	180-185 cm.	3	182.5	547.5
		$\Sigma f = 56$.		$\Sigma f.m = 9395$

* Observation Table :- (Shortcut Method)

Class Interval (CI)	(f) frequency	(m) midvalue	$d = (m - A)$	f.d.
155-160 cm.	4	157.5	157.5-167.5 = (-10)	-10 × 4 = (-40)
160-165 cm.	16	162.5	162.5-167.5 = (-5)	-5 × 16 = (-80)
165-170 cm.	19	167.5	167.5-167.5 = 0	0 × 19 = 0
170-175 cm.	10	172.5	172.5-167.5 = 5	5 × 10 = 50
175-180 cm.	4	177.5	177.5-167.5 = 10	4 × 10 = 40
180-185 cm.	3	182.5	182.5-167.5 = 15	15 × 3 = 45
	$\Sigma f = 56$			$\Sigma f.d = 15$

Calculation :-

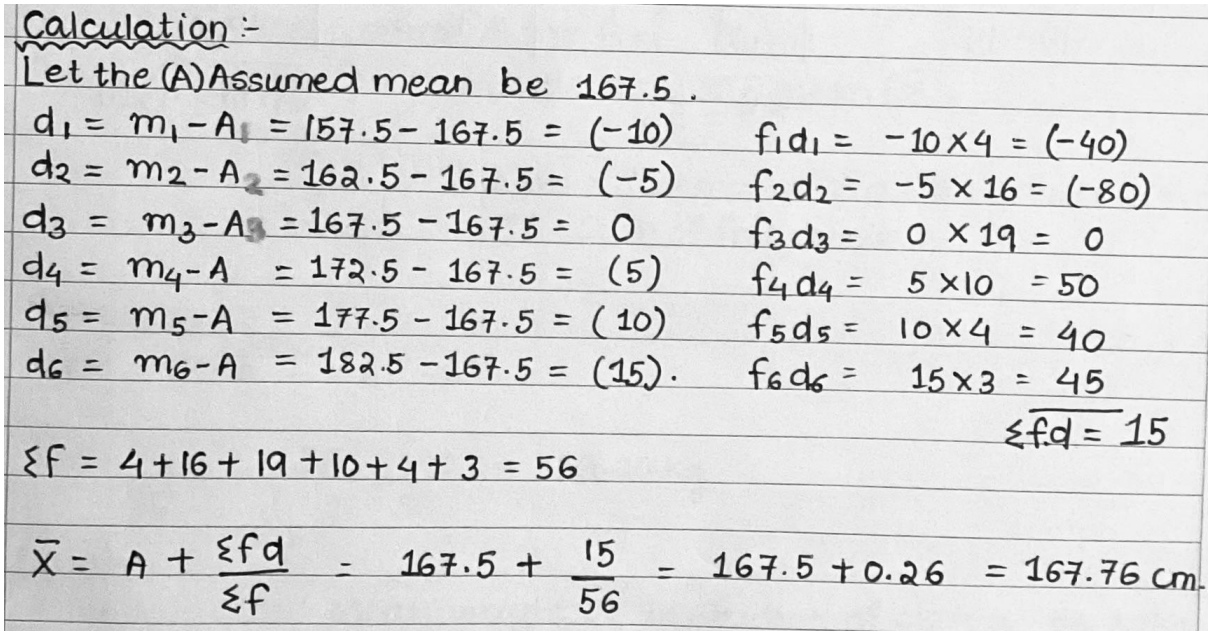
Direct method calculation

Calculation :-

$\Sigma f.m = 9395$, $\Sigma f = 56$

$$\bar{x} = \frac{\Sigma fm}{\Sigma f} = \frac{9395}{56} = 167.76 \text{ cm.}$$

Shortcut method calculation



Result :-

So the calculated mean height of the students of the class is 167.76 cm.

Experiment- 4

Aim :-To calculate the Mean weight of the students of class by using class intervals . (continuous series method)

Introduction :-

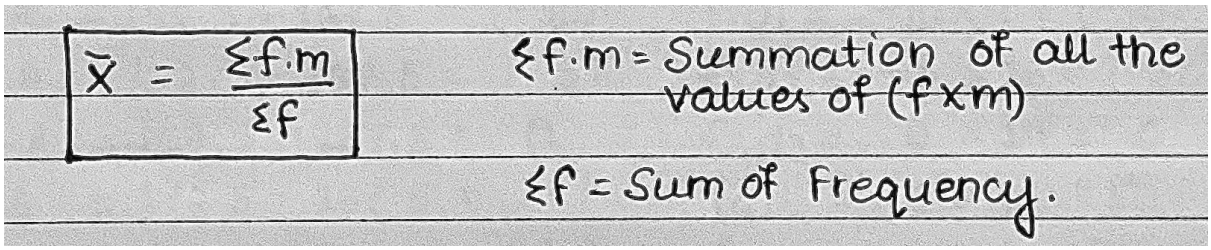
In a continuous series, the arithmetic mean may be calculated after taking into consideration the midpoint of various classes. However, the method will be the same for both inclusive class intervals and exclusive class intervals.

Procedure :-

There are two methods, i.e. direct method and shortcut method

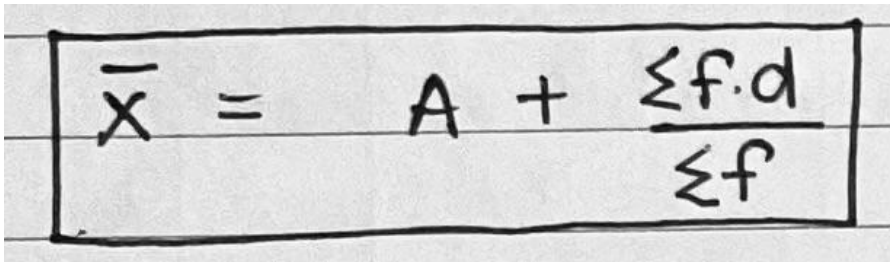
DIRECT METHOD

Step-1: Make class intervals from raw data and write their (f) frequencies also.
Step2 : Find the mid value of each class (m).
Step3: Individually multiple the Frequency with the respective mid value (f.m)
Step4: Find the product of the Frequency (sum of f).
Step-5: Find the product of the (f.m) [sum of f.m]
Step-6: By using formula, calculate the Mean

