**MEASURES OF CENTRAL TENDENCIES:**

**CENTRAL TENDENCY:**

Central tendency is the point (or value) about which all other scores in the distribution or data set tend to cluster. For this reason, it is often referred to as **averages.** It is a single number which represents the general ***level of performance*** of a group.

**The three commonly measures of central tendencies are**:

1. The Mean
2. The Median
3. The Mode
4. **THE MEAN**

The mean is defined as the sum of the values in the data set or distribution divided by the number of values. It is the most commonly used measure of central tendency. In ungrouped data, it is called arithmetic mean.

**When to use the mean?**

1. When the frequency distribution or set of data does not contain either open ended or extreme value.
2. When the measure of central tendency having the greatest stability is desired.
3. When other parameters or statistics like standard deviation, variance, coefficient of correlation, etc. are to be computed later.
4. When dealing with either interval or ratio scale of measurement.

**Calculating the Arithmetic Mean of ungrouped data:**

Formula : x = Where: x = score

N = number of scores

Σ = summation

***Illustrative example:***

Last week, a fruit vendor earned the following income from selling fruits at the Baclaran: Tuesday - ₱ 650, Wednesday - ₱ 900, Thursday - ₱ 720, Friday - ₱ 610, Saturday - ₱ 780, and Sunday - ₱ 950. What is the arithmetic mean of his income?

*Solution:*

Given: Σx= ₱ 650 + ₱ 900 + ₱ 720 + ₱ 610 + ₱ 780 + ₱ 950 = ₱ 4610

N = 6 (number of days)

X = , x = , x = 768.33

**Calculating the Weighted Mean of ungrouped data.**

The weighted arithmetic mean is expressed as the sum of the product each value and its corresponding weight divided by the sum of the weights.

*Formula:*

X = or xw =

***Illustrative example:***

The final grades of a student at the end of the semester are the following:

|  |  |  |
| --- | --- | --- |
| Subject | Grades (x) | Units (ƒ) |
| Accounting | 2.25 | 6 |
| Human Resource Mgt. | 2.50 | 3 |
| Economics | 1.75 | 3 |
| English | 1.50 | 3 |
| Finance | 2.00 | 3 |

What is the weighted mean grade of the student?

*Solution:*

Xw = = = 2. 04

**Calculating the Mean of grouped data:**

*Formula:*

X = for sample mean

µ = for population mean

***Illustrative example:***

Given the following scores of 50 selected tourism students who took the test in Algebra:

47 29 31 37 34 41 36 36 36 42

36 48 30 42 39 31 34 37 44 39

43 37 35 33 34 31 30 43 38 35

31 31 35 38 45 40 38 35 32 25

40 38 35 32 22 41 38 35 33 23

n = 50

Step 1. **Tabulate** the data in a grouped frequency distribution and **determine** the Frequency (ƒ), and the Class Mark (X). (See table below)

Step 2. **Multiply** the frequency and the class mark in every class and get the **sum**.

Grouped Frequency Distribution of 50 selected Tourism students who took the test in College Algebra.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| ci | Tally | ƒ | X | ƒX |
| 48 - 50 | 1 | 1 | 49 | 49 |
| 45 - 47 | 11 | 2 | 46 | 92 |
| 42 - 44 | 11111 | 5 | 43 | 215 |
| 39 - 41 | 111111 | 6 | 40 | 240 |
| 36 - 38 | 111111111111 | 12 | 37 | 444 |
| 33 - 35 | 11111111111 | 11 | 34 | 374 |
| 30 - 32 | 111111111 | 9 | 31 | 279 |
| 27 - 29 | 1 | 1 | 28 | 28 |
| 24 - 26 | 1 | 1 | 25 | 25 |
| 21 - 23 | 11 | 2 | 22 | 44 |

n = **50** ΣƒX = **1,790**

X = = = 35.84

Question: What does the sample mean of 35.84 tell you as regard to the performance of 50 TM students in College Algebra test?

