

Statistics Worksheet (12th Grade)

MONE Objectives

1. Gerçek hayat durumlarıyla ilgili bir istatistik problemini çözmek için verileri toplar, düzenler, temsil eder ve yorumlar.

Materials

- TI – 83/ TI – 84 Plus™ Family
- For station 1: Metric tape measure or meter stick
- EXCEL

Reflection

While I was deciding the topic, I preferred to make a worksheet on statistics to take benefit of for my future teaching practice. Before preparing this worksheet, I read the statistical distribution and descriptive statistics chapters from the Haese and Harris HL book. Then I tried to use information from the book with taking consideration of the objective of the MONE in statistics.

According to MONE, using the technology properly in mathematics provides the opportunity to students without their success on mathematics (2013). I think, technology helps students' thinking abilities because they can have a chance to see different ways, for example, on the graphing calculator they find statistical calculation like mean, median, standard deviation and so on rapidly and they can compare data with peers without spending too much time. During preparation the worksheet, I want students to gather into groups. I think it can provide to expand their knowledge and to involve in active learning. Furthermore Higazi stated that some statistical concepts such as probability, distribution are not easy to understand for some students. Technology can be useful to make the lesson effective if it is used properly (2002). Lastly, graphing calculators helps to check the answer when everything is done with the paper work.

Overall, I really appreciate to prepare this worksheet because of the reasons that I stated above. I remembered again the statistical concepts and also I tried to increase my conceptual understanding.

References

Higazi, S. M. F. (2002). Teaching statistics using technology. *ICOTS6 Proceedings, 1-3*.

Procedure

Part I: Collecting the Data

1. Gather into a group of 6. Then, collect the following data from each member in your group: height, circumference of wrist, circumference of neck, and arm span (from fingertip to fingertip). Enter data (in centimeters) into an Excel file. Create a table and write the followings:

Names	Height (cm.)	Wrist (cm.)	Neck (cm.)	Arm (cm.)

2. Calculate the statistics for each of these four variables: height, wrist circumference, neck circumference, and arm length. Place your results in the column marked "Original".

Appendix I

	Height		Wrist		Neck		Arm	
	<i>Original</i>	<i>Scaled</i>	<i>Original</i>	<i>Scaled</i>	<i>Original</i>	<i>Scaled</i>	<i>Original</i>	<i>Scaled</i>
Mean								
Median								
Mode								
Variance								
Standard Deviation								
1 st Quartile								
3 rd Quartile								
IQR								

In order to calculate the values above you should use graphing calculator.

First step, enter your data in the calculator.

- Turn the calculator on.
- Press **[STAT]** **[ENTER]**. You should see L1, L2, L3 ... list. If the lists contain data, you can clear them by highlighting the list number (use the arrow button in order to go down or up) and then press **[CLEAR]****[ENTER]**.
- Enter each student's height on L1, wrist circumference on L2, neck circumference on L3, and arm span on L4. Make sure that all of the data for a particular student are in the same row. Do not enter the name of the students in your calculator. For example, for the height :

L1	L2	L3	Z
165			
173			
180			
165			
164			
168			
167			

L2(1)=

Use the arrow button to move among the list numbers. While you are entering data if you made a mistake, highlight the number and then press **[ENTER]** correct the number. To delete an extra number, press **[DEL]**. To insert a number, press **[2ND]****[DEL]** and then the number.

- Finding out about a list statistics.

Press **[STAT]** **→** **CALC** and press **#1**. Then press **[2ND]****[1]** to enter L1. Press **[ENTER]**.

EDIT	TESTS
1:1-Var Stats	
2:2-Var Stats	
3:Med-Med	
4:LinReg(ax+b)	
5:QuadReg	
6:CubicReg	
7:QuartReg	

1-Var Stats
\bar{x} =168.8571429
Σx =1182
Σx^2 =199788
S_x =5.756983337
σ_x =5.329930887
$\downarrow n$ =7

1-Var Stats
$\uparrow n$ =7
minX=164
Q1=165
Med=167
Q3=173
maxX=180

Here, mean, median (Med), 1st quartile (Q1), 3rd quartile (Q3), Standard deviation (S_x).

Other statistics is interquartile range. $IQR = Q3 - Q1$.

One other statistic is the variance. In order to find variance press **[2ND]****[STAT]** **→** **MATH** . Press **#8**.

Press **[2ND]****[1]** for L1 and press **[)]****[ENTER]**.

You can find mode by looking the frequency of each number in the data set. The frequency of the 165 is 2 and the others are 1. So the mode here is 165. (Mode: The most frequency occurred in the data set)

NAMES OPS
2:↑max(
3:mean(
4:median(
5:sum(
6:Prod(
7:stdDev(
8:variance(

variance(L1)
33.14285714

Part II: Analyzing Data

Suppose that the unit conversions are made on the original data, converting the height, arm span, neck and wrist circumference from centimeters to inches.

1. Begin analyzing the data by converting the centimeters to inches. (1 inch= 2, 54 cm.)
Compare the measurements and look for a pattern. Each measurement in inches what multiple of the corresponding measurement in centimeters? _____
2. Predict what effects a scale change on the data set will have on the following descriptive statistics. Place your predictions in the top chart.

