



Individual Differences_4GE



مقرر

Individual Differences

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General Education

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الفرقةالرابعة ...برنامج.. التعليم الأساسي...معلم العلوم باللغة الانجليزية



Individual Differences_4GE

أستاذ المقرر

أ.د/ حجاج غانم : قسم علم النفس التربوي

كلية التربية بقنا

العام الجامعي

2022 – 2023 A. D.

بيانات أساسية

الكلية: التربية

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عدد الصفحات:

القسم التابع له المقرر : قسم علم النفس التربوي

الرموز المستخدمة



فيديو للمشاهدة.



والدراسة للقراءة نص

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رابط خارجي.



أسئلة للتفكير والتقييم الذاتي.



أنشطة ومهام.

تواصل عبر مؤتمر الفيديو.

Individual Differences

محتوي الكتاب

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	Video 2 : Types of individual differences
	Video 3 : Causes of individual differences

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	Video 4 : The role of individual differences in education
	Video 5 : Measuring individual differences



THE PSYCHOLOGY of Individual Differences

This course is divided into two chapters: The

first chapter contains a theoretical

background on individual first differences,

and the second chapter contains how to

measure individual differences.



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Let's start by introduction.

The scientific study of how and why people

differ in systematic ways is known as the

psychology of individual differences. The

psychology of individual differences seeks to

understand how inter and intra-individual

differences in psychological characteristics

interact with environmental affordances and

demands to produce differences in a variety of



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personal, work, educational, and social

outcomes.

The theories and psychometric methods

developed by individual difference

researchers are used by social scientists to

understand, critique, and address practical

problems in a variety of contexts such as

education, selection, evaluation, and guidance.

Chapter 1 : Theoretical Background:



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We will study in this chapter:

1. Definitions of Individual Differences.

2. Types of individual differences.

3. Causes of individual differences .

**4. The role of individual differences in
education.**

Chapter 2 : Measuring Individual differences:



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We will study in this chapter, how to measure individual differences using the statistical methods such as:

Standard deviation

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Deciles



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Normal curve

Chapter 1 : Theoretical Background:

1.Definitions of Individual Differences.


“Variations or deviations from the average of the group, with respect to the mental or physical characters, occurring in the individual member of the group are individual differences.”



<https://www.youtube.com/watch?v=Cg8HrChyq0A>

Individual Differences: Simplyinfo.net

Unique characteristics of individuals that have an impact on how they learn.



0:14 / 1:16

The image shows a video player interface. The main content area displays the text 'Individual Differences: Unique characteristics of individuals that have an impact on how they learn.' Below the text is a cartoon illustration of four diverse children (two boys and two girls) holding hands and smiling. The video player includes a progress bar at the bottom showing 0:14 / 1:16, and various control icons like play, volume, and settings.





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“The variation or deviations among individual is regard to a single characteristic or a number of characteristics, those differences which in their totality distinguish one individual from another.”

“Individual differences are found in all psychological characteristics physical mental

abilities, knowledge, habit, personality and character traits.”



According to Skinner, “Today we think of individual differences as including any measurable aspect of the total personality.” It is clear from this definition of individual differences that it comprehends every aspect



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of human personality which is in some manner measurable.

2.Types of Individual Differences

That the persons may differ in one type or

more ofsuch as :

.....,.....,.....,.....

.....,.....,..... ,

and so on.



<https://www.youtube.com/watch?v=WbjPMM2RUbw>

BEd 1st Semester

5.1 Concept of Individual Differences


Concept & Types of Individual Difference

Individual Differences

Perspectives in Child Development

By: Gitanjali Nanda

0:05 / 11:29





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1. Physical differences:

Shortness or tallness of stature, darkness or fairness of complexion, fatness, thinness, or weakness are various physical individual differences.

2. Differences in intelligence:



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There are differences in intelligence level among different individuals. We can classify the individuals from super-normal (above 120 I.Q.) to idiots (from 0 to 50 I.Q.) on the basis of their intelligence level.



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Wechsler (WAIS-III) 1997 IQ test classification

IQ Range ("deviation IQ")	IQ Classification
130 and above	Very superior
120–129	Superior
110–119	High average
90–109	Average
80–89	Low average
70–79	Borderline
69 and below	Extremely low

3. Differences in attitudes:

Individuals differ in their attitudes towards different people, objects, institutions and so on.



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4. Differences in achievement:

It has been found through achievement tests that individuals differ in their achievement abilities. These differences are very much visible in reading, writing and in learning mathematics.



These differences in achievement are even visible among the children who are at the same level of intelligence. These differences are on account of the differences in the various factors of intelligence and the differences in the various experiences, interests and educational background.



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And there are another types such as motor ability , gender, and so on .

3.Causes of Individual Differences

These causes may be , as we will say later:

Heredity

.....

.....

Educational

.....



https://www.youtube.com/watch?v=q_4JpTj0DBY



Some of the main causes of individual differences are as under:

1. Heredity:



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One of the most significant and chief causes of individual differences is heredity. Individuals inherit various physical traits like face with its features, color of eyes and hair, type of skin, shape of skull and size of hands, colour blindness, baldness, stub-finger and tendency to certain diseases like cancer and tuberculosis, mental traits like intelligence, abstract thinking, aptitudes and prejudices.



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Now it is an admitted fact that heredity differences result in the quantity and rate of physical as well as mental development being different and different individuals.

2. Environment:

Environment significantly influences individual differences. Changes in child's

environment are reflected in the changes in his personality. Psychologically speaking, a person's environment consists of sum total of stimulation which he receives from conception until his death.



Environment consists of physical, intellectual, social, moral, political, economic and cultural



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forces. All these forces cause individual differences. Modern psychologists believe that individual differences are caused by both heredity and environment. Personality is the outcome of mutual interaction between heredity and environment.

3. Influence of caste, race and nation:



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Individuals of different castes and races

exhibit very marked differences. It is

generally seen that son of a Kshatriya has a

more of courage in him while the son of a

trader has the traits of business.

Similarly individuals of different nations show

differences in respect of their personality,

character and mental abilities. These are the



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outcome of their geographical, social and cultural environment. Many studies have shown the existence of differences between Americans and Negroes, Chinese and Japanese, English and Indian individuals.

4. Sex differences:



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Development of boys and girls exhibits differences due to difference in sex. The physical development of the girl takes place a year or two earlier than the boys. Between the age of 11 and 14, girls are taller and heavier than the boys. After 15, boys start winning the race.

Girls are kind, affectionate, sympathetic and tender while the boys are brave, hard, choleric, efficient and competent.

And there are other causes that are limited to the mental , social , cultural , and so on.



Task1: Express in your own words the causes



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of individual differences

4.Role of Individual Differences in Education:

Role of Individual Differences in Education.

The teacher must

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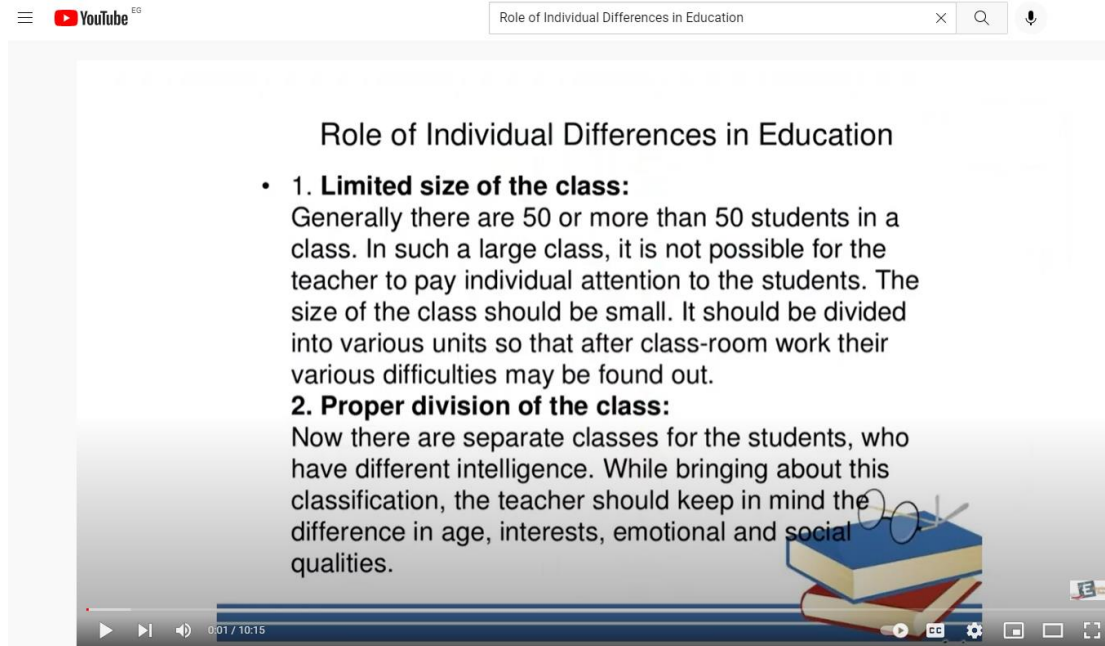
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<https://www.youtube.com/watch?v=QUcKeJnaMOM>

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Role of Individual Differences in Education

- **1. Limited size of the class:**
Generally there are 50 or more than 50 students in a class. In such a large class, it is not possible for the teacher to pay individual attention to the students. The size of the class should be small. It should be divided into various units so that after class-room work their various difficulties may be found out.
- **2. Proper division of the class:**
Now there are separate classes for the students, who have different intelligence. While bringing about this classification, the teacher should keep in mind the difference in age, interests, emotional and social qualities.



One of the important objectives of modern education is the complete development of the individual. Individuals have different goals,



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different interests, different emotional problems and different abilities. We cannot afford to ignore these individual differences in imparting education to children. Since school work is planned on group basis it presents a formidable challenge to all teachers.



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Hence some practical procedures for adapting school work to individual differences are suggested:

1. Limited size of the class:

Generally there are 50 or more than 50 students in a class. In such a large class, it is not possible for the teacher to pay individual



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attention to the students. The size of the class should be small. It should be divided into various units so that after class-room work their various difficulties may be found out.

2. Proper division of the class:

Now there are separate classes for the students, who have different intelligence.



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While bringing about this classification, the teacher should keep in mind the difference in age, interests, emotional and social qualities.

3. Home task:

The teacher should assign home task to the students while keeping in view the individual differences.



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4. Factor of sex:

Boys and girls are to play different roles in society. Hence the factor of sex should be kept in mind.

5. Curriculum:



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The curriculum should be modified to suit the needs of all types of children. A large number of subjects should be included in the curriculum so that education can be provided to each child according to his interests, needs and abilities. Curriculum should not be rigid but it should be flexible.

6. Methods of Teaching:



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Methods of teaching should be chosen on the basis of individual differences. It is not advisable to use the same method of education in the case of all children-gifted or backward.

7. Educational Guidance:



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Teacher should impart educational guidance to the students while keeping in view their individual differences. He can assist them in the selection of educational career, selection of subjects, selection of books, selection of hobbies and co-curricular activities and in many other areas connected with education.



Task2: How are individual differences taken into account in our schools and educational institutions?



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Chapter 2 : How to measure individual

differences :

As we will see later, there are a lot of

statistical methods which measure individual

differences such as:

Standard deviation

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Deciles

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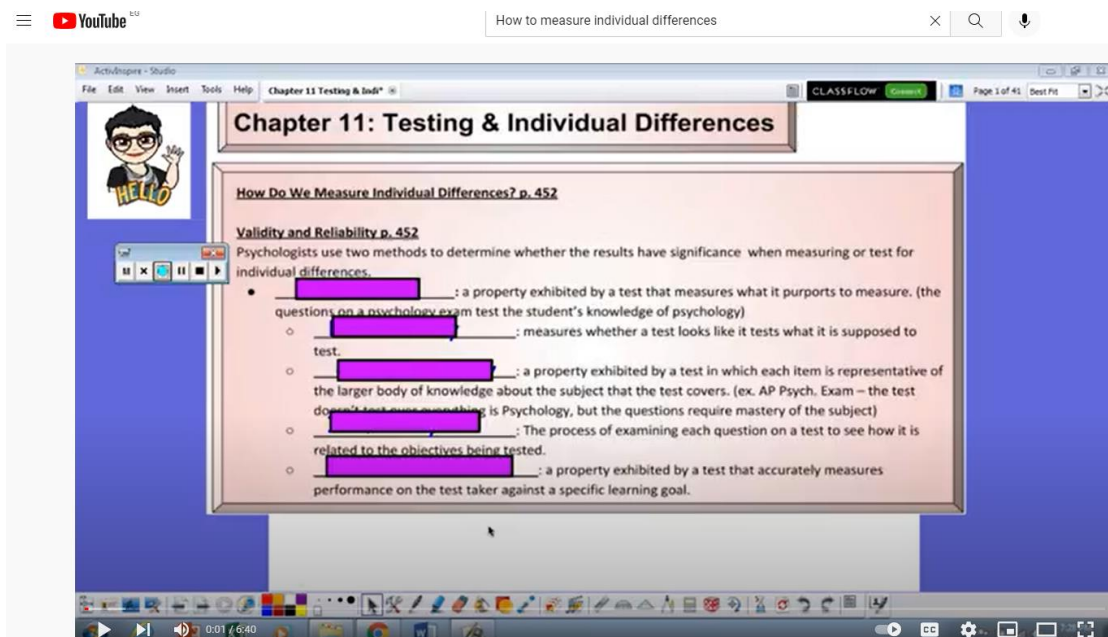
.....

.....

Normal curve



<https://www.youtube.com/watch?v=cjeJPalNE84>



The screenshot shows a YouTube video player with the title "How to measure individual differences". The video content is a presentation slide titled "Chapter 11: Testing & Individual Differences". The slide content is as follows:

Chapter 11: Testing & Individual Differences

How Do We Measure Individual Differences? p. 452

Validity and Reliability p. 452

Psychologists use two methods to determine whether the results have significance when measuring or test for individual differences.

- **Validity**: a property exhibited by a test that measures what it purports to measure. (the questions on a psychology exam test the student's knowledge of psychology)
 - **Content validity**: measures whether a test looks like it tests what it is supposed to test.
 - **Construct validity**: a property exhibited by a test in which each item is representative of the larger body of knowledge about the subject that the test covers. (ex. AP Psych. Exam – the test doesn't test everything is Psychology, but the questions require mastery of the subject)
 - **Criterion validity**: The process of examining each question on a test to see how it is related to the objectives being tested.
 - **Reliability**: a property exhibited by a test that accurately measures performance on the test taker against a specific learning goal.

1. (σ) Standard Deviation

2. (σ^2) Variance

3. Range

4. a. Percentiles (Centiles) (C)

b. Deciles (D)

c. Quartiles(Q)

5. Coefficient of Variance(COV)

6. a. Z-score

b. T-score



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7. Normal Curve



How to measure individual Differences

There are certain methods which is used to measure individual differences including:

Standard Deviation , Variance, Range, Percentiles , Deciles, Quartiles , Interquartile range ,coefficient of variance ,Z score , T score & Normal curve.