Another method for solving the sample mean of a grouped frequency distribution is by the use of Deviation or Coded formula

X = AM + (ἰ)

Where: AM = Assumed Mean (X with the highest ƒ)

ἰ = interval

ƒ = frequency

d = deviation from AM

Study the table below

Grouped Frequency Distribution of 50 selected Tourism students who took the test in College Algebra.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| ci | Tally | ƒ | X | d | ƒd |
| 48 - 50 | 1 | 1 | 49 | 4 |  |
| 45 - 47 | 11 | 2 | 46 | 3 |  |
| 42 - 44 | 11111 | 5 | 43 | 2 |  |
| 39 - 41 | 111111 | 6 | 40 | 1 |  |
| 36 - 38 | 111111111111 | 12 | 37 | 0 |  |
| 33 - 35 | 11111111111 | 11 | 34 | -1 |  |
| 30 - 32 | 111111111 | 9 | 31 | -2 |  |
| 27 - 29 | 1 | 1 | 28 | -3 |  |
| 24 - 26 | 1 | 1 | 25 | -4 |  |
| 21 - 23 | 11 | 2 | 22 | -5 |  |

n= **50 Σƒd =**

Solve for the sample mean using the deviation or coded formula. **(Seatwork)**

**THE MEDIAN**

The Median (**Md)** is a measure of central tendency that occupies the middle position in the frequency distribution or set of data. It is the value that divides the distribution or data set into two, such that 50% of the data lies above the median and the other 50% lies below it.

**When to use the Median**

1. When the data set or distribution is open-ended or contains extreme values.

2. When the data is arranged in descending or ascending order.

3. When the exact midpoint of the distribution is desired.

4. When dealing with ordinal data.

**Calculating the Median of ungrouped data**

A. When N is even, the median value is obtained using the formula:

Md  =

*Illustrative example:*

Ten middle-management employees of a certain company have the following ages:

52, 45, 49, 48, 53, 42, 50, 53, 55, 58.

Find the median age.

Arrange the data in ascending order:

42, 45, 48, 49, 50, 52, 53, 53, 55, 58

n = 10 (even number)

*Solution:*  Md = = = 51

B. When N is odd, the median is the value exactly at the middle of the data set

arranged either in descending or ascending order.

*Illustrative example:*

The daily rates of a sample of nine employees of RomAn firm are:

₱ 520, ₱ 450, ₱ 560, ₱ 500, ₱ 720, ₱ 660, ₱ 840, ₱ 490, ₱ 870

What is the median daily rate?

Arrange the data set in descending order

₱ 870, ₱ 840, ₱ 720, ₱ 660, ₱ 560, ₱ 520, ₱ 500, ₱ 490, ₱ 450

n = 9 (odd number)

*Solution:*

The median daily rate is the middle value **₱ 560** .

**Calculating the Median of grouped data**

Frequency distribution of 50 selected TM students

who took the test in Algebra

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| ci | 𝑓 | X | CB | ˂ c𝑓 | ˃ c𝑓 |
| 48 - 50 | 1 | 49 | 47.5 – 50.5 | 50 | 1 |
| 45 - 47 | 2 | 46 | 44.5 - 47.5 | 49 | 3 |
| 42 - 44 | 5 | 43 | 41.5 - 44.5 | 47 | 8 |
| 39 - 41 | 6 | 40 | 38.5 - 41.5 | 42 | 14 |
| 36 - 38 | 12 | 37 | 35.5 - 38.5 | 36 | 26 |
| 33 - 35 | 11 | 34 | 32.5 - 35.5 | 24 | 37 |
| 30 - 32 | 9 | 31 | 29.5 - 32.5 | 13 | 46 |
| 27 - 29 | 1 | 28 | 26.5 - 29.5 | 4 | 47 |
| 24 - 26 | 1 | 25 | 23.5 - 26.5 | 3 | 48 |
| 21 - 23 | 2 | 22 | 20.5 - 23.5 | 2 | 50 |

𝑓AMd class

AMd class

c𝑓p

n = 50

*Formula:*

Md =  LB +

*Where:*  LB - Lower class boundary

C𝑓p - the ˂ c𝑓 preceding the ˂ c𝑓 of the AMd class

(AMd) - frequency of the AMd class

**ἰ** - interval

*Solution:*

Step 1. Find the AMd class applying 25.