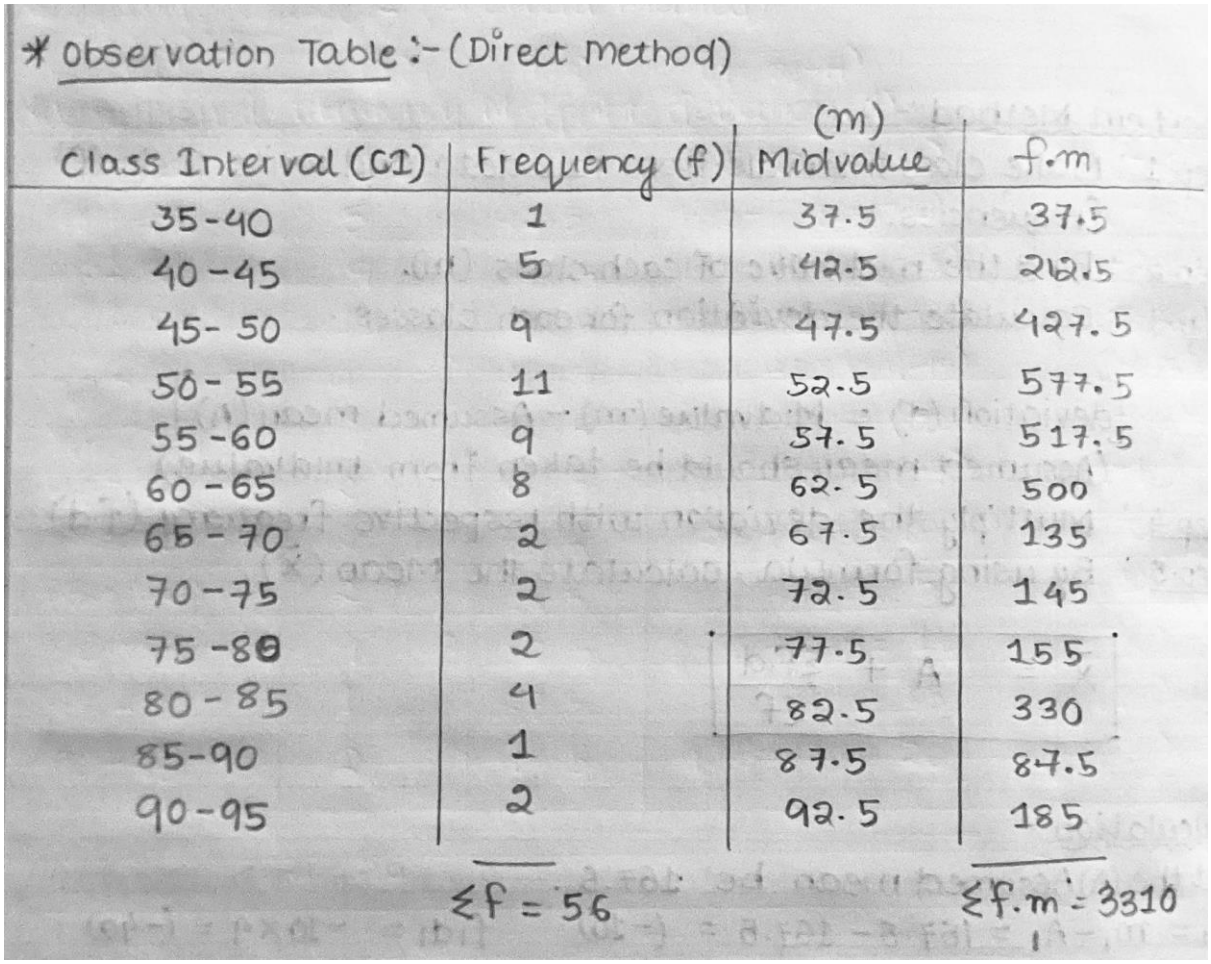


Shortcut Method

Step-1: Make class intervals from raw data and write their (f) frequencies.
Step-2: Find the mid value of each class (m).
Step-3: Calculate the deviation for each class .
[deviation (d) = Mid Value (m) - Assumed mean (A)]
(Assumed mean should be taken from mid value)
Step-4: Multiply the deviation with respective frequency (f.d)
Step-5: By using formula, calculate the Mean



Observation :-



* Observation Table :- (Direct Method)

Class Interval (CI)	Frequency (f)	(m) Midvalue	f.m
35-40	1	37.5	37.5
40-45	5	42.5	212.5
45-50	9	47.5	427.5
50-55	11	52.5	577.5
55-60	9	57.5	517.5
60-65	8	62.5	500
65-70	2	67.5	135
70-75	2	72.5	145
75-80	2	77.5	155
80-85	4	82.5	330
85-90	1	87.5	87.5
90-95	2	92.5	185
	$\Sigma f = 56$		$\Sigma f.m = 3310$

Observation Table :- (Shortcut Method)

(CI) Class Interval	(f) frequency	(m) Mid-point	(d = m - A) deviation (d)	f.d
35 - 40	1	37.5	37.5 - 72.5 = (-35)	(-35)
40 - 45	5	42.5	42.5 - 72.5 = (-30)	(-150)
45 - 50	9	47.5	47.5 - 72.5 = (-25)	(-225)
50 - 55	11	52.5	52.5 - 72.5 = (-20)	(-220)
55 - 60	9	57.5	57.5 - 72.5 = (-15)	(-135)
60 - 65	8	62.5	62.5 - 72.5 = (-10)	(-80)
65 - 70	2	67.5	67.5 - 72.5 = (-5)	(-10)
70 - 75	2	72.5	72.5 - 72.5 = 0	0
75 - 80	2	77.5	77.5 - 72.5 = 5	(10)
80 - 85	4	82.5	82.5 - 72.5 = 10	(40)
85 - 90	1	87.5	87.5 - 72.5 = 15	(15)
90 - 95	2	92.5	92.5 - 72.5 = 20	(40)
	$\Sigma f = 56$			$\Sigma f.d = (-750)$

Calculation :-

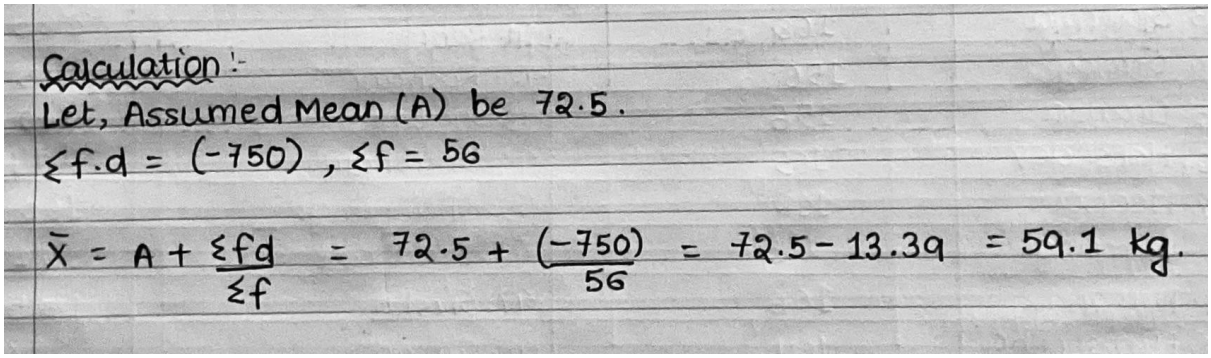
Direct method calculation

Calculation :-

$\Sigma f.m = 3495$ ~~3495~~ 3310, $\Sigma f = 56$

$\bar{x} = \frac{\Sigma f.m}{\Sigma f} = \frac{3310}{56} = 59.10$ Kg.