1. Standard Deviation :

- **The most important measure of dispersion, because it is the kernel for calculating other measures of dispersion that are important in interpretation, including variance , coefficient of variation, z score & t score .**
- **Take into account all of data.**



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- **It is used in calculating the Pearson correlation , ANOVA, MANOVA, Prediction , and so on .**

STANDARD DEVIATION

standard deviation is a way to measure the dispersion in a given data set—that is, how spread out the values are. Standard deviation is found by calculating the mean of a group of values, then using a type of averaging to determine how far away the other values in the group are from that mean. If the values in the group are all relatively close to the mean, then the standard deviation is low. Conversely, the more spread out the values are relative to the mean, the higher the standard deviation. For example, consider these two groups of values:

Set A: {0, 25, 50, 75, 100}

Set B: {48, 49, 50, 51, 52}

Both sets have five distinct values, and both have a mean of 50. But because the values in Set A are more widely dispersed (as much as 50 units away from the mean) than the values in Set B (all of which are within 2 units of the mean), Set A has a greater standard deviation than does Set B.

Note



The standard deviation can not take

negative value.



If the values are equal , then the standard

deviation will be zero .

- **The more the standard deviation is far from zero
 , the more the individual differences will be.**

So , we can formulate standard deviation as follow:

$$\sigma = \sqrt{\frac{\sum (X - \bar{X})^2}{n - 1}}$$

Where σ denote to standard deviation

\sum denote to summation

X the values of each person (student or whatever ...).

\bar{x} the average or mean of the all

values .

n the number of values , in other

words the number of cases (persons ,

students , or whatever).

Note



Task3: The previous formula of S. D. is not the only one , but there are other formulas which lead to the same result .

Can you search to find out that ?

Example: A researcher applied a test concerning the ability to remember with a total score of 10 on five

children of kindergarten, whose scores were as

follows : 2-8-1-3-1:calculate the standard deviation .

The Manual Method:

Step. 1: Calculate the average of scores as follows :

$$\bar{X} = \frac{\sum X}{N}$$

$$\bar{X} = \frac{15}{5} = 3$$

Step.2: using $\bar{x} = 3$, we can calculate σ as follows:

$(x - \bar{x})^2$	$x - \bar{x}$	x
1	1-	2
25	5+	8
4	2-	1
0	0	3

4	2-	1
$\sum(x-x')^2=34$	$\sum(x-x')=0$	$\sum X=15$

Step. 3 : The previous table indicates that:

‘ $\sum(x-x')^2=70$, Thus:

$$\sigma = \sqrt{\frac{\sum (X - \bar{X})^2}{n - 1}}$$

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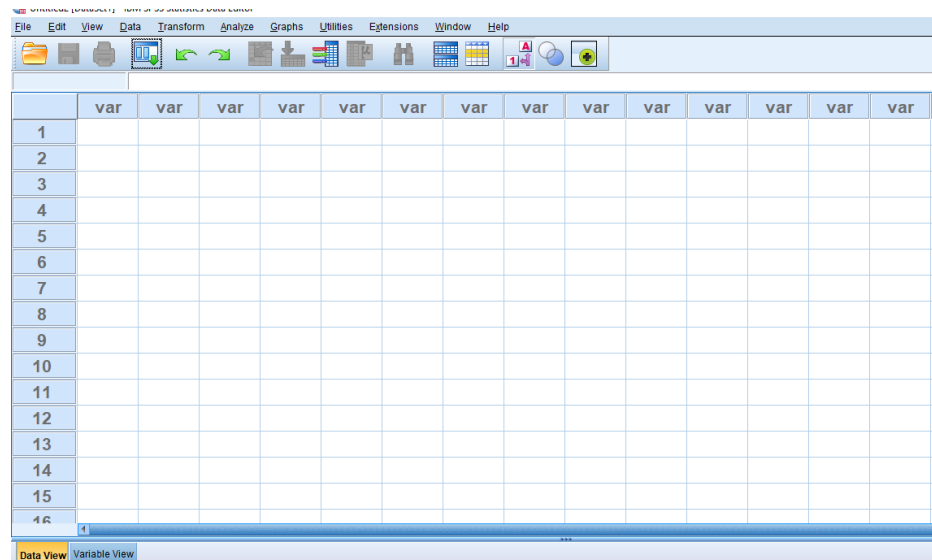
$$\sigma = \sqrt{\frac{34}{4}}$$

$$= 2.92$$

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.....

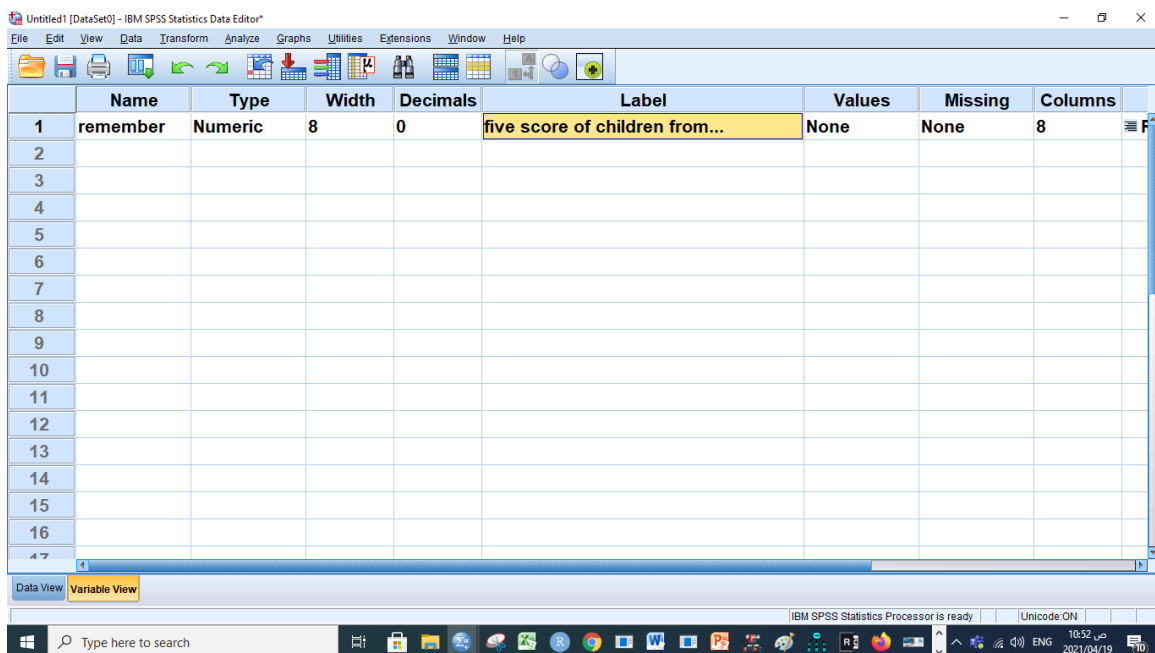
Using SPSS :

SPSS is a program which is used to execute a lot of statistical tools .



Task4: Evaluate yourself: there are two names of the spss , one ancient , and the other current , can you write the two names?

We can use spss to calculate the standard deviation of the previous data , as follows:



The screenshot shows the IBM SPSS Statistics Data Editor interface. The main window displays a variable named 'remember' with the following properties:

	Name	Type	Width	Decimals	Label	Values	Missing	Columns
1	remember	Numeric	8	0	five score of children from...	None	None	8
2								
3								
4								
5								
6								
7								
8								
9								
10								
11								
12								
13								
14								
15								
16								
17								

The interface also shows the menu bar (File, Edit, View, Data, Transform, Analyze, Graphs, Utilities, Extensions, Window, Help) and the toolbar. The status bar at the bottom indicates 'IBM SPSS Statistics Processor is ready' and 'Unicode: ON'.

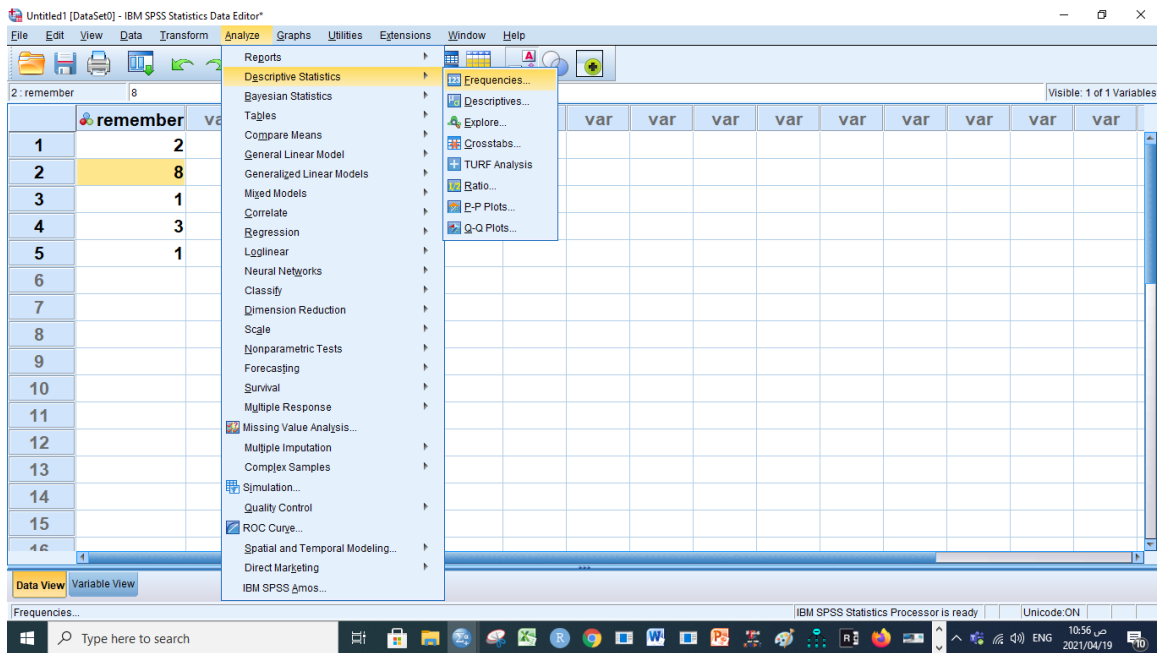


Task5: Evaluate yourself: What are the controls for writing the name?

IBM SPSS Statistics Data Editor

	remember	var	var	var	var	var	var	var	var	var	var	var	var	var	var	var
1	2															
2	8															
3	1															
4	3															
5	1															
6																
7																
8																
9																
10																
11																
12																
13																
14																
15																

IBM SPSS Statistics Processor is ready | Unicode ON | 10:55 ص 2021/04/19



The screenshot shows the IBM SPSS Statistics Data Editor interface. The main window displays a data table with the following content:

1	remember	2
1	2	
2	8	
3	1	
4	3	
5	1	
6		
7		
8		
9		
10		
11		
12		
13		
14		
15		
16		

The 'Analyze' menu is open, showing the following options:

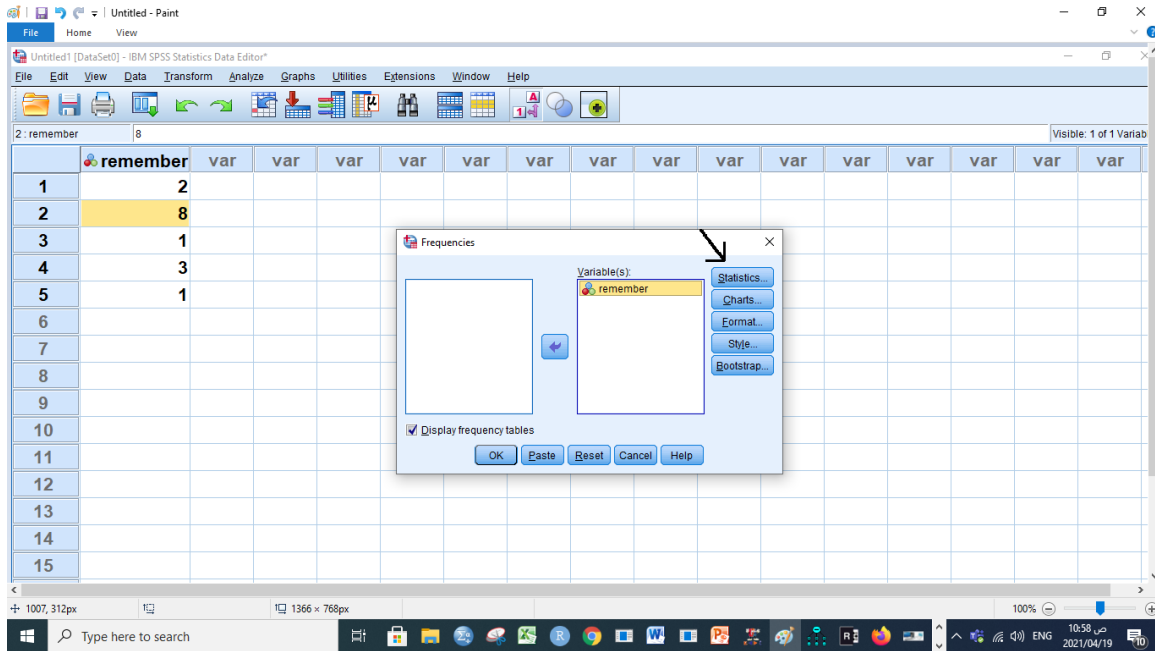
- Reports
- Descriptive Statistics
 - Frequencies...
 - Descriptives...
 - Explore...
 - Crosstabs...
 - TURF Analysis
 - Relo...
 - P-P Plots...
 - Q-Q Plots...
- Bayesian Statistics
- Tables
- Compare Means
- General Linear Model
- Generalized Linear Models
- Mixed Models
- Correlate
- Regression
- Loglinear
- Neural Networks
- Classify
- Dimension Reduction
- Scale
- Nonparametric Tests
- Forecasting
- Survival
- Multiple Response
- Missing Value Analysis...
- Multiple Imputation
- Complex Samples
- Simulation...
- Quality Control
- ROC Curve...
- Spatial and Temporal Modeling...
- Direct Marketing
- IBM SPSS Amos...

The bottom status bar shows: Frequencies..., IBM SPSS Statistics Processor is ready, Unicode ON, 10:56 ص 2021/04/19.