Counting from ˂ c𝑓 of the lowest class and moving upward (arrow), 25 falls on ˂ c𝑓 36. Therefore, AMd class is

〔36 – 38〕.

Step 2. Write the values of the following variables with respect to the AMd :

LB  = 35.5 𝑓AMd class = 12

C𝑓p = 24 ἰ = 3

Step 3. Substitute the formula and solve for the Md.

Md = LB + = 35.5 + **〔**

Md = 35.5 + = 35.5 +**〔**0.08 **〕3**

= 35.5 + 0.24

Md = 35.74

For purposes of checking this solution, the ˃ c𝑓 is used in the formula:

Md = UB -

**THE MODE**

The Mode (Mo) is that single data or score which occurs most frequently in a data set. In grouped frequency distribution, the Mode (called crude mode) is the midpoint with the highest frequency.

**When to use the Mode**

1. When a quick and approximate measure of central tendency is desired

2. When the data is either quantitative or qualitative.

3. When the frequency distribution contains open-ended or extreme values.

4. When dealing with nominal data.

**Calculating the Mode of ungrouped data**

Data set may have no mode. If it contains one mode, it is called Unimodal. If there are two modes, it is called Bimodal, three modes or Trimodal.

*Illustrative examples:*

1. The following data represent the total unit sales for MYRO 2000from a sample of 10 Gaming Centers for the month of October:

16, 18, 11, 13, 14, 11, 15, 11, 6, 7.

Find the mode.

Arrange the data in ascending or descending order.

6, 7, 11, 11, 11, 13, 14, 15, 16, and 18.

The Mode is **11**. *Unimodal*.

2. An operation manager in charge of a company’s manufacturing keeps track of the number of manufactured LCD television in a day. If the number of LCD”s produced in the past 3 weeks were:

21, 19, 20, 26, 21, 22, 21, 26, 31, 30, 29, 30, 26, 26, 28, 27, 23, 21.

What is the mode of these data?

Arranging the data,

19, 20, 21, 21, 21, 21, 22, 23, 26, 26, 26, 26, 27, 28, 29, 30, 30, 31

There are two modes, **21** and **26**. *Bimodal*

3. Nine middle-management of a certain company have the following ages:

47, 52, 59, 56, 55, 49, 60, 46, 54.

What is the mode of this data set?

**None**.

**Calculating the Mode of grouped data**

Grouped Frequency Distribution of 50 selected Tourism

students who took the test in College Algebra.

|  |  |  |
| --- | --- | --- |
| ci | f | CB |
| 48 - 50 | 1 | 47.5 – 50.5 |
| 45 - 47 | 2 | 44.5 – 47.5 |
| 42 - 44 | 5 | 41.5 – 44.5 |
| 39 - 41 | 6 | 38.5 – 41.5 |
| 36 - 38 | 12 | 35.5 – 38.5 |
| 33 - 35 | 11 | 32.5 – 35.5 |
| 30 - 32 | 9 | 29.5 – 32.5 |
| 27 - 29 | 1 | 26.5 – 29.5 |
| 24 - 26 | 1 | 23.5 – 26.5 |
| 21 - 23 | 2 | 20.5 – 23.5 |

Find the Mode of this distribution using the formula:

Mo = LB + ,

Where: LB = Lower boundary of the modal class

The **modal class** is the class with the highest frequency.

d1  = Difference between the frequency of the modal class and the frequency of the class immediately below it.

d2  = Difference between the frequency of the

modal class and the frequency of the class above it.

Given: Modal Class = (36 - 38)

LB  = 35.5

d1  = 12 – 11 = 1

d2 = 12 - 6 = 6

*Solution*:

Mo = LB + **〔** = 35.5 +

Mo = 35.5 + (0.14) 3 = 35.5 + 0.42

Mo = 35.92