Shortcut method calculation



Result :-

So the calculated mean weight of the students of the class is 59.10 kg .

Experiment- 5

Aim :-To calculate the Median height of the students of class from raw data .

Introduction :-

The median is another important and widely used measure of central tendency. The median is usually defined as that value which divides the distribution so that an equal number of items occur on either side of it. In other words 50% of the observation will be smaller than the median . The data are arranged in ascending order of magnitude to find out the value of the median. If the data set contains an odd number of values, the middle one of the array is the median and if there is an even number of items, the median is the average of the middle two items.

Procedure :-

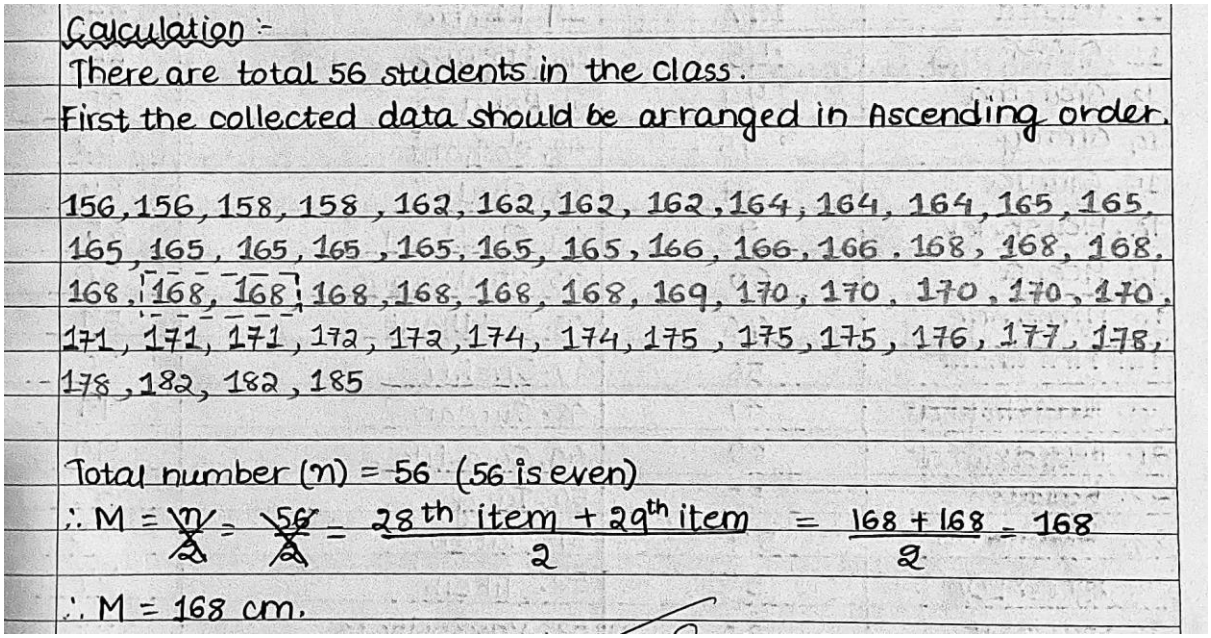
Step-1: Arrange the data in Ascending / Descending order of magnitude.
Step-2: Find the value of (n+1)/2 th item or (n/2) th
Step-3 : If the number of items is even, the mean of two middle terms is taken as Median.

Observation :-

* Observation :-

Name	Height (in cm.)	Name	Height (in cm)
1. Aadya	165	29. Nikesh	175
2. Aakash	170	30. Nilesh	170
3. Abhay	165	31. Onkar	171
4. Abhishek	168	32. Pallavi	168
5. Akansha	165	33. Prashant	177
6. Alka	165	34. Purbasha	168
7. Anuradha	164	35. Purvi	166
8. Arun	178	36. Rahul	168
9. Aryan	162	37. Ravesh	170
10. Deepshikha	169	38. Reetika	164
11. Farhat	162	39. Rhitu	172
12. Gajendra	170	40. Ritika	168
13. Garima	168	41. Rohit	185
14. Gracy	156	42. Roshani	165
15. Gunja	156	43. Shalini	160
16. Harshdev	165	44. Shubham	174
17. Heena	168	45. Shubhangi	162
18. Himangi	165	46. Siddhant	171
19. Himanshi	166	47. Srishti	158
20. Himshikha	164	48. Suman	158
21. Indrakumar	182	49. Swastik	171
22. Kajal	168	50. Tanya	168
23. Kanha	165	51. Tarun	175
24. Khushboo	168	52. Tikesh	174
25. Manjeet	182	53. Vasundhara	172
26. Mansi	162	54. Vikash	175
27. Michael	176	55. Vinay	178
28. Mihir.	165	56. Yash.	176

Calculation :-



Result :-

So the calculated median height of the students of the class is 168 cm.

Experiment- 6

Aim :-To calculate the Median weight of the students of class from raw data .

Introduction :-

The median is another important and widely used measure of central tendency. The median is usually defined as that value which divides the distribution so that an equal number of items occur on either side of it. In other words 50% of the observation will be smaller than the median . The data are arranged in ascending order of magnitude to find out the value of the median. If the data set contains an odd number of values, the middle one of the array is the median and if there is an even number of items, the median is the average of the middle two items.

Procedure :-

Step-1: Arrange the data in Ascending / Descending order of magnitude.
Step-2: Find the value of (n+1)/2 th item or (n/2) th
Step-3 : If the number of items is even, the mean of two middle terms is taken as Median.