The screenshot shows the IBM SPSS Statistics Data Editor interface. The main window displays a data table with the following content:

	remember	var	var	var	var	var	var	var	var	var	var	var	var	var	var	var
1	2															
2	8															
3	1															
4	3															
5	1															
6																
7																
8																
9																
10																
11																
12																
13																
14																
15																

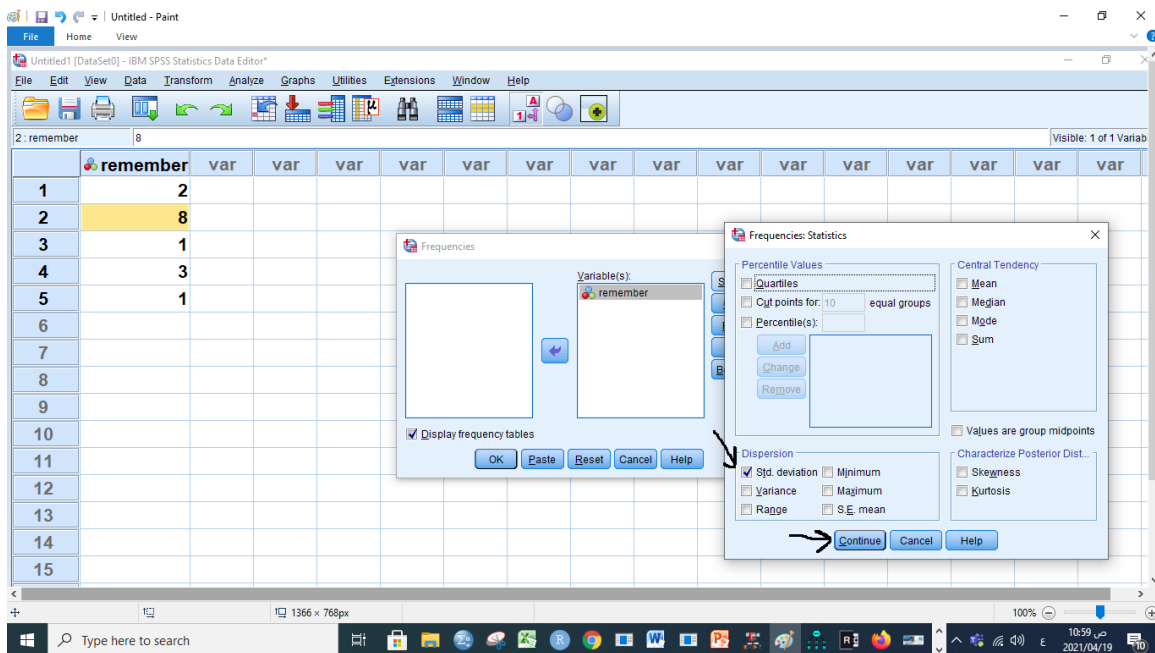
A 'Frequencies' dialog box is open, showing the variable 'remember' selected in the 'Variable(s):' list. The 'Display frequency tables' checkbox is checked. The dialog box includes buttons for 'Statistics...', 'Charts...', 'Format...', 'Style...', and 'Bootstrap...'. The 'OK' button is highlighted.



The screenshot shows the IBM SPSS Statistics Data Editor interface. The data table contains the following values for the variable 'remember':

Case	remember
1	2
2	8
3	1
4	3
5	1
6	
7	
8	
9	
10	
11	
12	
13	
14	
15	

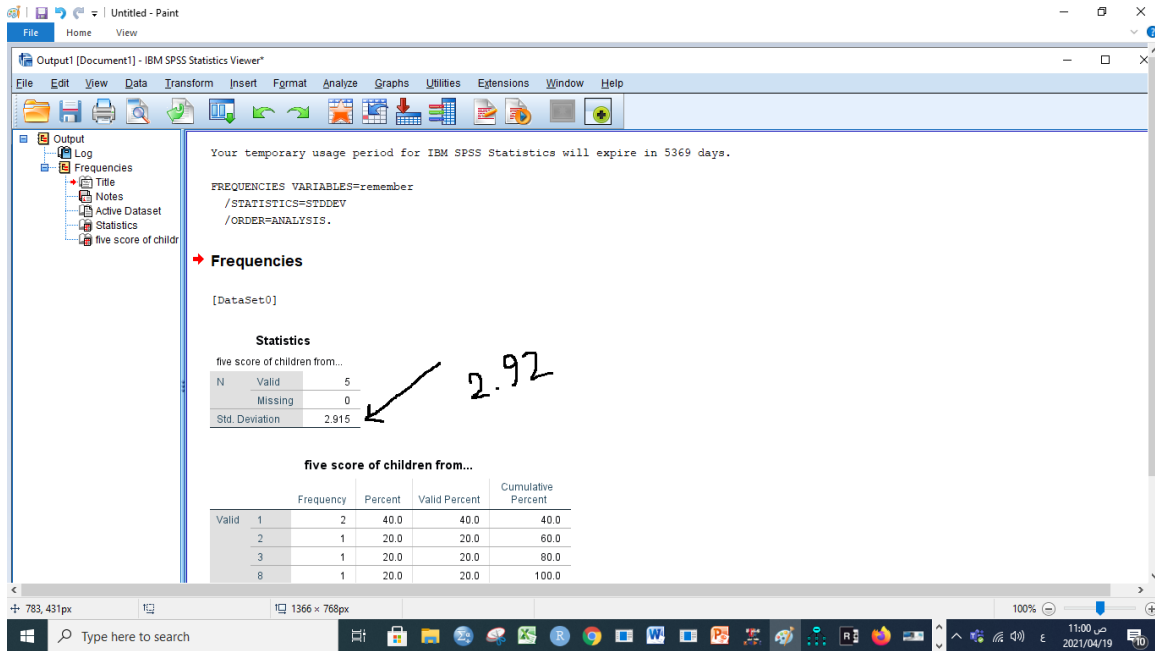
The 'Frequencies' dialog box is open, showing 'remember' in the 'Variable(s)' list. The 'Display frequency tables' checkbox is checked. The 'Statistics...' button is highlighted with an arrow.



The screenshot shows the 'Frequencies: Statistics' dialog box. The 'Frequencies' dialog box is still open in the background. The 'Frequencies: Statistics' dialog box has the following settings:

- Percentile Values:**
 - Quartiles
 - Cyt points for: 10 equal groups
 - Percentile(s):
- Central Tendency:**
 - Mean
 - Median
 - Mgde
 - Sum
- Dispersion:**
 - Std. deviation
 - Variance
 - Range
 - Minimum
 - Maximum
 - S.E. mean
- Characterize Posterior Dist...:**
 - Values are group midpoints
 - Skewness
 - Kurtosis

The 'Continue' button is highlighted with an arrow.



Comparing the manual method with spss:

We conclude that: the two methods lead to the same

result , that $\sigma = 2.92$, which mean that there is a

discrepancy among scores equal two units and 0.92

form the unit , so there is some thing from the

**individual differences among the children concerning
the ability to remember .**



Task6: a. calculate manually the SD of the following

data :

4-2-6-9-1-7

b. From the following screen , what is the next step to

calculate the SD?

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The screenshot shows the SPSS Statistics interface. The main window is a data editor with a single variable named 'Science_test'. The data points are: 2, 5, 6, 4, 8, 9. Two dialog boxes are open over the data editor.

Frequencies Dialog Box:

- Variable(s): Science_test
- Display frequency tables

Frequencies: Statistics Dialog Box:

- Percentile Values
 - Quartiles
 - Cyt points for: 10 equal groups
 - Percentile(s):
- Dispersion
 - Std deviation
 - Variance
 - Range
 - Mjnimium
 - Magimum
 - S.E. mean
- Central Tendency
 - Mean
 - Median
 - Mgdg
 - Sum
- Values are group midpc
- Characterize Posterior Dis
 - Skewness
 - Kurtosis

C.

Output

Log

Frequencies

- Title
- Notes
- Active Dataset
- Statistics
- Science_Test

```

FREQUENCIES VARIABLES=Science_Test
  /STATISTICS=STDDEV
  /ORDER=ANALYSIS.
    
```

→ Frequencies

[DataSet0]

Statistics

Science_Test		
N	Valid	7
	Missing	0
	Std. Deviation	3.735

Science_Test

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid	2	14.3	14.3	14.3
	5	28.6	28.6	42.9
	6	28.6	28.6	71.4
	8	14.3	14.3	85.7
	14	14.3	14.3	100.0
Total	7	100.0	100.0	

The value of Statistical method which is used to measure individual differences in the current Screen is:
A.14.3 B.85.7 C.3.74 D.28.6

2.Variance :

It is the square of standard deviation (σ^2).

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If we have data which its standard deviation $\sigma = 6$,

then the variance = $6^2 = 36$.

- The variance is the square of standard deviation, it is the other side of standard deviation, that in the time which the standard deviation is used in calculation Pearson correlation & regression, the variance is used in calculation ANOVA, MANOVA, T test, and so on.
- The formula of variance:

$$\sigma^2 = \frac{\sum (X - \bar{X})^2}{n - 1}$$

So, if we want to calculate variance

manually , we will follow the same steps of

calculation the standard deviation without

the square root in the formula .

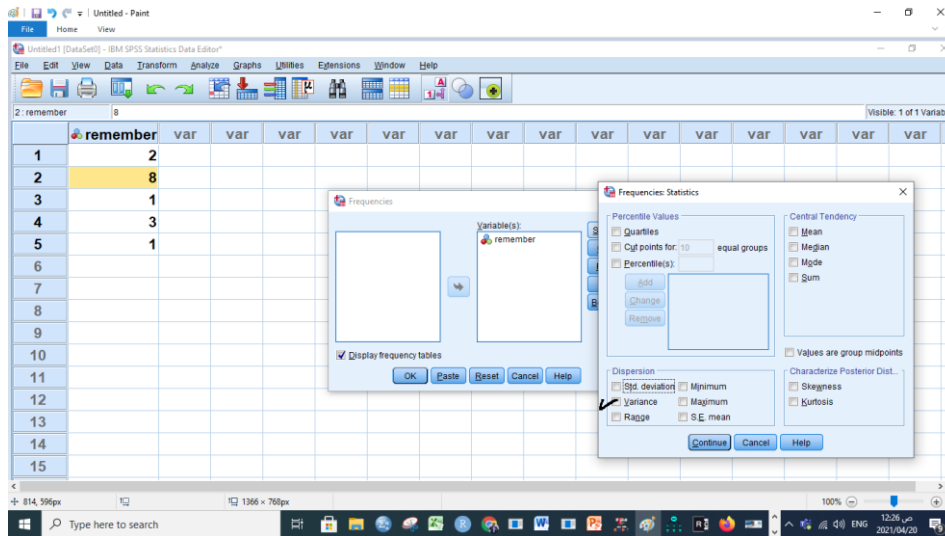
Using spss in calculating variance:

We will follow the same steps of the

standard deviation , but we will tick on the

front of variance instead of standard

deviation , in the following dialog :



Note: using the previous dialog ,you can tick on a lot of options in same time ,for example , you can tick on standard deviation , variance & range at once in the same time , and so on .

Note : The steps which are followed to calculate standard deviation using spss are the same steps for calculating other methods such as: variance , range , percentiles , deciles , quartiles & coefficient of variance



Example: calculate the variance of the scores in the previous example.

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Example: A researcher applied a test concerning the ability to remember with a total score of 10 on five children of kindergarten, whose scores were as follows : 2-8-1-3-1:calculate the standard deviation .

The manual Method:

$$\sigma^2 = \frac{34}{4} = 8.5$$

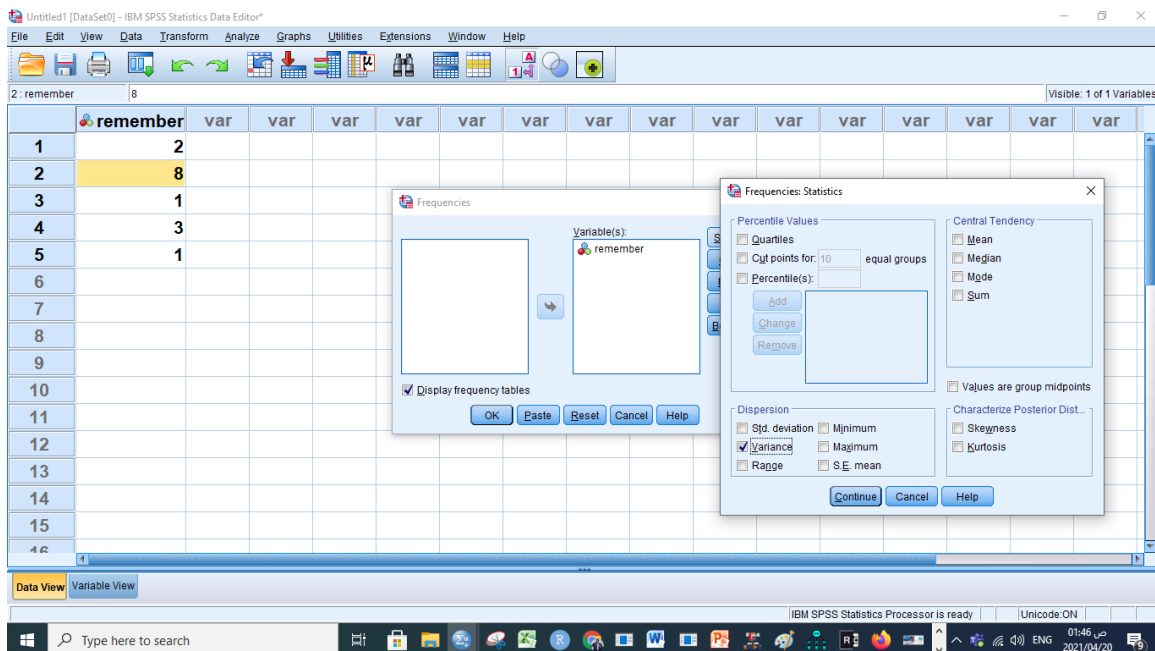
Using spss : the same steps which are used to calculate the standard deviation , except ticking on the variance in the following dialog box, and after that clicking on

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continue , and ok in the next dialog box , to

get the output window which contains the

value of variance as follows :



The screenshot shows the IBM SPSS Statistics Data Editor interface. The main window displays a data set with the following values for the variable 'remember':

Case Number	remember
1	2
2	8
3	1
4	3
5	1
6	
7	
8	
9	
10	
11	
12	
13	
14	
15	
16	

Two dialog boxes are open over the data editor:

- Frequencies**: The variable 'remember' is selected in the 'Variable(s):' list. The 'Display frequency tables' checkbox is checked.
- Frequencies: Statistics**: This dialog box is used to select statistical measures. Under 'Dispersion', the 'Variance' checkbox is checked. Other options include Std. deviation, Range, Minimum, Maximum, S.E. mean, and Sum of Squares.

FREQUENCIES VARIABLES=remember
 /STATISTICS=VARIANCE
 /ORDER=ANALYSIS.

→ Frequencies

Statistics

five score of children from...

N	Valid	5
	Missing	0
Variance		8.500

↙ 8.5

five score of children from...

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	2	40.0	40.0	40.0
	2	1	20.0	20.0	60.0
	3	1	20.0	20.0	80.0
	8	1	20.0	20.0	100.0
Total		5	100.0	100.0	



Comparing the manual method with spss:

We conclude that: the two methods lead to the same result , that $\sigma^2 = 8.5$, which means that there is a discrepancy among scores equal two units and 0.92 form the unit , so there is some thing from the individual differences among the children concerning the ability to remember .



Task7 : a. If you have data which its variance is 17 , what is the SD of this data .

b.

