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LIFE EXPECTANCY IN VARIOUS COUNTRIES

Expectation of life at birth is a statistic that tells, for each country, how long its citizens can expect to live on the average. Let's see how various countries compare by making a histogram from the following data:

Life Expectancy at Birth for Selected Countries

Country	Expectation	Country	Expectation	Country	Exp.
U. S. A.	77.2	Argentina	75.4	Australia	79.9
Austria	77.9	Bangladesh	60.5	Brazil	63.3
Canada	79.6	Chile	76.0	China	71.7
Columbia	70.6	Congo	49.0	Costa Rica	76.1
Cuba	76.5	Egypt	63.7	El Salvador	70.1
Ethiopia	44.7	France	79.0	Germany	77.7
Greece	78.7	India	62.9	Indonesia	68.3
Iran	70.0	Italy	79.2	Japan	80.9
Mexico	71.8	Morocco	69.5	N'ithri'nds	78.5
Nicaragua	69.1	Nigeria	51.1	Pakistan	61.5
Peru	70.4	Philippines	67.9	Portugal	76.1
Russia	67.5	Singapore	80.3	S. Africa	48.1
Spain	79.0	Thailand	68.9	U. Kingdom	77.9
Venezuela	73.4	Vietnam	70.0		

How to Create a Histogram by Hand

- 1) Divide the range of data into classes of equal width. The most informative histograms have between 5 and 15 classes.
- 2) Count the number of observations in each class. These counts are called *frequencies* and the complete chart is called the *frequency table*.
- 3) Using a ruler and graph paper, draw the histogram.

Example:

1 and 2) Suppose you were making a frequency table of the life span of the U.S. Presidents. If you chose a class width of 10, your frequency table would look something like . . .

$40 \leq x < 50$	
$50 \leq x < 60$	
$60 \leq x < 70$	
$70 \leq x < 80$	
$80 \leq x < 90$	
$90 \leq x < 100$	

Assignment: Create a histogram by hand from the life expectancies. Use a ruler to make straight "buildings" or classes.

How to Create a Histogram on the TI-83 Calculator

- 1) Clear the statistics area:
Hit ON. Hit STAT. Hit C1rList. Hit 2nd L1. Hit ENTER. The calculator says "Done."
- 2) Enter your data:
Hit STAT. You're on EDIT. Hit ENTER. You're on L1(1). Hit 77.2. Hit ENTER. Hit 75.4. Hit ENTER. . . . Keep going until you have entered expectations for all 41 countries. When you are done the calculator will be requesting L1(42).
- 3) Prepare your statistics plot.
Hit STAT PLOT (It's on the Y=key). Hit PlotsOff. Hit ENTER. Your calculator says "Done." Hit STAT PLOT. Your calculator says "1." Hit ENTER. The cursor is on ON. Hit ENTER. Arrow Down. Arrow Right to the third icon: it looks like buildings. Hit ENTER. Arrow Down. You're on L1 for the Xlist. Hit ENTER. Arrow Down. Input 1 next to Freq.
- 4) Prepare your window.
Hit WINDOW. Xmin should be a round number just below the data. Xmax, a round number just above the data. Xscl is the class width you've

chosen. Input $Y_{min} = -4$ for viewing data. Y_{max} is a whole number above the greatest frequency. $Y_{sc1} = 1$. $X_{res} = 1$.

A good first WINDOW is:

$X_{min} = 40$
 $X_{max} = 85$
 $X_{sc1} = 3$
 $Y_{min} = -3$
 $Y_{max} = 10$
 $Y_{sc1} = 1$
 $X_{res} = 1$

5) Look at your graph.

Hit GRAPH.

6) Experiment with different X_{sc1} values. Hit WINDOW. Increase X_{sc1} to 4, then 5, then 6. Do you notice the class width changing? Finally, let $X_{sc1} = 5$. We will use this histogram.

7) Make a final height adjustment to use the maximum amount of screen.

Hit WINDOW. Make sure $X_{sc1} = 5$. Input $Y_{min} = -4$. Input $Y_{max} = 17$.

8) Read your histogram.

Hit GRAPH. Hit TRACE. Arrow Right. Repeat. As you go from class to class (building to building) your calculator tells you the frequency--the number of countries whose life expectancies fall into that range.

Assignment: Interpret this histogram by answering these questions:

1) As you increased the value of X_{sc1} , the class width, from 3, to 4, to 5 what happened to the frequencies of the classes, i.e., the "heights of the buildings"? _____ Why? _____

2) When you trace and go across, it says $n = 5$ for the class between 60 and 65. What is the in-context meaning of this? (Mention life expectancy. Mention countries.) _____

3) For which two classes does $n = 2$? _____

4) How would you describe the shape of this data distribution?
Symmetric? Skewed right? Skewed left? _____

Now increase the class width, X_{scl} , to 6, and then 7. (You will have to make corresponding increases in Y_{max} to raise the ceiling.) Do these changes affect the shape of the distribution? _____ If yes, how? _____

5) Now, let's return to $X_{scl} = 5$ and $Y_{max} = 17$. Are there gaps in the distribution? _____ How would you describe the countries to the left of the peak, i.e., the ones with the lower life expectancies?

6) Does the distribution have clusters? _____ How many? _____

7) Which class has the greatest frequency? _____ Name some things many of the countries in this class--the biggest "building"--have in common? _____

8) Suppose that researchers concluded from this histogram that there exists a strong correlation between hot tropical climates and low life expectancy. What variable might confound this conclusion, making it "not the real story"? _____

9) Do there appear to be outliers? _____ If yes, which country or countries? _____

In 10 – 12, let's explore what happens to the summary statistics when you remove outliers.

In the table below, find the summary statistics about these 41 countries. Then remove the outliers--countries whose life expectancy is less than 50 years old--and recalculate the statistics.

<u>Statistic</u>	<u>.For all 41 Countries</u>	<u>Outliers Removed</u>
Sample mean	_____	_____
Median	_____	_____
Range (maximum – minimum)	_____	_____
Sample standard Deviation	_____	_____
Inter-Quartile Range (Q3 – Q1)	_____	_____

10) Which summary statistics moved a lot?

11) Which summary statistics moved very little?

12) A statistic that moves very little because of the presence or absence of an outlier is said to be a *resistant statistic*. Which of the statistics listed in the table are resistant?

How to Create a Box-and-Whisker Plot on the TI-83/TI-84
Calculators

Hit On. Hit 2nd STAT PLOT. Turn on Plot2 by hitting '2.' Hit ENTER. Where it says Type, light up the 4th icon—this is the box-and-whisker plot with outliers. Where it says Xlist, input 2nd L1. Where it says Freq, input ALPHA 1.

Use this WINDOW: Xmin = 40, Xmax = 85, Xscl = 5, Ymin = -7, Ymax = 30, Yscl = 1, Xres = 1.

Analyze how the histogram and the box-and-whisker plot are related. How does each graph show dense frequencies? How does each show scarce frequencies?