Observation :-

*Observation Table :-

Name	Weight (in Kg)	Name	Weight (in kg)
1. Aadya	45	29. Nikesh	65
2. Aakash	93	30. Nilesh	68
3. Abhay	72	31. Onkar	64
4. Abhishek	56	32. Pallavi	53
5. Akansha	50	33. Prashant	81
6. Alka	45	34. Purbasha	64
7. Anuradha	46	35. Purvi	48
8. Arun	76	36. Rahul	75
9. Aryan	50	37. Rajesh	52
10. Deepshikha	60	38. Reetika	54
11. Farhat	47	39. Rhitu	64
12. Gajendra	55	40. Ritika	65
13. Garima	49	41. Rohit	85
14. Gracy	45	42. Roshani	52
15. Gunja	39	43. Shalini	64
16. Harshdev	43	44. Shubham	65
17. Heena	60	45. Shubhangi	50
18. Himangi	46	46. Siddhant	59
19. Himanshu	56	47. Srishti	56
20. Himshikhar	47	48. Suman	49
21. Indrdkumar	62	49. Swastik	94
22. Kajal	58	50. Tanya	52
23. Kanha	54	51. Tarun	85
24. Khushboo	52	52. Tikesh	54
25 Manjeet	83	53. Vasundhara	68
26. Mansi	55	54. Vikash	60
27. Michael	87	55. Vinay	77
28. Mihir	53	56. Yash	59

Calculation :-

Calculation :-

Arrange the data in ascending order for median calculation.

39, 43, 45, 45, 45, 46, 46, 47, 47, 48, 49, 49, 50, 50, 50, 52, 52, 52, 52, 53, 53, 54, 54, 54, 55, 55, 56, 56, 56, 58, 59, 59, 60, 60, 60, 62, 64, 64, 64, 64, 65, 65, 65, 68, 68, 72, 75, 76, 77, 81, 83, 85, 85, 87, 93, 94

$$\text{Median (M)} = \frac{50+56}{2} = \frac{112}{2} = 56 \text{ kg}$$

Result :-

So the calculated median weight of the students of the class is 56kg .

Experiment- 7

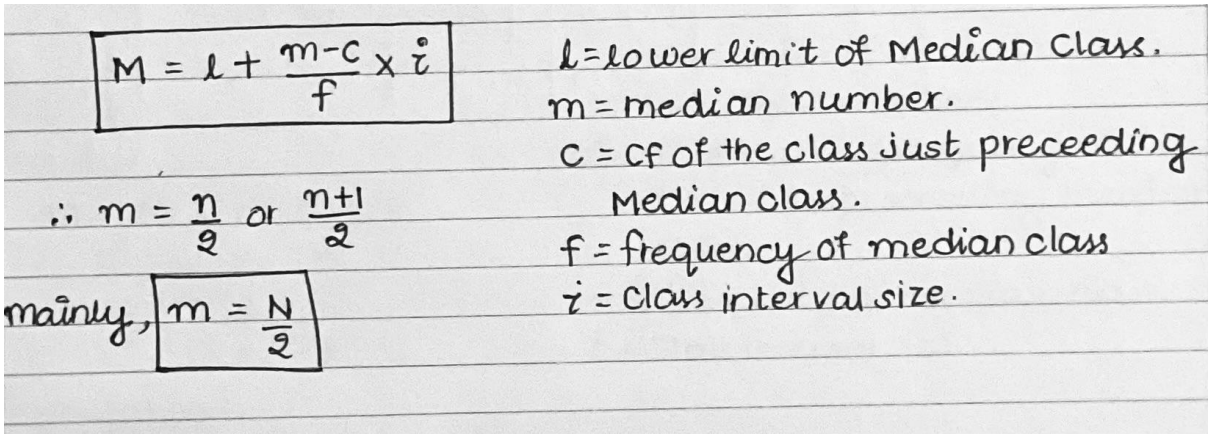
Aim :-To calculate the Median height of the students of class by using class interval (continuous series) method .

Introduction :-

The median is another important and widely used measure of central tendency. The median is usually defined as that value which divides the distribution so that an equal number of items occur on either side of it. In other words 50% of the observation will be smaller than the median . The data are arranged in ascending order of magnitude to find out the value of the median. If the data set contains an odd number of values, the middle one of the array is the median and if there is an even number of items, the median is the average of the middle two items.

Procedure :-

Step-1: Make class intervals from raw data and write their (F) frequencies also.
Step-2: Find out the cumulative frequency (CF)
Step-3: Find the Median number (n/2) or (n+1)/2
Step-4: Locate the median number in the CF , the respective class will be the median class.
Step-5: Calculate the median with the help of formula.



Observation :-

* observation Table:-

Class Interval (CI)	frequency	Cumulative frequency (cf)
155 - 160	4	4
160 - 165	16	20
165 - 170	19	39 → median class
170 - 175	10	49
175 - 180	4	53
180 - 185	3	56

Calculation :-

Calculation :-

Median number (M) = $\frac{N}{2} = \frac{56}{2} = 28$

$l = 165$

$c = 20$

$f = 19$

$i = 5$

$$M = l + \frac{m-c}{f} \times i$$

$$= 165 + \frac{28-20}{19} \times 5$$

$$= 165 + \frac{8}{19} \times 5 = 165 + 2.1 \text{ cm.} = 167.10 \text{ cm.}$$

Result :-

So the calculated median height of the students of the class is 167.10 cm

Experiment- 8

Aim :-To calculate the Median weight of the students of class by using class interval (continuous series) method .

Introduction :-

The median is another important and widely used measure of central tendency. The median is usually defined as that value which divides the distribution so that an equal number of items occur on either side of it. In other words 50% of the observation will be smaller than the median . The data are arranged in ascending order of magnitude to find out the value of the median. If the data set contains an odd number of values, the middle one of the array is the median and if there is an even number of items, the median is the average of the middle two items.

Procedure :-

Step-1: Make class intervals from raw data and write their (F) frequencies also.
Step-2: Find out the cumulative frequency (CF)
Step-3: Find the Median number (n/2) or (n+1)/2
Step-4: Locate the median number in the CF , the respective class will be the median class.
Step-5: Calculate the median with the help of formula.