The screenshot shows the IBM SPSS Statistics Data Editor with a data table for 'Science_Test' and the 'Frequencies: Statistics' dialog box. The dialog box has several sections: 'Percentile Values' (Quartiles, Cut points for: 10, Percentile(s)), 'Central Tendency' (Mean, Median, Mode, Sum), 'Dispersion' (Std. deviation, Variance, Range, Minimum, Maximum, S.E. mean), and 'Characterize Posterior Dist...' (Skewness, Kurtosis). A text box is overlaid on the dialog box with the following text:

The true order of steps which are needed to calculate the variance is:

- A. Continue –tick variance –OK
- B. OK –tick variance – Continue
- C. Continue–OK–tick variance
- D. tick variance –OK -Continue

3. Range ¹:

In statistics, the **range** is the spread of your data from the lowest to the highest value in the distribution. It is a commonly used measure of [variability](#).

Calculate the range

¹ <https://www.scribbr.com/statistics/range/>

The formula to calculate the range is:

$$R = H - L$$

- R = range
- H = highest value
- L = lowest value

The range is the easiest measure of variability to calculate. To find the range,

follow these steps:

1. Order all values in your data set from low to high.
2. Subtract the lowest value from the highest value.

How useful is the range?

The range generally gives you a good indicator of variability when you have a

distribution without extreme values.

But the range can be misleading when you have outliers in your data set. One extreme value in the data will give you a completely different range.

Example : calculate the range of the following data:

Participant	1	2	3	4	5	6	7	8
Age	37	19	31	29	21	26	33	36

The manual method:

Step1 : .

Order all values in your data set from low to high, as follows:

Age	19	21	26	29	31	33	36	37
-----	----	----	----	----	----	----	----	----

Step1 : .

- Subtract the lowest value from the highest value, as follows:

$$R = H - L$$

$$R = 37 - 19 = 18$$

The range of our data set is **18 years**.

Note: Range example with an outlier One value in your data set is replaced with an outlier.

Age	19	21	26	29	31	33	36	61
-----	----	----	----	----	----	----	----	----

Using the same calculation, we get a very different result this time:

$$R = H - L$$

Individual Differences_4GE

$$R = 61 - 19 = 42$$

With an outlier, our range is now **42 years**.



<https://www.dkfindout.com/us/math/averag>

[es/range/](https://www.dkfindout.com/us/math/averages/range/)



Individual Differences_4GE



Using spss : As we knew previously that ,

the steps which are followed to calculate standard

deviation using spss are the same steps for calculating

other methods such as: range, except we will tick on

the front of range , after that , continue + ok , to get

the value of the range , as follows:

Individual Differences_4GE

The screenshot shows the SPSS interface with a data grid containing the variable 'age' and several 'var' columns. Two dialog boxes are open over the grid:

- Frequencies:** This dialog box has a list of variables on the left (VAR00001, VAR00002) and a 'Variable(s):' list on the right containing 'age'. The 'Display frequency tables' checkbox is checked. Buttons for 'OK', 'Paste', 'Reset', 'Cancel', and 'Help' are at the bottom.
- Frequencies: Statistics:** This dialog box is for selecting statistical options. It includes:
 - Percentile Values:** 'Quartiles' is checked. 'Cut points for: 10 equal groups' is selected. 'Percentile(s):' is empty. Buttons 'Add', 'Change', and 'Remove' are present.
 - Central Tendency:** 'Mean', 'Median', 'Mode', and 'Sum' are all unchecked.
 - Dispersion:** 'Range' is checked. 'Std. deviation', 'Variance', 'Mjnimum', 'Magimum', and 'S.E. mean' are unchecked.
 - Characterize Posterior Dist.:** 'Skewness' and 'Kurtosis' are unchecked.
 Buttons 'Continue', 'Cancel', and 'Help' are at the bottom.

SPSS Output Window: FREQUENCIES VARIABLES=age

```

/STATISTICS=RANGE
/ORDER=ANALYSIS.

```

→ Frequencies

Statistics

age		
N	Valid	8
	Missing	5
Range		18

		age			
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	19	1	7.7	12.5	12.5
	21	1	7.7	12.5	25.0
	26	1	7.7	12.5	37.5
	29	1	7.7	12.5	50.0
	31	1	7.7	12.5	62.5
	33	1	7.7	12.5	75.0
	36	1	7.7	12.5	87.5
	37	1	7.7	12.5	100.0
	Total	8	61.5	100.0	
Missing	System	5	38.5		
Total		13	100.0		



Task8: A teacher applied a French test on 7

students and their scores were as follows:

5-2-17-8-4

a. Use the range manually to measure individual

differences, explaining whether there are

extreme values in the distribution.

b. What are the remaining steps to show the

range value in the following screen?

	class1_score	class2_score	Zclass1_score	Zclass2_score	French_test	var	var	var	var
1		2	15	-1.15441					
2		8							
3		4							
4		18							
5		14							
6		4							
7		2							
8		12							
9		8							
10		10							
11									
12									
13									
14									
15									

c. From the following screen, the value of statistical tool which is difference between the high score and low score is:?

Output [Document] - IBM SPSS Statistics Viewer

File Edit View Data Transform Insert Format Analyze Graphs Utilities Extensions Window Help

Output

- Log
- Ratio Statistics
 - Title
 - Notes
 - Case Processing
 - Ratio Statistics fo
- Log
- **Frequencies**
 - Title
 - Notes
 - Statistics
 - Perc_Skills
- Log
- Frequencies
 - Title
 - Notes
 - Statistics
- Frequency Table
 - Title
 - class1_scor
 - class2_scor
- Log
- Descriptives
 - Title
 - Notes
 - Descriptive Statis
- Log
- Frequencies
 - Title
 - Notes
 - Statistics
 - French_test

/ORDER=ANALYSIS.

→ **Frequencies**

Statistics

French_test

N	Valid	5
	Missing	5
Mean		7.2000
Std. Deviation		5.89067
Range		15.00
Percentiles	28	3.3600

A.7.2

B.5.89

C.15

D.3.36

French_test

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid	2.00	1	10.0	20.0
	4.00	1	10.0	40.0
	5.00	1	10.0	60.0
	8.00	1	10.0	80.0
	17.00	1	10.0	100.0
Total	5	50.0	100.0	
Missing System	5	50.0		
Total	10	100.0		



4. Percentiles or Centiles /Deciles/Quartiles :

a. Percentiles(or Centiles): 99 points divide the data into 100 parts (or groups), after arranging the data in ascending or descending order, each point is called percentile(or centile). Each percentile is denoted by the symbol C in relation to the centiles, for example the 38th percentile is symbolized by the symbol C38 and the 90th

percentile symbolized by the symbol C_{90} and so on.

Each percentile divides the data into two parts, the first part starts from the percentile & less and the other part after the percentile.

Example: The 35th percentile means score from which 35% of the number of data falls and then 65% of the number of data exit .

The 77th percentile means the score from which 77% of the number of data is located, and then 23% of the number of data exit.



<https://www.statisticshowto.com/probability-and-statistics/percentiles-rank-range>

Note: try to differentiate among three concepts:

(1)the number of Centile, (2) the order of Centile , &

(3) the value of Centile . you can recognize the

differences among these concepts in the following

example, so take care.

Example: calculate the value of C_{28} , for the

following data for achievement the subject of

Geometry : 7-9-14-5-4-13-19-16 -15-10-14-13-11 .

Solution :

Note: remember that we have 99 Centiles , but we want only the value of C28 .

The manual method:

Step1: We arrange the data in ascending or

descending order, as usual in ascending order, as

follows:

4-5-7-9-10-11-13-13-14-14-15-16-19

Step2: The required Centile order is equal to (Centile

number / 100) x (number of data +1).

Centile number =28 (because we want the value of C28).

Number of data =13 (you can count the previous data to make sure of that).

So : Centile order= $(28/100) \times (13+1) = 0.28 \times 14 = 3.92$

Step3: where that the order of C28= 3.92 , so find the the third value in the ascending data which equal =7

, and subtract this value(7) , from the next value (9) to get $(9-7)=2$, then multiply the last difference by the

decimal in the order(0.92) , to get the product-x

$$(2 \times 0.92) = 1.84 .$$

The order of $C_{28} = 3.92$

4-5-7-9-10-11-13-13-14-14-15-16-19

$$9-7=2 \times 0.92 = 1.84$$

Step 5: Add the value corresponding to the integer

number order(3) , which equals 7 , to the product-x

which equals 1.84 as follows : $7+1.84$ to get the value

of centile C28 which equal 8.84 .

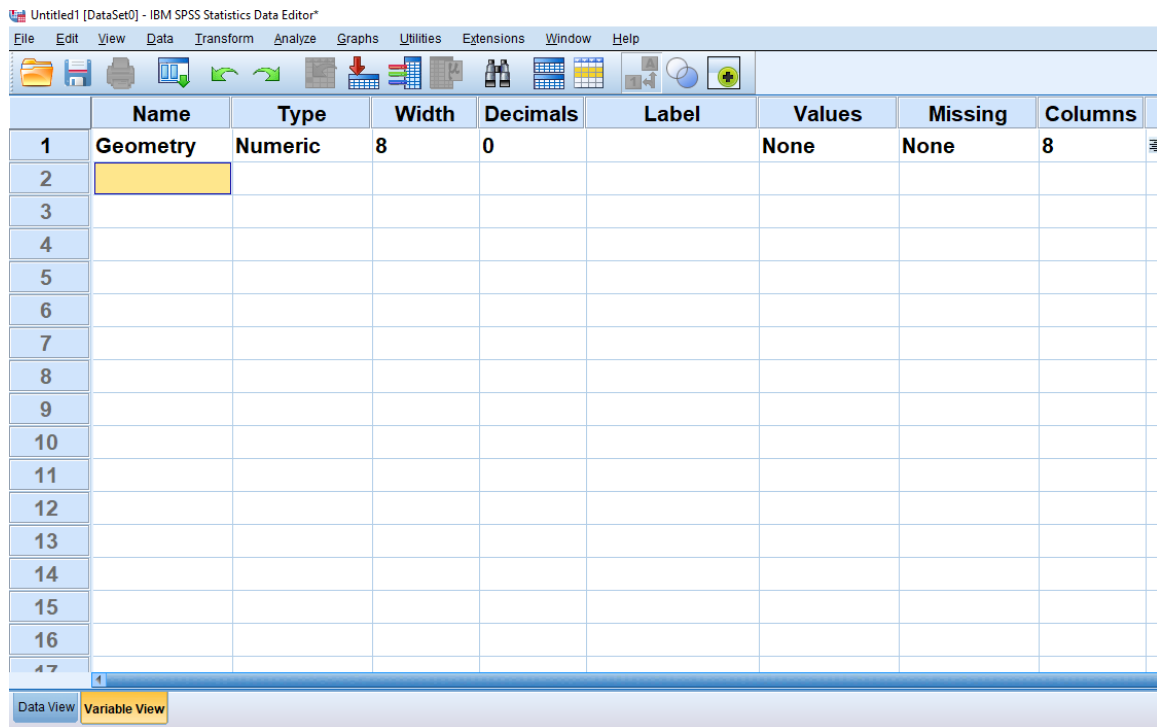
Using SPSS :

As we studied previously , the steps for calculating

Centiles (and some methods) are the steps for

calculating Standard Deviation, so the steps are as

follows:



Untitled1 [DataSet0] - IBM SPSS Statistics Data Editor*

File Edit View Data Transform Analyze Graphs Utilities Extensions Window Help

	Name	Type	Width	Decimals	Label	Values	Missing	Columns
1	Geometry	Numeric	8	0		None	None	8
2								
3								
4								
5								
6								
7								
8								
9								
10								
11								
12								
13								
14								
15								
16								
17								

Data View Variable View

Individual Differences_4GE

Untitled1 [DataSet0] - IBM SPSS Statistics Data Editor*

File Edit View Data Transform Analyze Graphs Utilities Extensions Window Help

14 : Geometry

	Geometry	var	var	var	var	var	var	var	var	var	var	var	var	var
1	7													
2	9													
3	14													
4	5													
5	4													
6	13													
7	19													
8	16													
9	15													
10	10													
11	14													
12	13													
13	11													
14														
15														
16														

Data View Variable View

Save this document IBM SPSS Statistics Processor is ready

Untitled1 [DataSet0] - IBM SPSS Statistics Data Editor*

File Edit View Data Transform Analyze Graphs Utilities Extensions Window Help

14 : Geometry

	Geometry	var	var	var	var	var	var	var	var	var	var	var	var	var
1	7													
2	9													
3	14													
4	5													
5	4													
6	13													
7	19													
8	16													
9	15													
10	10													
11	14													
12	13													
13	11													
14														
15														
16														

Data View Variable View

Visible: 1 of 1 Variables

IBM SPSS Statistics Processor is ready Unicode:ON

10:46 ص 2021/05/13

Untitled1 [DataSet0] - IBM SPSS Statistics Data Editor*

File Edit View Data Transform Analyze Graphs Utilities Extensions Window Help

14 : Geometry

	Geometry	var	var	var	var	var	var	var	var	var	var	var	var
1	7												
2	9												
3	14												
4	5												
5	4												
6	13												
7	19												
8	16												
9	15												
10	10												
11	14												
12	13												
13	11												
14													
15													
16													

Frequency dialog box: Variable(s): Geometry, Display frequency tables checked.

Data View Variable View

Untitled1 [DataSet0] - IBM SPSS Statistics Data Editor*

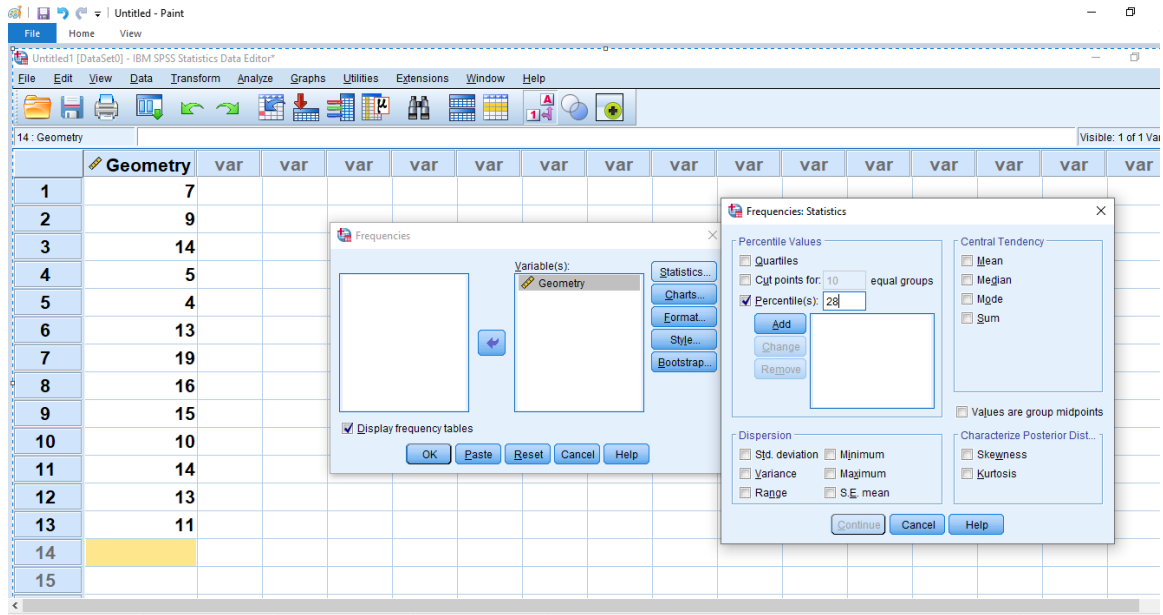
File Edit View Data Transform Analyze Graphs Utilities Extensions Window Help

14 : Geometry

	Geometry	var	var	var	var	var	var	var	var	var	var	var	var
1	7												
2	9												
3	14												
4	5												
5	4												
6	13												
7	19												
8	16												
9	15												
10	10												
11	14												
12	13												
13	11												
14													
15													
16													

Frequency dialog box: Variable(s): Geometry, Display frequency tables checked.