Mean	
Median	
Mode	
Variance	
Standard Deviation	
1 st Quartile	
3 rd Quartile	
IQR	

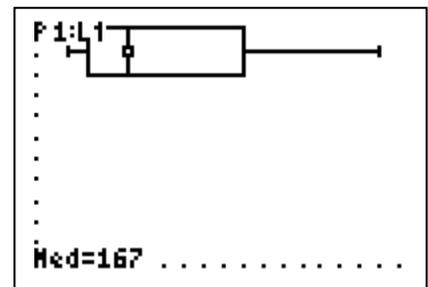
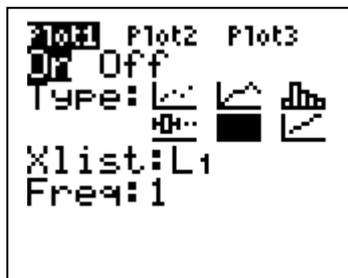
3. Your graphing calculator can perform this scale change on your original data set. Calculate the scale - changed data set and share your statistics with your group and enter them into the “scaled” column for each of the variables in the Appendix I.
4. Compare the statistics in the “scaled” column with those of the data set in the “original” column for each of the four variables. Answer following questions.
 - a. What do you see happening?
 - b. Are the data same or are they changed? If they changed, how are they changed? Is the change related to the number by which you multiplied each piece of data?
 - c. Conjecture what would happen in general for each of these statistics when the data set undergoes a scale change. Summarize your conjectures in the bottom chart.

- d. If you multiply each data point in a set by a factor m , what happens to the statistics in the table?

5. Construct a box plot for your assigned data variable for both the original data set and the scale changed data set. Compare the two box plots. Use [TRACE] button of your calculator to locate values on your box plot.

Drawing Box Plot on the graphing calculator:

First, be sure that L1 list is filling with data. Then, press **[2ND][Y=]** and then **[ENTER]** for #1. Make changes by using arrow button and **[ENTER]** button as on the screen. After that, press **[GRAPH]** and then **[TRACE]**. You can easily see the median, Q1, Q3, min and max value on the screen by using arrow button. (If the screen does not show a box, press **[ZOOM]** and #9. Then again press **[GRAPH]**).



- 1) Do your box plots confirm your conjectures with regard to the median?
- 2) The first and third quartiles?
- 3) The IQR?
- 4) Share this with the other in your group. Re-examine and re-formulate any conjectures that do not agree and place any new conjectures in the chart below.

Mean	
Median	
Mode	
Variance	
Standard Deviation	
1 st Quartile	
3 rd Quartile	
IQR	

6. Take a look at the height of your group. Let us assume that the heights of your group were distributed normally. Use the mean and standard deviation that you found in advance for the following questions. Find the probability that a randomly selected person in your group was at least 160 cm tall by using.
- First sketch a graph.

b. Find the z-score that corresponds to 160 cm.

c. Find the area of that z-score.

- d. Write the result as a sentence.

Now, in order to check your findings you can use graphing calculator.

Let us use the previous example. The heights of the group are in the L1 column.

L1	L2	L3	2
165	██████	-----	
173			
180			
165			
164			
168			
167			
L2(1)=			

1-Var Stats
$\bar{x}=168.8571429$
$\Sigma x=1182$
$\Sigma x^2=199788$
$Sx=5.756983337$
$\sigma x=5.329930887$
$\downarrow n=7$
█

The mean is approximately 169 and standard deviation is approximately 6.

Steps:

1. Before starting be sure that your all plots are off and no equation in the function toolbox. Now, press **[WINDOW]** and change variables as shown below.

WINDOW
Xmin=-3.2
Xmax=3.2
Xscl=1
Ymin=-.12
Ymax=.45
Yscl=.1
Xres=1

2. Press **[2ND][PRGM] → STO** and **#3 (StoreGDB)** and then press **[1][ENTER]**.

DRAW POINTS OFF
1:StorePic
2:RecallPic
3 :StoreGDB
4:RecallGDB

StoreGDB 1	Done
█	

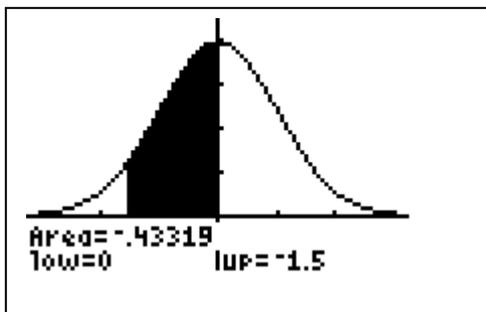
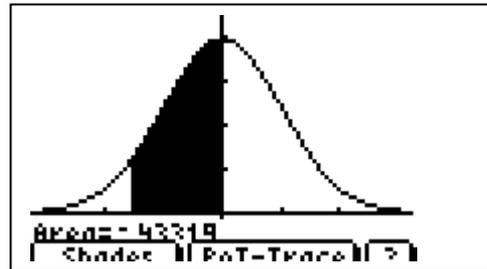
3. Calculate the z-score for 160 using the z-score formula. Then press **[ENTER]**. Now, store the answer to the "A" by pressing **[STO] [ALPHA][MATH]**.

StoreGDB 1	Done
$(160-169)/6$	-1.5
█	

$(160-169)/6 \rightarrow A$	-1.5
-----------------------------	------

4. In order to draw the area press **[2ND][VARS]→ DRAW** and press **#1**. For the “A and E” capital letter use **[ALPHA][MATH]** and **[ALPHA][SIN]**. Press **[ENTER]**. Seeing the lower and upper standard deviation press **[TRACE]** button.

```
ShadeNorm( -E99, A
)
```



Here, you can see the lower standard deviation and upper standard deviation and we can say that %43.3 people were taller than 160 cm in the group.

- Another way of checking answer is using the Excel. (You can use any way to check answer.) Enter the $f_x = \text{NORMDIST}(160, 169, 6, \text{TRUE})$ and press Enter. You can see the result easily.