$$M = l + \frac{m-c}{f} \times i$$

$\therefore m = \frac{n}{2}$ or $\frac{n+1}{2}$

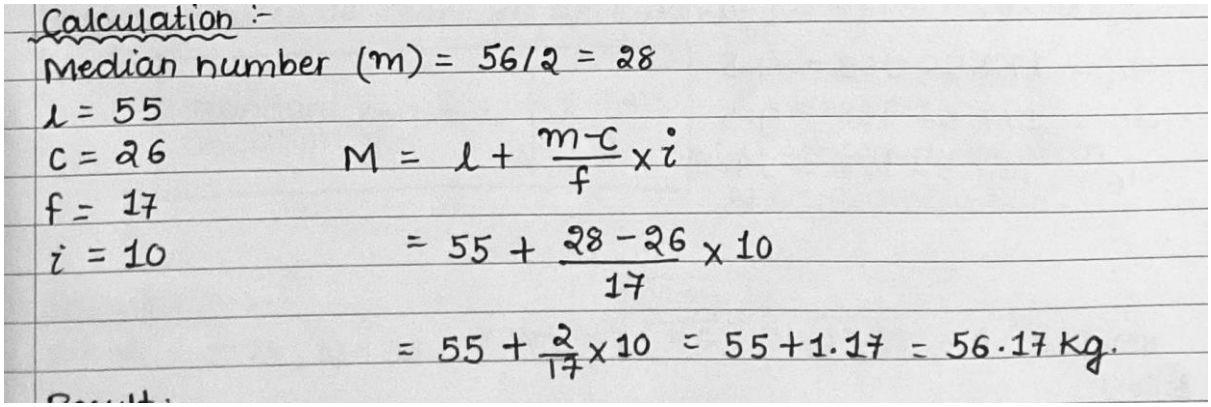
mainly, $m = \frac{N}{2}$

l = lower limit of Median class.
m = median number.
c = cf of the class just preceeding Median class.
f = frequency of median class
i = class interval size.

Observation :-

Class Interval (CI)	Frequency (f)	Cumulative frequency (CF)
35-45	6	6
45-55	20	26
55-65	17	43 → Median class
65-75	4	47
75-85	6	53
85-95	3	56

Calculation :-



Result :-

So the calculated median weight of the students of the class is 56.17kg

Experiment- 9

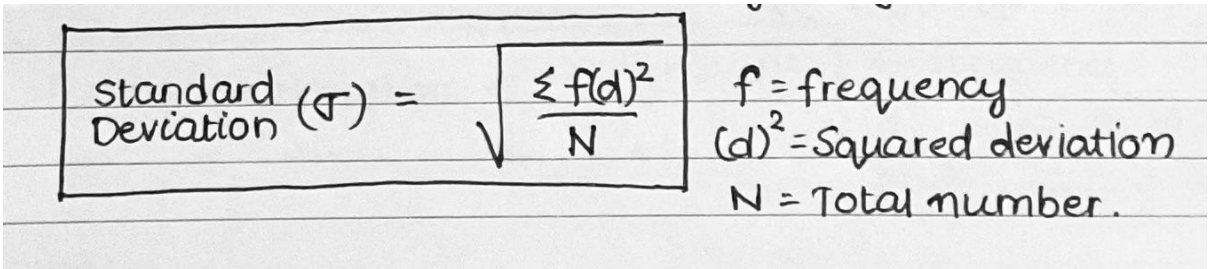
Aim :-To calculate standard deviation of height of the class .

Introduction :-

Standard deviation is a statistical measure that reflects the amount of variability or dispersion in a set of data points. Higher standard deviation indicates greater variability while lower standard deviation suggest that the data points tend to be close to the mean .

Procedure :-

Step-1: Collect the data (height measurements) From all the students in a class as class intervals. (continuous series).
Step-2: Calculate the Mean height.
Step-3: Calculate the mid values (m) for each class.
Step-4: Calculate deviation (d) by subtracting the mean from each midpoint for all classes.
Step-5 : Square each of the deviations.
Step-6 : Multiply the squared deviation with respective Frequency for each class.
Step-7: Calculate standard deviation by using the formula:-



Observation :-

*Observation Table :-

(CI) Class Interval	(f) frequency	($\bar{x}$) Mean	(m) Midvalue	(d) deviation	squared deviation (d^2)	fd^2
155-160	4		157.5	(-10.5)	110.25	441
160-165	16		162.5	(-5.5)	30.25	484
165-170	19	168	167.5	(-0.5)	0.25	4.75
170-175	10		172.5	4.5	20.25	202.5
175-180	4		177.5	9.5	90.25	361
180-185	3		182.5	14.5	210.25	630.75

$\Sigma fd^2 = 2124$

$d_1 = 157.5 - 168 = (-10.5)$
$d_2 = 162.5 - 168 = (-5.5)$
$d_3 = 167.5 - 168 = (-0.5)$
$d_4 = 172.5 - 168 = 4.5$
$d_5 = 177.5 - 168 = 9.5$
$d_6 = 182.5 - 168 = 14.5$

Calculation :-

Calculation :-
$\Sigma fd^2 = 2124, N = 56$ $\quad \sigma = \sqrt{\frac{2124}{56}} = \sqrt{37.92} = 6.1579$ cm.

Result :-
So the calculated standard deviation of height is 6.1579 cm

Experiment- 10

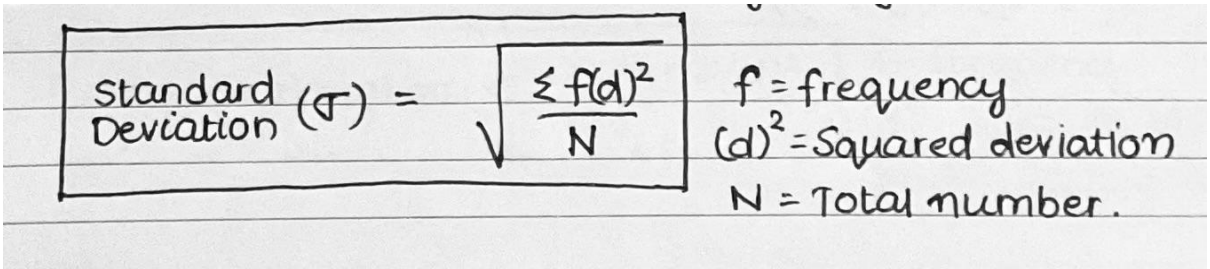
Aim :-To calculate standard deviation of weight of the class .

Introduction :-

Standard deviation is a statistical measure that reflects the amount of variability or dispersion in a set of data points. Higher standard deviation indicates greater variability while lower standard deviation suggests that the data points tend to be close to the mean .