Data View Variable View



14: Geometry

	Geometry	var	var	var	var	var	var	var	var	var	var	var	var	var	var	var
1	7															
2	9															
3	14															
4	5															
5	4															
6	13															
7	19															
8	16															
9	15															
10	10															
11	14															
12	13															
13	11															
14																
15																

Frequencies: Statistics

Percentile Values

- Quartiles
- Cut points for: 10 equal groups
- Percentile(s): 28

Central Tendency

- Mean
- Median
- Mode
- Sum

Dispersion

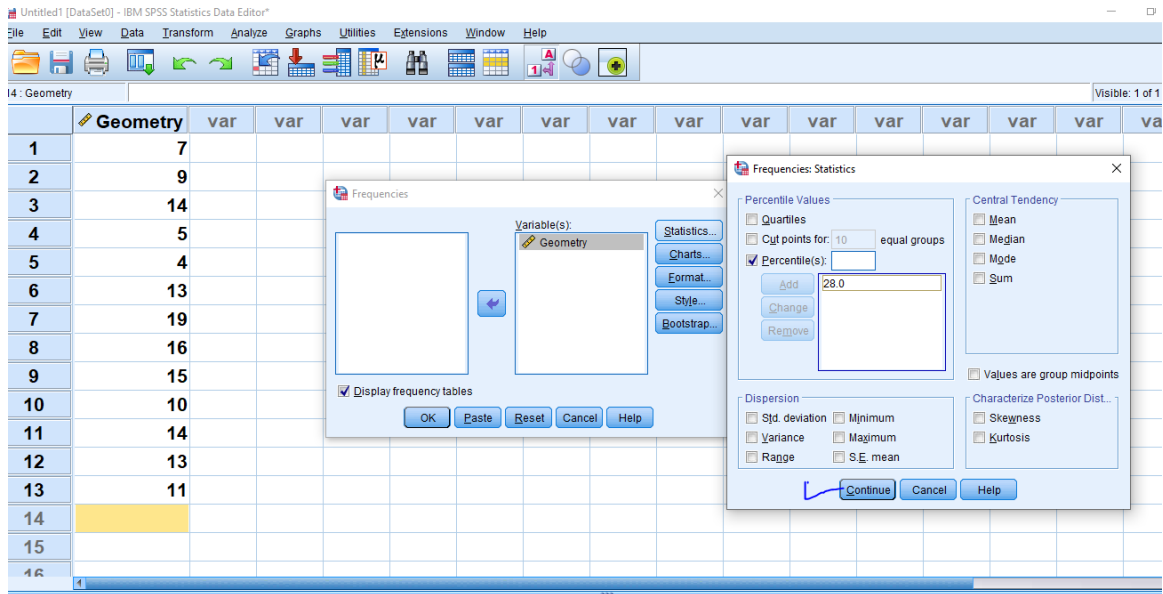
- Std. deviation
- Variance
- Range
- Minimum
- Maximum
- S.E. mean

Characterize Posterior Dist...

- Skewness
- Kurtosis

Values are group midpoints

Display frequency tables:



14: Geometry

	Geometry	var	var	var	var	var	var	var	var	var	var	var	var	var	var	var
1	7															
2	9															
3	14															
4	5															
5	4															
6	13															
7	19															
8	16															
9	15															
10	10															
11	14															
12	13															
13	11															
14																
15																
16																

Frequencies: Statistics

Percentile Values

- Quartiles
- Cut points for: 10 equal groups
- Percentile(s): 28.0

Central Tendency

- Mean
- Median
- Mode
- Sum

Dispersion

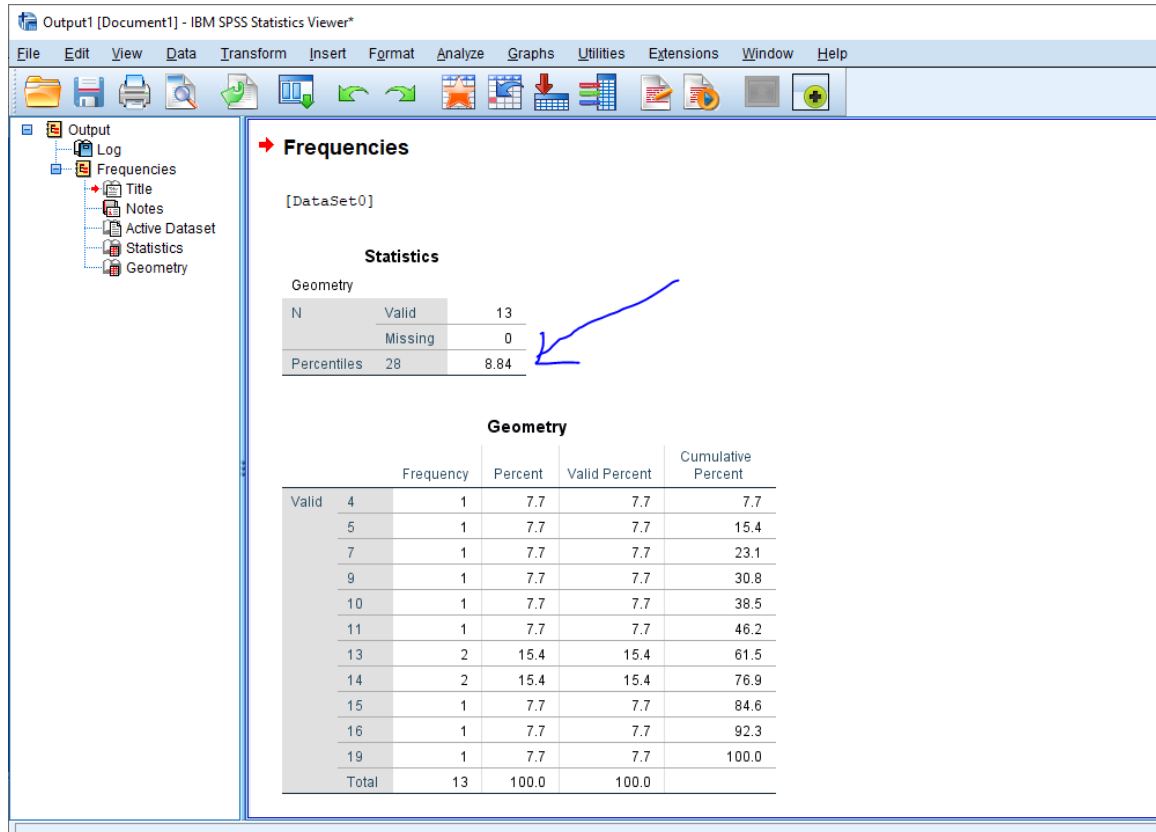
- Std. deviation
- Variance
- Range
- Minimum
- Maximum
- S.E. mean

Characterize Posterior Dist...

- Skewness
- Kurtosis

Values are group midpoints

Display frequency tables:



The screenshot shows the SPSS Statistics Viewer interface. The 'Frequencies' output is displayed, showing the distribution of scores for the variable 'Geometry'. A blue arrow points to the 'Percentiles' row in the 'Statistics' table, specifically to the value 8.84.

Statistics

Geometry		
N	Valid	13
	Missing	0
Percentiles	28	8.84

Geometry

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid 4	1	7.7	7.7	7.7
5	1	7.7	7.7	15.4
7	1	7.7	7.7	23.1
9	1	7.7	7.7	30.8
10	1	7.7	7.7	38.5
11	1	7.7	7.7	46.2
13	2	15.4	15.4	61.5
14	2	15.4	15.4	76.9
15	1	7.7	7.7	84.6
16	1	7.7	7.7	92.3
19	1	7.7	7.7	100.0
Total	13	100.0	100.0	



<https://ezspss.com/how-to-calculate-percentiles-in->

[spss/](#)

It is the same result which we got using the manual method , that $C28 = 8.84$.

$C28=8.84$ means that first 28% of the ascending score are 8.8 or bellow, and the rest of the scores are above 8.84 , this may direct the teacher to change his educational practices to move this point as required, to the right or the left.



Task9: A teacher applied an English test on 7

students and their scores were as follows:

9-1-5-2-4-7-3

a. Calculate manually C_{43} .

b. From the following screen , the value of the

$D_6 = ?$

Statistics

Science_Test

N	Valid	7
	Missing	0
Std. Deviation		3.735
Percentiles	5	2.00
	6	2.00
	15	2.60
	50	6.00
	60	6.00
	66	6.56

Science_Test

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid	2	14.3	14.3	14.3
	5	28.6	28.6	42.9
	6	28.6	28.6	71.4
	8	14.3	14.3	85.7
	14	14.3	14.3	100.0
Total	7	100.0	100.0	

A.3.74
B.2
C.6
D.6.56

c. From the following screen, what is the number you should insert in the indicated cell, to calculate Q1:

Individual Differences_4GE

The screenshot shows the IBM SPSS Statistics Data Editor interface. The main window displays a data table with the following data:

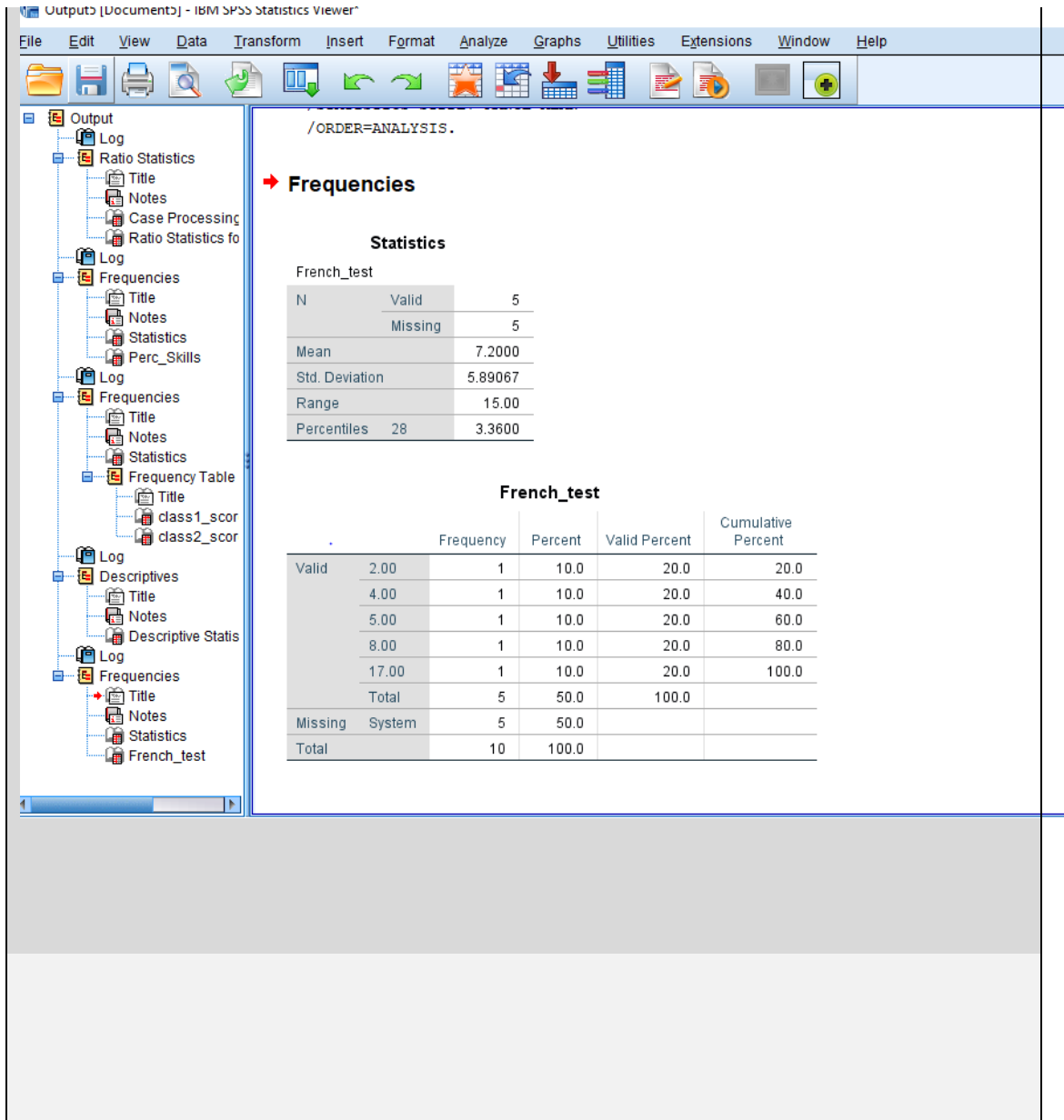
Science_Test	var
1	2
2	5
3	6
4	8
5	14
6	5
7	6
8	
9	
10	
11	
12	
13	
14	
15	
16	

The 'Frequencies: Statistics' dialog box is open, showing the following settings:

- Variable(s): Science_Test
- Display frequency tables:
- Percentile Values:
 - Quartiles
 - Cyt points for: 10 equal groups
 - Percentile(s): 15.0, 50.0, 60.0, 66.0
- Central Tendency:
 - Mean
 - Median
 - Mode
 - Sum
- Dispersion:
 - Std. deviation
 - Variance
 - Range
 - Minimum
 - Maximum
 - S.E. mean
- Characterize Posterior Dist...:
 - Skewness
 - Kurtosis

A list box in the foreground contains the following options:

- A.15
- B.25
- C.50
- D.1



The screenshot shows the IBM SPSS Statistics Viewer interface. The left pane displays a tree view of the output, with 'Frequencies' selected under the 'French_test' variable. The main window displays the following output:

`/ORDER=ANALYSIS.`

Frequencies

Statistics

French_test		
N	Valid	5
	Missing	5
Mean		7.2000
Std. Deviation		5.89067
Range		15.00
Percentiles	28	3.3600

French_test

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid	2.00	1	10.0	20.0
	4.00	1	10.0	40.0
	5.00	1	10.0	60.0
	8.00	1	10.0	80.0
	17.00	1	10.0	100.0
Total	5	50.0	100.0	
Missing System	5	50.0		
Total	10	100.0		

b. Deciles: 9 points divide the data into 10 parts (or groups), after arranging the data in ascending or

descending order, each point is called Decile. Each

Decile is denoted by the symbol D in relation to the

Decile, for example the 3rd Decile is symbolized by

the symbol D_3 and the 9th Decile is symbolized by the

symbol D_9 and so on.

Each Decile divides the data into two parts, the first

part starts from the Decile & less and the other part

after the Decile.

Example: The 4th Decile means score from which 40% of the number of data falls and then 60% of the number of data exit .

The 7th Decile means the score from which 70% of the number of data is located, and then 30% of the number of data exit.

c. Quartiles: 3 points divide the data into 4 parts (or groups), after arranging the data in ascending or descending order, each point is called Quartile. Each Quartile is denoted by the symbol Q in relation to the



Individual Differences_4GE



Quartile, for example the 2nd Quartile is symbolized

by the symbol Q2 and the 1st Quartile symbolized by

the symbol Q1 and so on.

Each Quartile divides the data into two parts, the first

part starts from the Quartile & less and the other

part after the Quartile.

Example: The 2nd Quartile means score from which

50% of the number of data falls and then 50% of the

number of data exit .

The 3rd Quartile means the score from which 75% of the number of data is located, and then 25% of the number of data exit.

Note: C10=D1, C20=D2, C25=Q1, C30=D3, C40=D4, C50=D5=Q2, C60=D6, C70=D7, C75=Q3, C80=D8, C90=D9.

Note: The steps either manually or using spss which are used to calculate the percentiles are the same steps which are used to calculate the Deciles & the Quartiles , because the two later are other forms from the Centiles , that the Deciles

**(D1,D2,D3,D4,D5,D6,D7,D8,D9) are the Centiles
(C10,C20,C30,C40,C50,C60,C70,C80, & C90) ,
respectively , and the Quartiles (Q1,Q2,Q3), are the
Centiles(C25,C50 & C75), respectively .**

**So , if you want to calculate the fourth Decile (D4) , all
you have to do is to calculate the fortieth
Centile(C40), which equal (D4).**

**Also , if you want to calculate the second Quartile
(Q2) , all you have to do is to calculate the fiftieth
Centile(C50), which equal (Q2).**

Note: Depending on the relation among C, D, & Q, we can say that : calculation the Centile is the most important operation , because , we can conclude from the value of Centile the values of Deciles or Quartiles.



Task 10 : Complete :

10-1: The maximum number on centiles =.....

10-2: $D2 = \dots = \dots$

10-3: $Q3 = \dots$



Task11: what is the value of C1 for the following

data: 8-17-20-5-33-11

5: Coefficient of variance (COV)



<https://www.investopedia.com/terms/c/coefficient>

[ofvariation.asp](#)

$$\text{COV} = \frac{\sigma}{\bar{X}}$$

x- refer to the average of scores,

σ refer to the standard deviation

COV refer to coefficient of variance

In the time that Standard Deviation can not give us a percentage of discrepancy(individual differences), and it just tells us about the distances of scores from the sample mean without absolute value, COV gives us a percentage of the discrepancy this percentage is easy to understand, so it is better than SD .

Example: A researcher applied a test concerning perceptual skills with a total score of 20 on eight

students, whose scores were as follows : 3-14-16-9-

18-12-15-9 :calculate the coefficient of variance .

Solution:

The manual method:

Step 1: calculate the average (the mean) of scores:

$$\bar{X} = \frac{\sum X}{N} = \frac{96}{8} = 12$$

Step 2: calculate the standard deviation of

scores :

$$\sigma = \sqrt{\frac{\sum (X - \bar{X})^2}{n-1}} = 4.84 \text{ (review the lecture of standard deviation)}$$

Step3: calculate the COV as follows:

$$\text{COV} = \frac{\sigma}{\bar{X}} = \frac{4.84}{12} = 0.403 = 40.3 \%$$

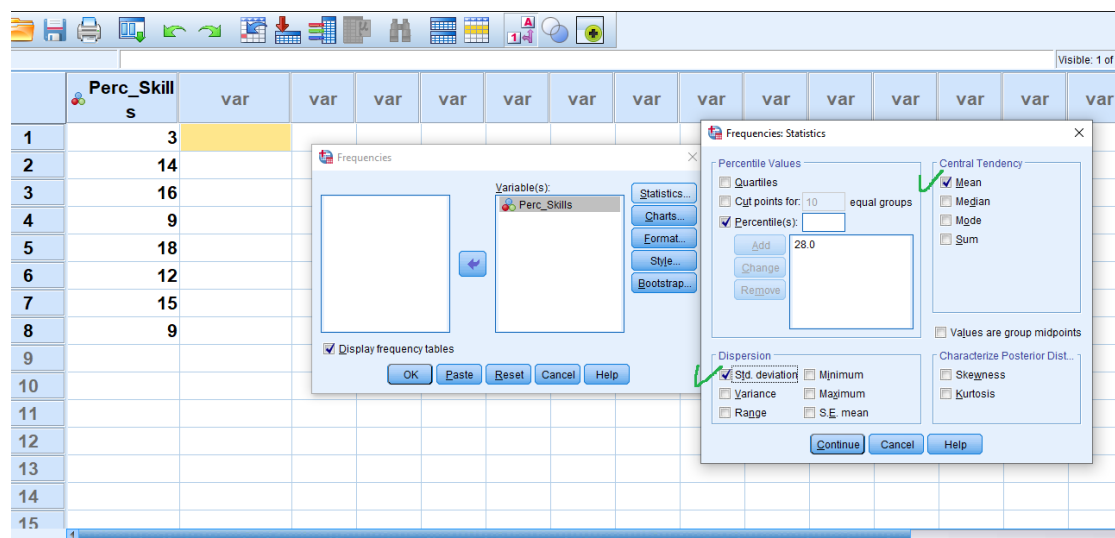
Using SPSS:

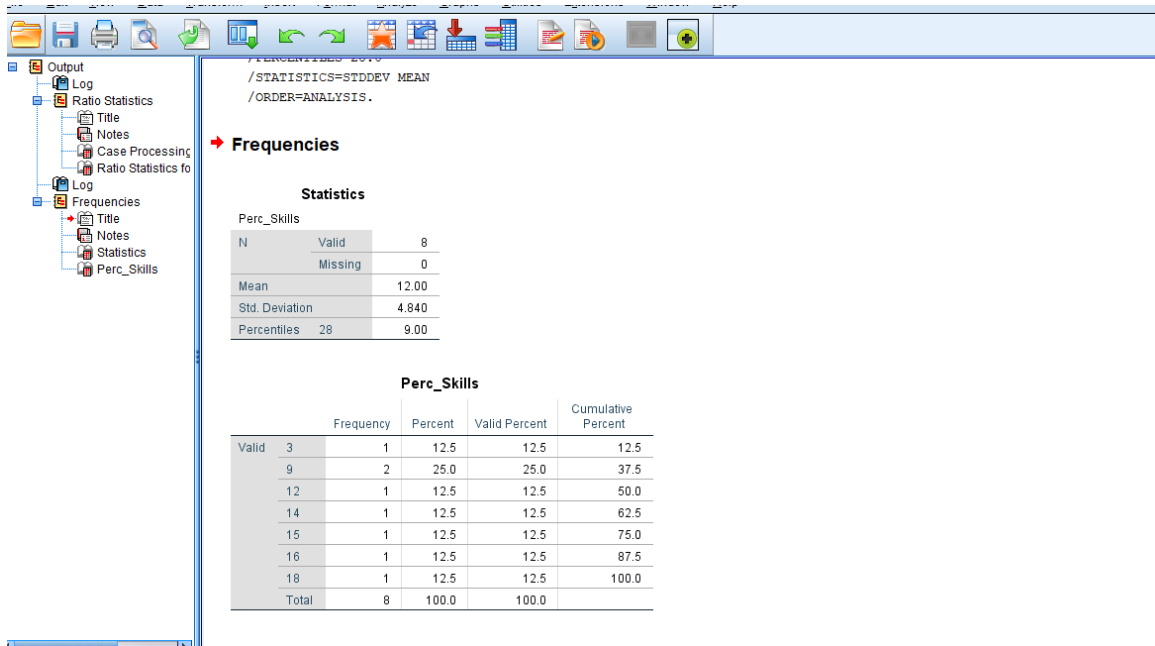
We can calculate COV using two SPSS methods as

follows:

SPSS1:

By following the same steps which are followed to calculate the SD, plus ticking on the mean beside the SD, to get the values of mean & SD in the outputs windows :





From the previous window, we divide manually the SD

over mean ($4.84/12$) to get the value of COV which

equal 0.403 (40.3%).

SPSS2:

Step1:

Individual Differences_4GE

Untitled1 [DataSet1] - IBM SPSS Statistics Data Editor

File Edit View Data Transform Analyze Graphs Utilities Extensions Window Help

	Name	Type	Width	Decimals	Label	Values	Missing	Columns	Align	
1	Perc_Skills	Numeric	8	0		None	None	8	Right	U
2	Unity	Numeric	8	0		None	None	8	Right	U
3										
4										
5										
6										
7										
8										
9										
10										
11										
12										
13										
14										
15										
16										
17										

Data View Variable View

Step 2:

Individual Differences_4GE

Untitled1 [DataSet0] - IBM SPSS Statistics Data Editor*

File Edit View Data Transform Analyze Graphs Utilities Extensions Window Help

14 :

	Perc_Skill s	Unity	var	var	var	var	var	var	var	var	var
1	3	1									
2	14	1									
3	16	1									
4	9	1									
5	18	1									
6	12	1									
7	15	1									
8	9	1									
9											
10											
11											
12											
13											
14											
15											

Step 3:

Individual Differences_4GE

Untitled1 [DataSet0] - IBM SPSS Statistics Data Editor*

File Edit View Data Transform Analyze Graphs Utilities Extensions Window Help

14 :

	Perc_Skill s				
1	3				
2	14				
3	16				
4	9				
5	18				
6	12				
7	15				
8	9				
9					
10					
11					
12					
13					
14					
15					

Reports

- Descriptive Statistics
- Bayesian Statistics
- Tables
- Compare Means
- General Linear Model
- Generalized Linear Models
- Mixed Models
- Correlate
- Regression
- Loglinear
- Neural Networks
- Classify
- Dimension Reduction
- Scale
- Nonparametric Tests
- Forecasting
- Survival
- Multiple Response
- Missing Value Analysis...
- Multiple Imputation
- Complex Samples
- Simulation...
- Quality Control
- ROC Curve...

123 Frequencies...

Descriptives...

Explore...

Crosstabs...

TURF Analysis

Ratio...

P-P Plots...

Q-Q Plots...

Step 4:

Untitled1 [DataSet0] - IBM SPSS Statistics Data Editor*

File Edit View Data Transform Analyze Graphs Utilities Extensions Window Help

	Perc_Skill s	Unity	var	var	var	var	var	var	var	var
1	3	1								
2	14	1								
3	16	1								
4	9	1								
5	18	1								
6	12	1								
7	15	1								
8	9	1								
9										
10										
11										
12										
13										
14										

Ratio Statistics

Numerator: Perc_Skills

Denominator: Unity

Group Variable:

Sort by group variable

Ascending order

Descending order

Display results

Save results to external file

File... Statistics... OK Paste Reset Cancel Help

Step 5:

File Edit View Data Transform Analyze Graphs Utilities Extensions Window Help

	Perc_Skill s	Unity	var	var	var	var	var	var	var
1	3	1							
2	14	1							
3	16	1							
4	9	1							
5	18	1							
6	12	1							
7	15	1							
8	9	1							
9									
10									
11									
12									
13									
14									
15									

Ratio Statistics

Numerator: Perc_Skills

Denominator: Unity

Group Variable:

Sort by group variable

Ascending order

Descending order

Display results

Save results to external file

File... Statistics... OK Paste Reset Cancel Help

Ratio Statistics: Statistics

Central Tendency: Median, Mean, Weighted Mean

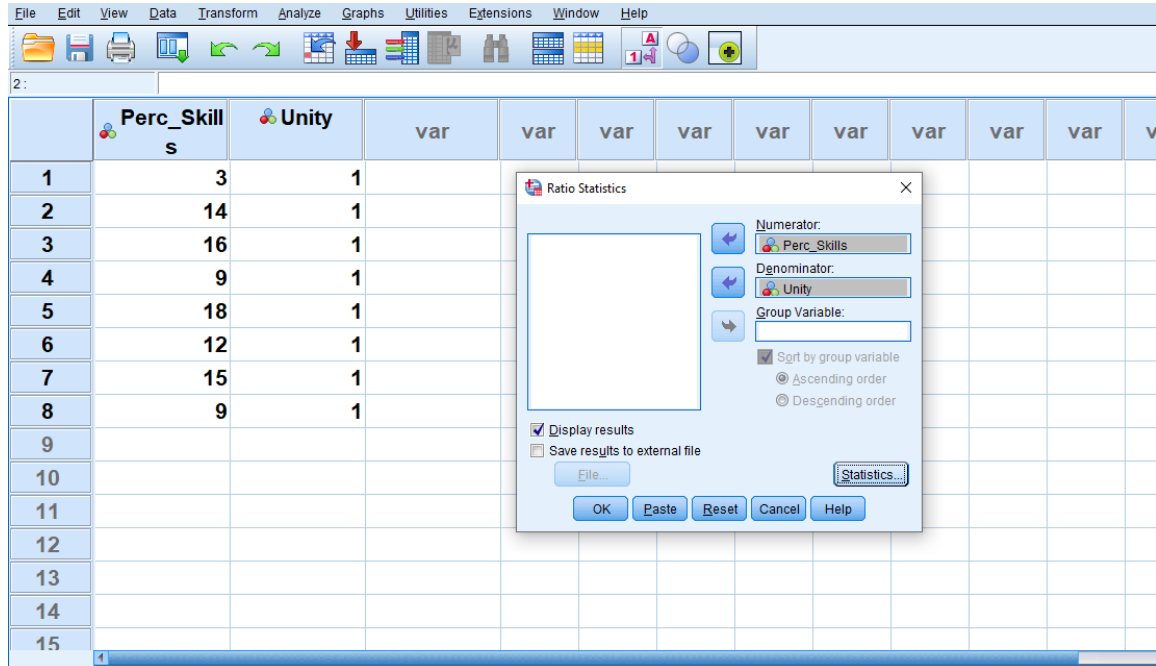
Dispersion: AAD, QDD, PRD, Median Centered COV, Mean Centered COV

Confidence intervals: Level (%): 95

Concentration Index: Between Proportions (Low/High Proportion), Within Percentage of Median (Percentage of median)

Continue Cancel Help

Step6:



The screenshot shows the SPSS software interface. A data table is visible with the following data:

	Perc_Skills	Unity	var	var	var	var	var	var	var	var	var
1	3	1									
2	14	1									
3	16	1									
4	9	1									
5	18	1									
6	12	1									
7	15	1									
8	9	1									
9											
10											
11											
12											
13											
14											
15											

The 'Ratio Statistics' dialog box is open, showing the following settings:

- Numerator: Perc_Skills
- Denominator: Unity
- Group Variable: (empty)
- Sort by group variable
- Ascending order
- Descending order
- Display results
- Save results to external file

Buttons: File..., Statistics, OK, Paste, Reset, Cancel, Help.

Step7:

Output5 [Document5] - IBM SPSS Statistics Viewer*

File Edit View Data Transform Insert Format Analyze Graphs Utilities Extensions Window Help

RATIO STATISTICS Perc_Skills WITH Unity
/MISSING=EXCLUDE
/PRINT=COD MDCOV MNCOV PRD.