Procedure :-

Step-1: Collect the data (height measurements) From all the students in a class as class intervals. (continuous series).
Step-2: Calculate the Mean height.
Step-3: Calculate the mid values (m) for each class.
Step-4: Calculate deviation (d) by subtracting the mean from each midpoint for all classes.
Step-5 : Square each of the deviations.
Step-6 : Multiply the squared deviation with respective Frequency for each class.
Step-7: Calculate standard deviation by using the formula:-



Observation :-

*Observation Table :-

(CI) Class Interval	(f) frequency	Mean ($\bar{x}$)	Mid value (m)	Deviation (d)	Squared deviation (d^2)	fd^2
35-45	5		40	(-20)	400	2000
45-55	21		50	(-10)	100	2100
55-65	17	60	60	0	0	0
65-75	5		70	10	100	500
75-85	5		80	20	400	2000
85-95	3		90	30	900	2700

$\Sigma fd^2 = 9300$

$d_1 = 40 - 60 = (-20)$
$d_2 = 50 - 60 = (-10)$
$d_3 = 60 - 60 = 0$
$d_4 = 70 - 60 = 10$
$d_5 = 80 - 60 = 20$
$d_6 = 90 - 60 = 30$

Calculation :-

Calculation :-

$\Sigma fd^2 = 9300, N = 56 \quad \therefore \sigma = \sqrt{\frac{9300}{56}} = \sqrt{166.07} = 12.8 \text{ kg}.$

Result :-

So the calculated standard deviation of weight is 12.8 kg

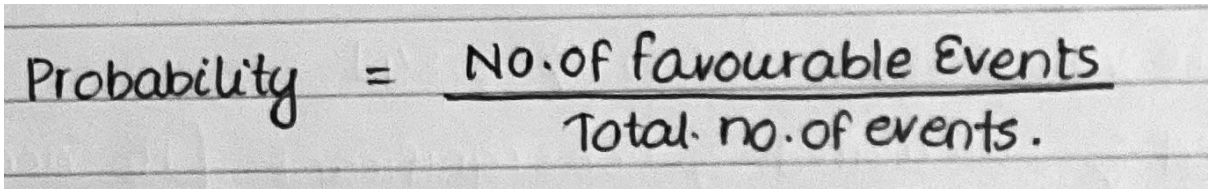
Experiment- 11

Aim :-To study the ideas and concepts of probability theory through chi-Square .

Introduction :-

The theory of probability has its own origin in the games of chance related to gambling. It measures the relative frequency of a particular event happening by chance.

Probability is the likelihood of occurrence of an event. The simplest example of a classical probability experiment is a coin toss, when we toss a coin there is a 50% chance of getting a head and 50% chance of getting a tail.



Procedure :-

1. Toss the coin, write all the outcomes that came during tossing the coins.
2. Write the observed and expected frequency in the separate columns
3. Minus the observed frequency from expected frequency and then square the value.
4. Divide the squared value by expected frequency or by putting in the chi-square formula , calculate the value.
5. After matching the calculated value from the chi-square tabulated value, provide the hypothesis .

Observation :-

1 Coin (24 times)			2 coins (36 times)				3 coins (64 time)				
H	T	Total	HH	HT/TH	TT	Total	HHH	HHT	HTT	TTT	Total
𝍸	𝍸	T = 14	𝍸	𝍸	𝍸	HH = 15	𝍸	𝍸	𝍸	𝍸	HHH = 12
𝍸	𝍸	H = 10	𝍸	𝍸	IIII	HT = 12	𝍸	𝍸	𝍸	𝍸	HHT = 23
	IIII		𝍸	II		TT = 9	II	𝍸	𝍸	II	HTT = 17
								𝍸	II		TTT = 12
								III			

I. Calculated value = 0.68
chi-square value at ($\alpha = 0.05$) ⇒ 3.841

Tabulated value > Calculated value → non significant [Ho = accept, HA = reject]

(means, there is no significant differences)

II. Calculated value = 6
chi-square value at ($\alpha = 0.05$) ⇒ 5.991

Tabulated value < Calculated value → significant [HA = accept, Ho = reject]

(Means there is significant differences)

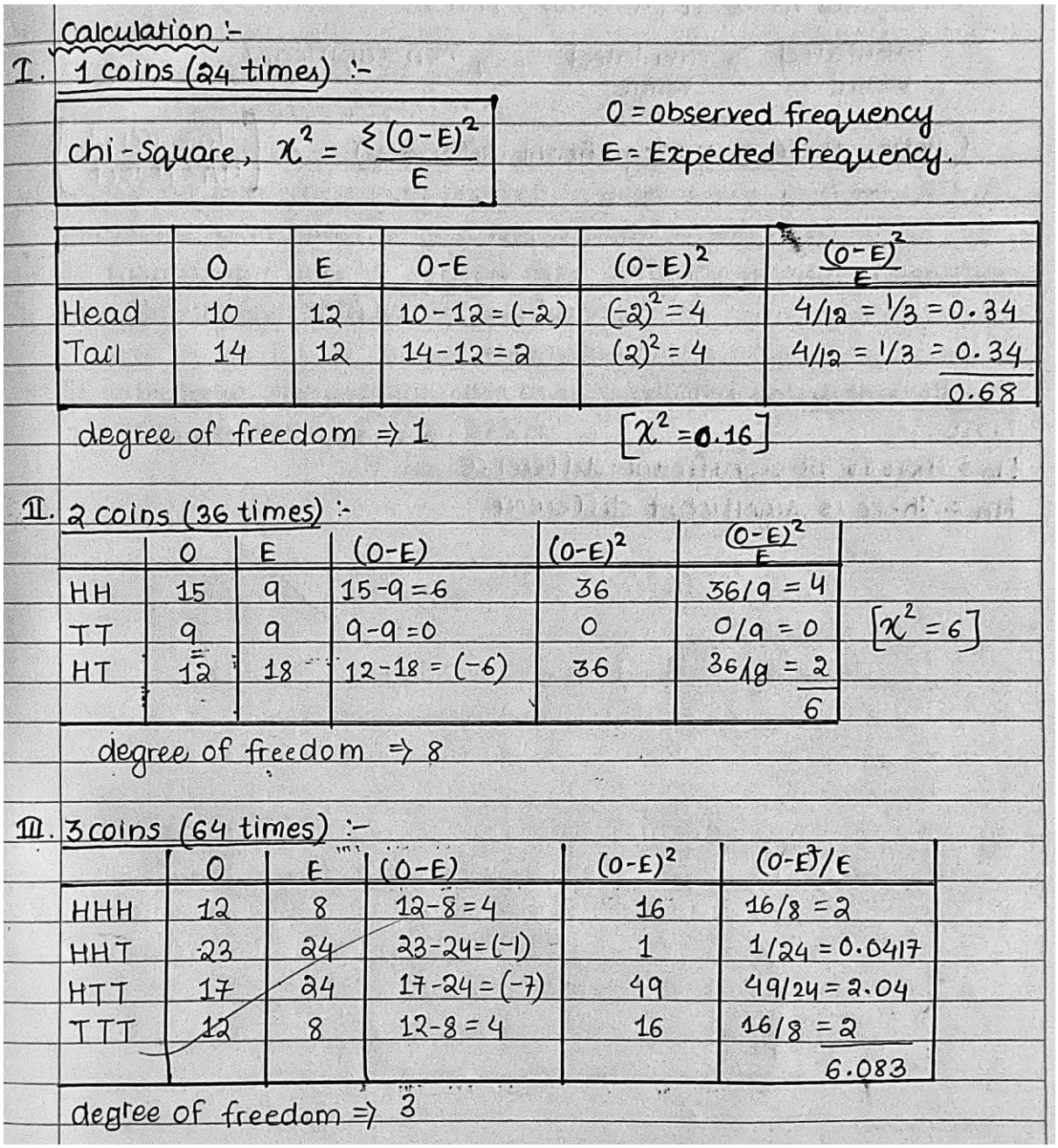
III. Calculated value = 6.083
chi-square value at ($\alpha = 0.05$) = 7.815

Tabulated value > Calculated value → non significant

(Means, there is no significant difference) [Ho = accept, HA = reject]

NOTE
Ho = There is no significant difference
HA = There is significant difference.