→ **Ratio Statistics**

Case Processing Summary

Count	
Overall	8
Excluded	0
Total	8

Ratio Statistics for Perc_Skills / Unity

Price Related Differential	Coefficient of Dispersion	Coefficient of Variation	
		Mean Centered	Median Centered
1.000	.288	40.3%	38.1%




It is the same result whether manually or using

SPSS , that COV=40.3% which means that there is

40.3% of discrepancy in the data , means that there is



Individual Differences_4GE



individual differences among students equal 40.3% ,

this result may redirect the teacher to do his best to

minimize this percentage in the next time .

Note: COV can be used either to recognize the

discrepancy of one group , or to recognize the

difference between the discrepancy of two groups

,in situations where the sample, time, and unit of

measure differ, so it is better than SD .

For example, if we want to know the differences

between the discrepancy of two classes in scores for

the same test, or the differences between the discrepancy of scores for the same test and the same class but in two different periods, or compare the discrepancy in income for two samples from two different countries using different currencies.

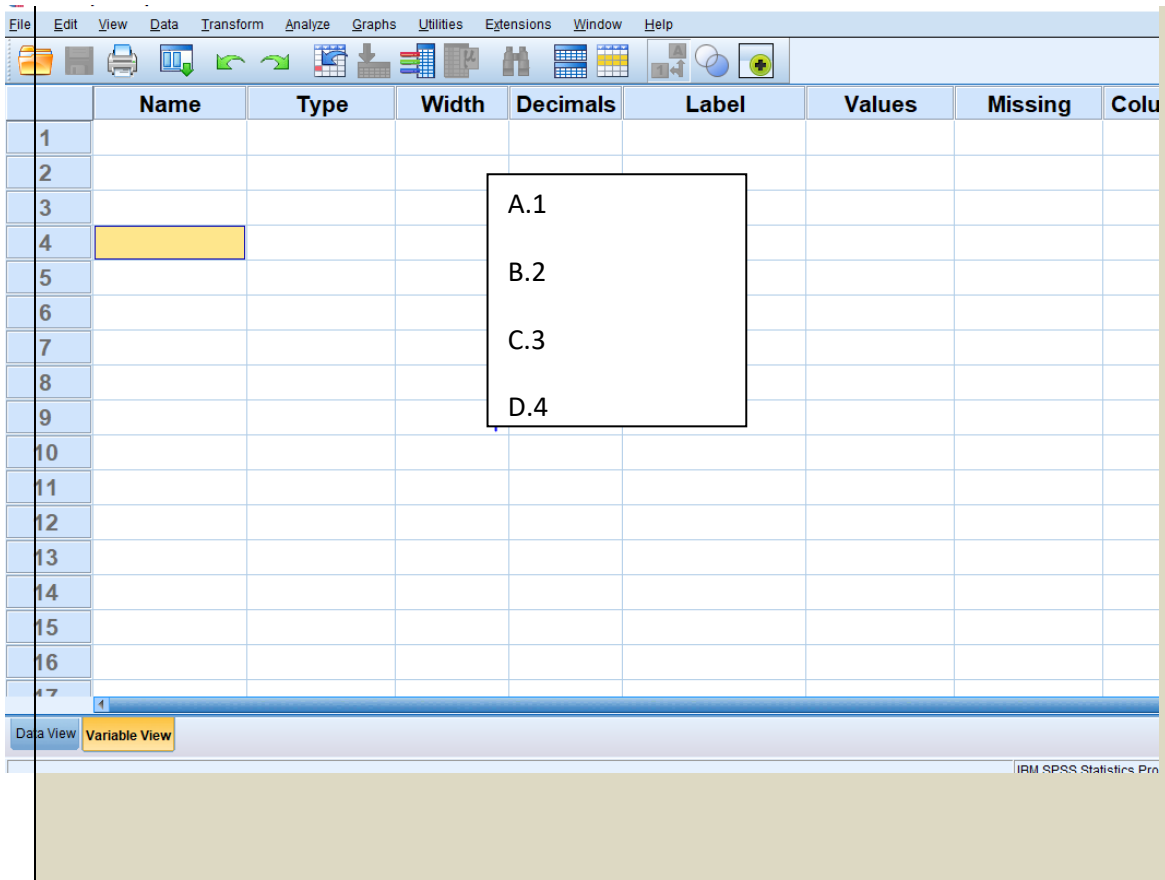


Task12 . A researcher applied an achievement test on 5 students to get the following scores : 1-4-2-2-7,

**calculate manually the percent of discrepancy for
this data.**



**Task13: In the following Screen , the number of
variables which should be edited to calculate COV,
for one set of data is:**



The screenshot shows the SPSS Variable View dialog box. The 'Name' field is highlighted in yellow. A dropdown menu is open, showing the following options: A.1, B.2, C.3, and D.4. The dialog box has a menu bar (File, Edit, View, Data, Transform, Analyze, Graphs, Utilities, Extensions, Window, Help) and a toolbar with various icons. The main area is a table with columns: Name, Type, Width, Decimals, Label, Values, Missing, and Columns. The table has 17 rows, with row 4 highlighted. At the bottom, there are tabs for 'Data View' and 'Variable View', with 'Variable View' selected. The status bar at the bottom right reads 'IBM SPSS Statistics Pro'.



[https://www.statology.org/coefficient-of-](https://www.statology.org/coefficient-of-variation-spss)

[/variation-spss](https://www.statology.org/coefficient-of-variation-spss)



Why has the coefficient of variation not been studied in research?

6. Z-scores



<https://www.statisticshowto.com/probability-and-statistics/z-score>

It is a redistribution of scores with mean = 0, and standard deviation = 1. It is useful in the absolute comparison between scores, regardless of the test difficulty or the difference in circumstances, so it is a fair statistical tool .

$$Z\text{score} = \frac{X - X^-}{\sigma}$$



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Where x : the raw score

\bar{X} the average(mean)

σ is the Standard Deviation

Example:

Two students from two different classes got 14 /20 in

two arithmetic tests, and the grades of the class1 in

which the first student is located are:

2-8-4- 18 - 14 -4-2-12-8-10

The grades of the class2 in which the second student

is located are:

Individual Differences_4GE

15-17-11-19-18-17-14-13-17-19

Which student grade is better than the other?

Solution :

The manual method:

Step 1: calculate the average (the mean) of scores:

$$\bar{X}_1 = \frac{\sum X}{N} = \frac{82}{10} = 8.2 \text{ (for class 1)}$$

$$\bar{X}_2 = \frac{\sum X}{N} = \frac{160}{10} = 16 \text{ (for class 2)}$$

Step 2: calculate the standard deviation of scores :

Individual Differences_4GE

$$\sigma_1 = \sqrt{\frac{\sum (X - \bar{X}_1)^2}{n - 1}} = 5.37 \quad (\text{review the lecture of standard deviation}) \quad \text{For class 1}$$

$$\sigma_2 = \sqrt{\frac{\sum (X - \bar{X}_2)^2}{n - 1}} = 2.67 \quad (\text{review the lecture of standard deviation}) \quad \text{For class 2}$$

Step3: calculate the Z score as follows:

$$\text{Zscore}_1 = \frac{14 - 8.2}{5.37} = 1.08$$

$$\text{Zscore}_2 = \frac{14 - 16}{2.67} = -0.75$$



Individual Differences_4GE



Using SPSS:

We can calculate Z score using two SPSS methods as

follows:

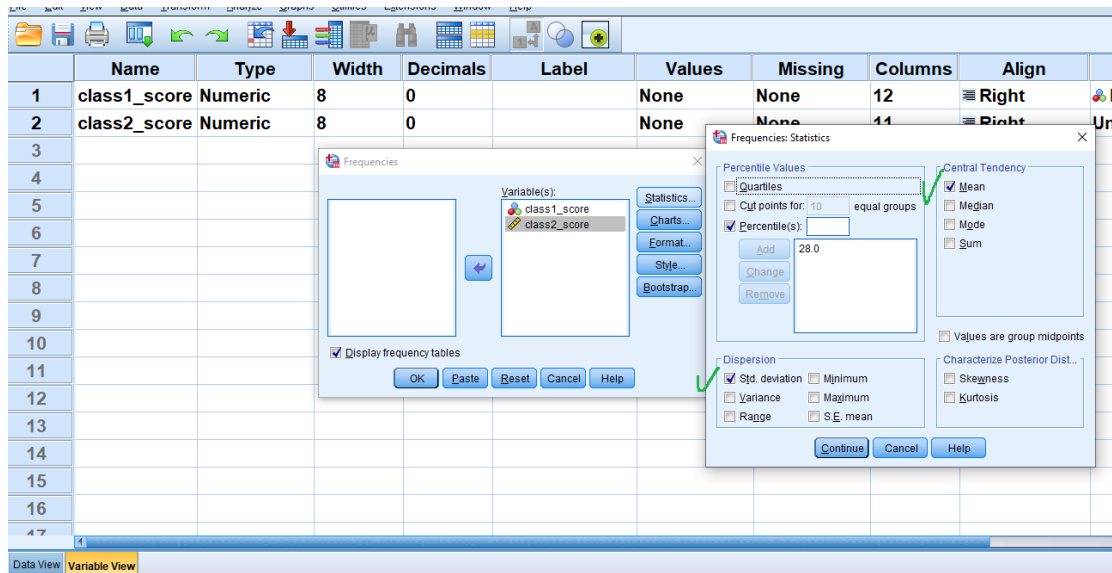
SPSS1:

By following the same steps which are followed to

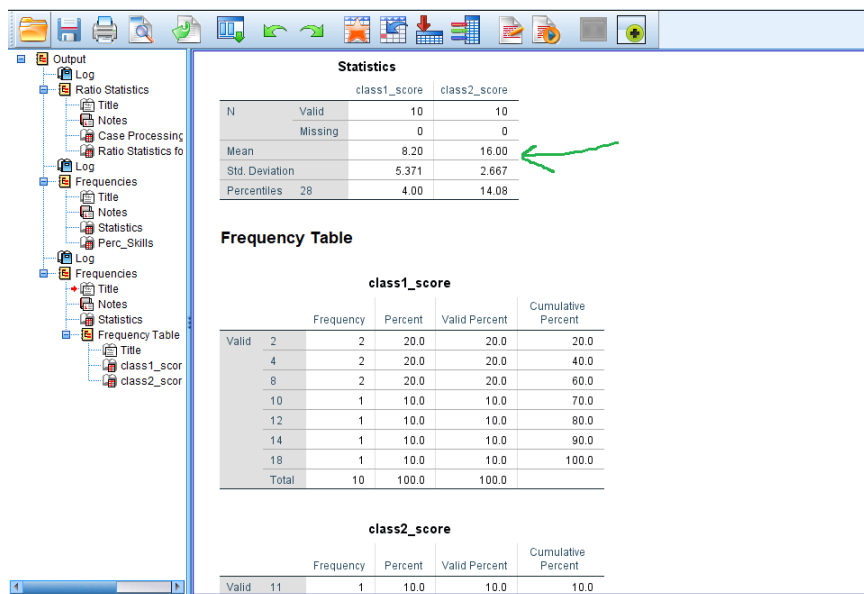
calculate the SD, plus ticking on the mean beside the

SD , to get the values of mean & SD for each variable

in the output window :



The screenshot shows the SPSS Variable View window with two variables: class1_score and class2_score, both Numeric with a width of 8 and 0 decimals. Overlaid on this are the 'Frequencies' dialog box (with 'Display frequency tables' checked) and the 'Frequencies: Statistics' sub-dialog box. In the 'Frequencies: Statistics' dialog, the 'Percentile Values' section has 'Percentile(s): 28.0' entered. The 'Central Tendency' section has 'Mean' checked. The 'Dispersion' section has 'Std. deviation' checked. The 'Characterize Posterior Dist...' section has 'Skewness' and 'Kurtosis' checked.



The screenshot shows the SPSS Output window. The 'Statistics' table is as follows:

	class1_score	class2_score
N	Valid 10	10
	Missing 0	0
Mean	8.20	16.00
Std. Deviation	5.371	2.667
Percentiles	28 4.00	14.08

The 'Frequency Table' for class1_score is:

Valid	Frequency	Percent	Valid Percent	Cumulative Percent
2	2	20.0	20.0	20.0
4	2	20.0	20.0	40.0
8	2	20.0	20.0	60.0
10	1	10.0	10.0	70.0
12	1	10.0	10.0	80.0
14	1	10.0	10.0	90.0
18	1	10.0	10.0	100.0
Total	10	100.0	100.0	

The 'Frequency Table' for class2_score is:

Valid	Frequency	Percent	Valid Percent	Cumulative Percent
11	1	10.0	10.0	10.0

A green arrow points to the 'Std. Deviation' value of 2.667 for class2_score in the Statistics table.

From the previous window, we note that :

$X_1 = 8.2$, $\sigma_1 = 5.37$; $X_2 = 16$, $\sigma_2 = 2.67$, using these

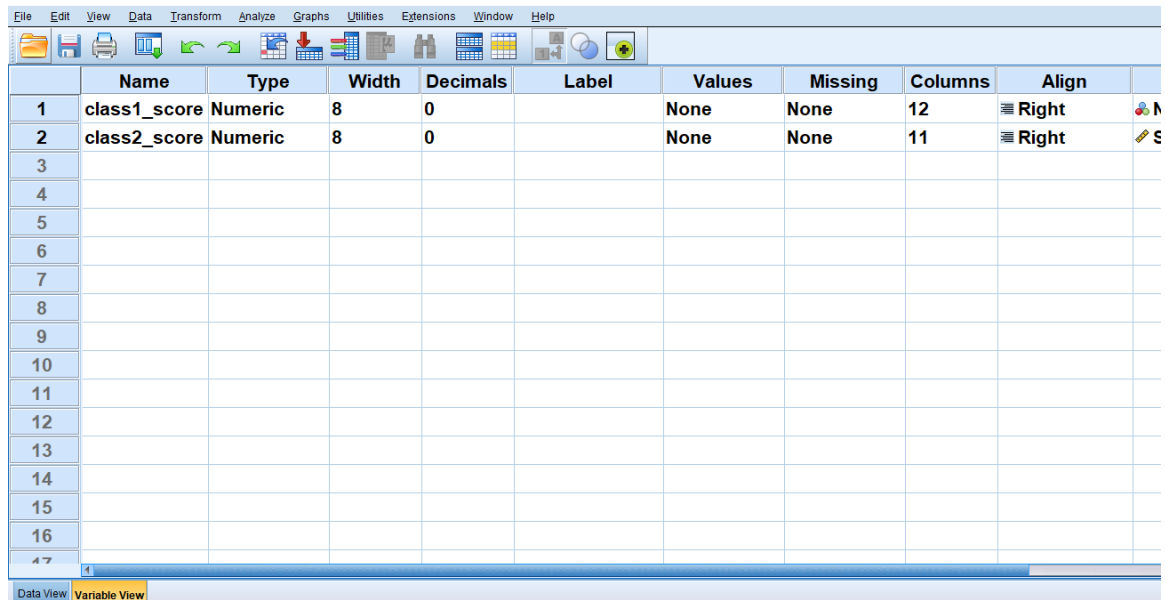
results we can calculate the z-score as follow:

$$Zscore_1 = \frac{14 - 8.2}{5.37} = 1.08$$

$$Zscore_2 = \frac{14 - 16}{2.67} = -0.75$$

SPSS2:

Step1:



The screenshot shows the SPSS Variable View dialog box. The 'Name' column contains 'class1_score' and 'class2_score'. The 'Type' column is set to 'Numeric' for both. The 'Width' is 8 and 'Decimals' is 0. The 'Values' column is set to 'None' and 'Missing' is also 'None'. The 'Columns' column is 12 for 'class1_score' and 11 for 'class2_score'. The 'Align' column is set to 'Right' for both. The 'Label' column is empty. The 'Data View' and 'Variable View' tabs are visible at the bottom.

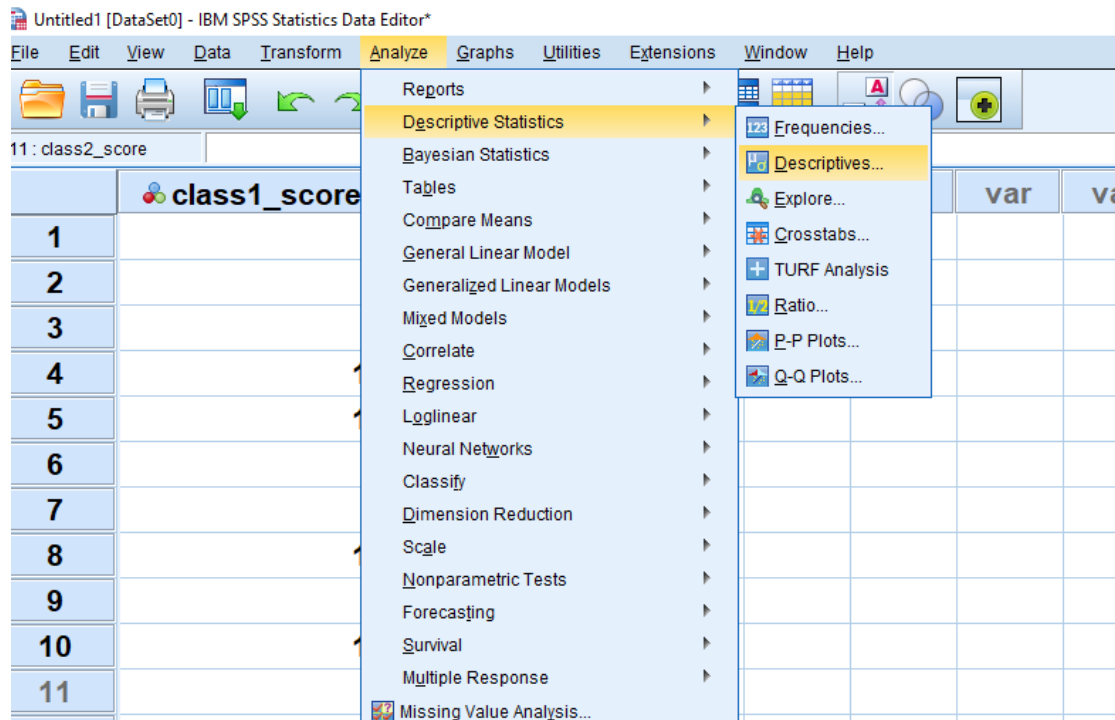
	Name	Type	Width	Decimals	Label	Values	Missing	Columns	Align
1	class1_score	Numeric	8	0		None	None	12	Right
2	class2_score	Numeric	8	0		None	None	11	Right
3									
4									
5									
6									
7									
8									
9									
10									
11									
12									
13									
14									
15									
16									
17									

Step 2:

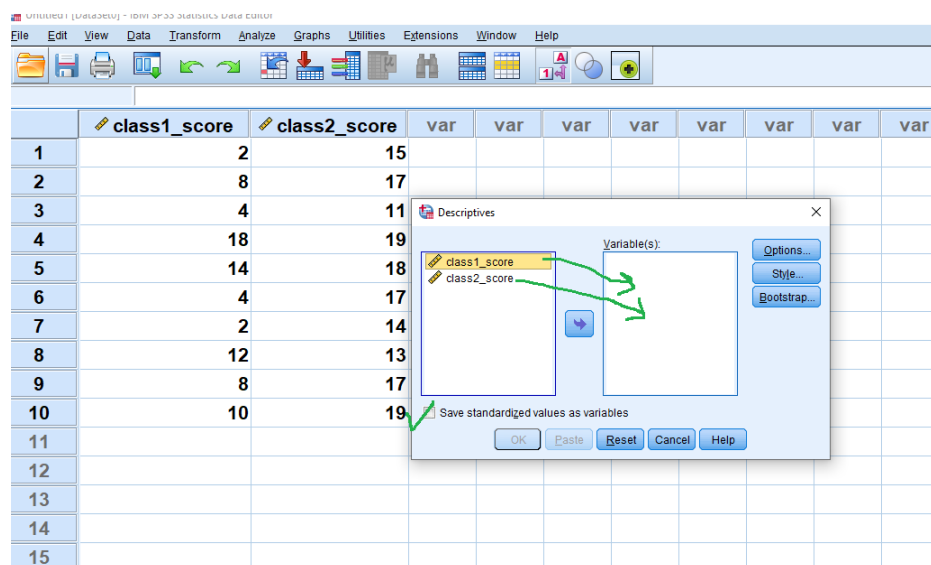
Individual Differences_4GE

	class1_score	class2_score	var	var	var	var	var	var	var	var	var
1	2	15									
2	8	17									
3	4	11									
4	18	19									
5	14	18									
6	4	17									
7	2	14									
8	12	13									
9	8	17									
10	10	19									
11											
12											
13											
14											
15											
16											

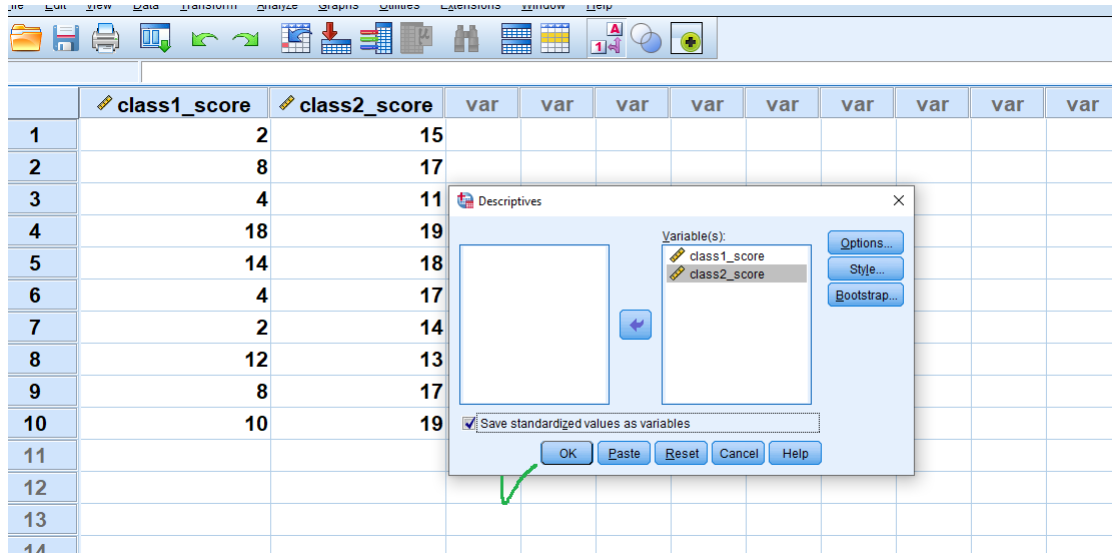
Step 3:



Step 4:

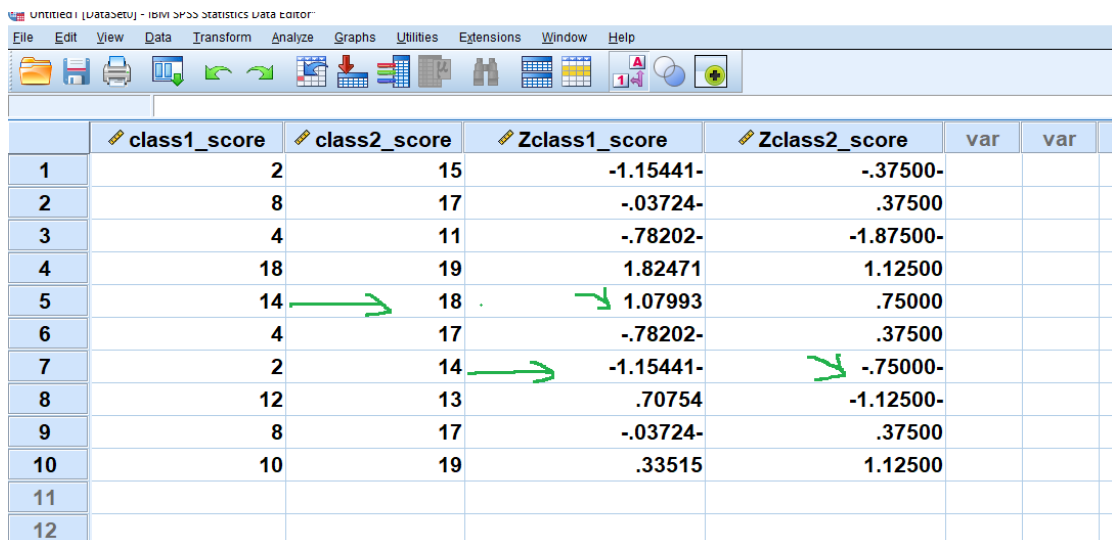


Step 5:



	class1_score	class2_score	var	var	var	var	var	var	var	var
1	2	15								
2	8	17								
3	4	11								
4	18	19								
5	14	18								
6	4	17								
7	2	14								
8	12	13								
9	8	17								
10	10	19								
11										
12										
13										
14										

Step6:



	class1_score	class2_score	Zclass1_score	Zclass2_score	var	var
1	2	15	-1.15441	-.37500		
2	8	17	-.03724	.37500		
3	4	11	-.78202	-1.87500		
4	18	19	1.82471	1.12500		
5	14	18	1.07993	.75000		
6	4	17	-.78202	.37500		
7	2	14	-1.15441	-.75000		
8	12	13	.70754	-1.12500		
9	8	17	-.03724	.37500		
10	10	19	.33515	1.12500		
11						
12						



It is the same result whether manually or using

SPSS , that $Z_{score1}=1.08$, $Z_{score2}=-0.75$, which means

that the score of student1 (14) is better than the score

of student 2 (14), and that maybe because the test in

class1 is more difficult than the test in class2 , so this

method is fair in comparison among individuals .

Note: there is another form of Z-score called T-

score , which is a new distribution of the raw scores by

,mean =50 , In contrast to the Z-score, the T-score is

free of negative values, and always takes positive

values. The form of T-score as follows:

$$\mathbf{T\ scores = (Z\ score \times 10) + 50}$$



Task14. From the following table, which student score is

better than other?

Student	Raw score	X^-	σ
A	11.5	9	1.6
B	8	7	0.72



Task 15 . In the following screen , the value of z-score which is corresponding to the score 8 is :

	Science_Test	ZScience_Test	VAR00001	var
1	2	-1.11803-	5.00	
2	5	-.44721-	8.00	
3	6	-.22361-	4.00	
4	8	.22361	3.00	
5	14	1.56525	9.00	
6				
7				
8				
9				
10				

A.-0.44
B.0.22
C.3
D.5



<https://www.statisticshowto.com/z-scores-in-spss>

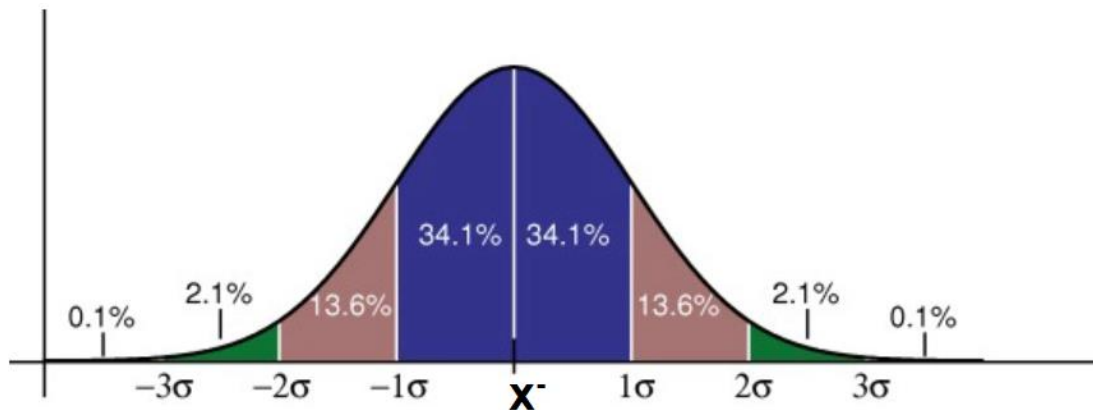


What is the relationship of the z standard scores to the fairness of the test?

7.Normal Curve



[https://courses.lumenlearning.com/boundless-
/statistics/chapter/the-normal-curve](https://courses.lumenlearning.com/boundless-statistics/chapter/the-normal-curve)



A normal distribution, sometimes called the bell curve, is a distribution that occurs naturally in many situations.

For example, the bell curve is seen in tests like the SAT and GRE. The bulk of students will score the average



Individual Differences_4GE



(C), while smaller numbers of students will score a B or

D. An even smaller percentage of students score an F or

an A. This creates a distribution that resembles a bell

(hence the nickname). The bell curve is symmetrical.

Half of the data will fall to the left of the mean; half will

fall to the right.

Many groups follow this type of pattern. That's why it's

widely used in business, statistics and in government

bodies like the FDA:

Heights of people.



Individual Differences_4GE



Measurement errors.

Blood pressure.

Points on a test.

IQ scores.

Salaries.

The empirical rule tells you what percentage of your data falls within a certain number of standard deviations from the mean:

- 68% of the data falls within one standard deviation of the mean.

- 95% of the data falls within two standard deviations of the mean.

- 99.7% of the data falls within three standard deviations of the mean



Task16: Explain using your own words the normal curve , and how can we make use of it in the educational field ?



Individual Differences_4GE

<https://www.spss-tutorials.com/normal-distribution/>



Are all phenomena subject to the distribution of the normal curve?

References

<http://psychology.iresearchnet.com/developmental-psychology/personality-development->

[psychology/what-is-individual-differences/](http://psychology.iresearchnet.com/developmental-psychology/personality-development-)

<https://www.psychologydiscussion.net/psychology/individual-differences->

[psychology/individual-differences-types-causes-and-role-psychology/2557](https://www.psychologydiscussion.net/psychology/individual-differences-)



Individual Differences_4GE



Jonassen. D.& Grabowski, B.(2012). Handbook of Individual Differences, Learning, and Instruction. Routledge.