Calculation :-



Calculation :-

I. 1 coins (24 times) :-

chi-Square, $\chi^2 = \frac{\Sigma (O-E)^2}{E}$

O = Observed frequency
E = Expected frequency.

	O	E	O-E	$(O-E)^2$	$\frac{(O-E)^2}{E}$
Head	10	12	10-12 = (-2)	$(-2)^2 = 4$	$4/12 = 1/3 = 0.34$
Tail	14	12	14-12 = 2	$(2)^2 = 4$	$4/12 = 1/3 = 0.34$
					0.68

degree of freedom ⇒ 1 $[\chi^2 = 0.16]$

II. 2 coins (36 times) :-

	O	E	(O-E)	$(O-E)^2$	$\frac{(O-E)^2}{E}$
HH	15	9	15-9 = 6	36	$36/9 = 4$
TT	9	9	9-9 = 0	0	$0/9 = 0$
HT	12	18	12-18 = (-6)	36	$36/18 = 2$
					6

$[\chi^2 = 6]$

degree of freedom ⇒ 8

III. 3 coins (64 times) :-

	O	E	(O-E)	$(O-E)^2$	$(O-E)^2/E$
HHH	12	8	12-8 = 4	16	$16/8 = 2$
HHT	23	24	23-24 = (-1)	1	$1/24 = 0.0417$
HTT	17	24	17-24 = (-7)	49	$49/24 = 2.04$
TTT	12	8	12-8 = 4	16	$16/8 = 2$
					6.083

degree of freedom ⇒ 3

Result :-

So, before the experiment we make two assumptions.

First, Ho= There is no significant difference.

HA= There is a significant difference.

→ On the basis of our calculated chi-square value and tabulated value, we do the calculation and provide our assumption.

→ If the tabulated value is greater than the calculated value, then there are no significant differences (Ho= accept , HA= reject).

→ If the calculated value is greater than the tabulated value then there are significant differences (Ho = Reject , HA= accept) .

Experiment- 12

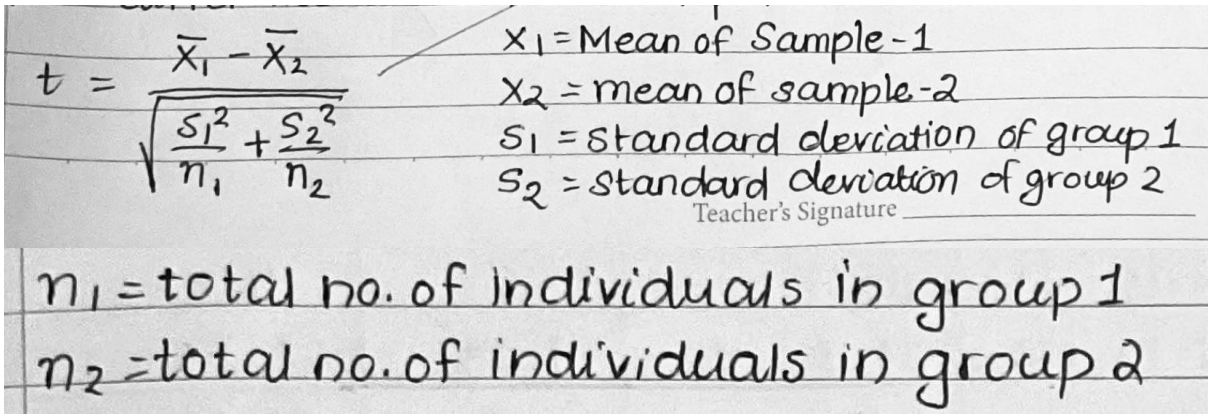
Aim :-To study the basic concept of T-test and method of computation.

Introduction :-

Sir William Gosset, gave a test popularly known as T-test. The test is based on T-distribution. Gosset was employed by Guinness Brewery (Dubling, Ireland), which does not permit employees to publish research findings under their own name, hence Gosset adopted the pen name "student" and published his discoveries in 1905, under his name, thereafter, the t-test is commonly Known as student t-test. This test helps us in determining Whether observed differences between 2 samples are actually due to chance, or whether they are really significant or not.

Procedure :-

1. Separately, calculate the mean of both the samples (S1,S2). (Mean = Sum of all observations/Total no. of observation)
2. Now, we have to calculate standard deviation for calculating this, first of all we have to calculate the deviation of each value in the sample from mean. (X-meanX)
3. Then square the value (X-meanX)2 and sum up all the values.
4. Now, put in the formula of standard deviation and calculate the value (S1 and S2) of both samples.
5. Now, we have to put all the values in the formula of T-test for a difference between two independent means.



6. Now, the value obtained is called the calculated T-test value.
7. Compare the calculated value from the tabulated Value and give a hypothesis

Observation :-

- Given Table :-

Subject	Baseline	6-week after
1	8.3	19.3
2.	5.7	10.7
3.	3.3	8.3
4.	4.6	9
5.	5.6	13.6
6.	2.3	9.3
7.	11.7	16.6
8.	33.7	47.3
9.	3.3	9
10.	1.3	18
11.	5.3	12
12.	32.3	43
13.	2	10.3
14.	0.8	7
15.	2.7	9
16.	2.7	10
17.	3	7.7
18.	0	23.7
19.	3.7	10.3
20.	4.7	15

• Observation Table :-

Subject	Baseline	$x-\bar{x}$	$(x-\bar{x})^2$	S.no.	6 weeks after	$x-\bar{x}$	$(x-\bar{x})^2$
1.	8.3	1.45	2.10	1.	19.3	3.85	14.82
2.	5.7	-1.15	1.32	2.	10.7	-4.75	22.56
3.	3.3	-3.55	12.60	3.	8.3	-7.15	51.12
4.	4.6	-2.25	5.06	4.	9	-6.45	41.60
5.	5.6	-1.25	1.56	5.	13.6	-1.85	3.42
6.	2.3	-4.55	20.70	6.	9.3	-6.15	37.82
7.	11.7	4.85	23.52	7.	16.6	1.15	1.32
8.	33.7	26.85	720.92	8.	47.3	31.85	1014.42
9.	3.3	-3.55	12.60	9.	9	-6.45	41.60
10.	1.3	-5.55	30.80	10.	18	2.55	6.50
11.	5.3	-1.55	2.40	11.	12	-3.45	11.90
12.	32.3	25.45	647.70	12.	43	27.55	759
13.	2	-4.85	23.52	13.	10.3	-5.15	26.52
14	0.8	-6.05	36.60	14.	7	-8.45	71.40
15.	2.7	-4.15	17.22	15.	9	-6.45	41.60
16.	2.7	-4.15	17.22	16.	10	-5.45	29.70
17.	3	-3.85	14.82	17.	7.7	-7.75	60.06
18.	0	-6.85	46.92	18.	23.7	8.25	68.06
19.	3.7	-3.15	9.92	19.	10.3	-5.15	26.52
20.	4.7	-2.15	4.62	20.	15	-0.45	0.20
Total.	Mean $\bar{x}$ =6.85		1652.12		Mean $(\bar{x})$ = 15.45		2330.14.

Calculation :-

Calculation :-

- Standard deviation of first group, $S_1 = \sqrt{\frac{\Sigma(x-\bar{x})^2}{n-1}}$

$$S_1 = \sqrt{\frac{1652.12}{19}} = \sqrt{86.95} = 9.32$$

- Mean of first group :- $\bar{X} = \frac{x_1+x_2+x_3+\ldots.x_{20}}{n}$

$$\bar{X}_1 = \frac{8.3+5.7+3.3+4.6+\ldots.+4.7}{20} = \frac{137}{20} = 6.85.$$

- Standard deviation of second group. $S_2 = \sqrt{\frac{\Sigma(x-\bar{x})^2}{n-1}}$

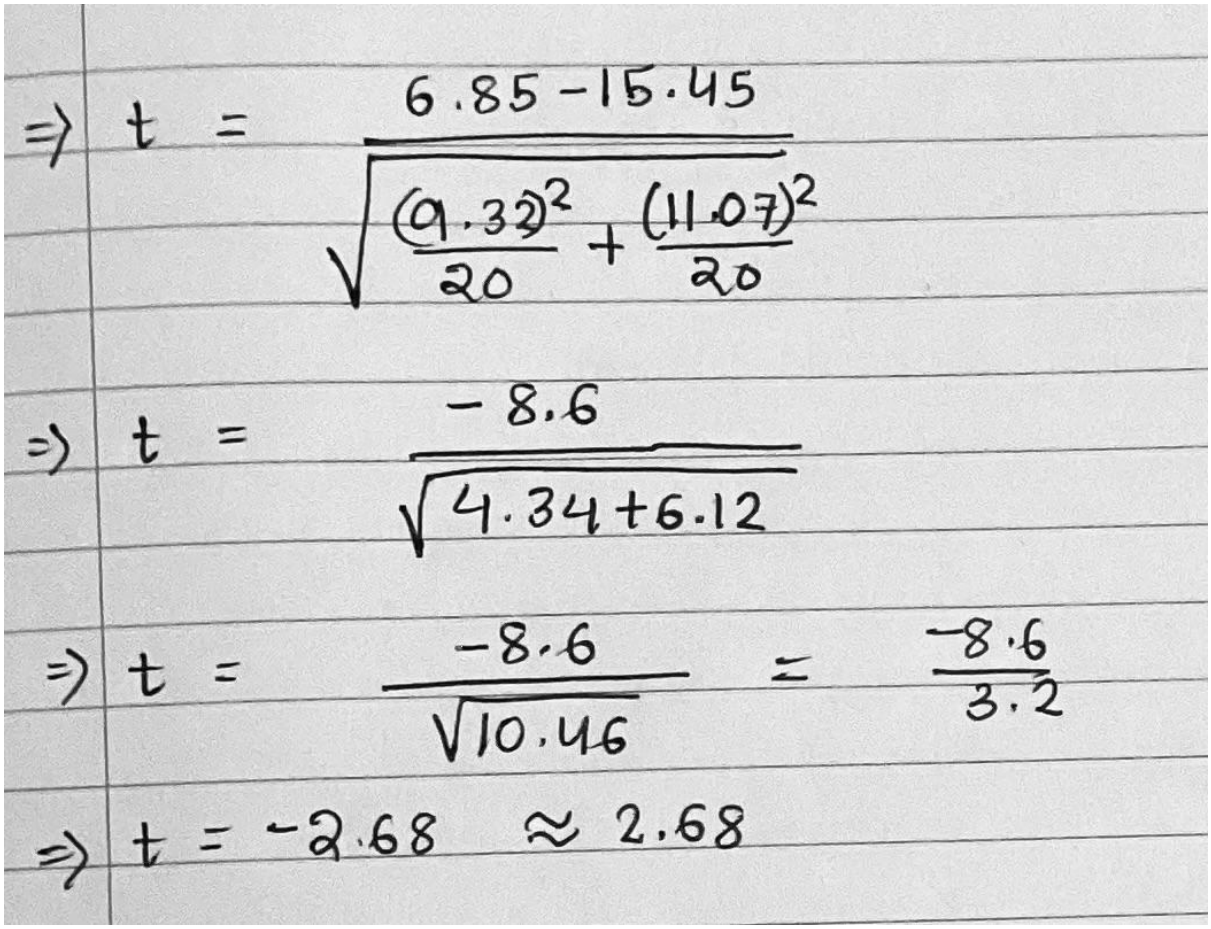
$$S_2 = \sqrt{\frac{2330.14}{19}} = \sqrt{122.63} = 11.07$$

- Mean of second group :- $\bar{X} = \frac{x_1+x_2+x_3+\ldots.+x_n}{n}$

$$\bar{X}_2 = \frac{19.3+10.7+8.3+9+\ldots.+15}{20} = \frac{309.1}{20} = 15.45.$$

T-Test Formula :-

$$t = \frac{\bar{X}_1 - \bar{X}_2}{\sqrt{\frac{S_1^2}{n_1} + \frac{S_2^2}{n_2}}}$$



Result :-

calculated value = 2.68

(one-Tailed) Tabulated value = 2.09 (At t=19, d=0.05)

(calculated value › Tabulated value.)

There is a significant difference.

HA = Accept

Ho = Reject .