

# Criminal Justice Statistics



# Criminal Justice Statistics

*A Lab Manual*

*ELIAS NADER*



*Criminal Justice Statistics by Elias Nader is licensed under a [Creative Commons Attribution-NonCommercial-ShareAlike 4.0 International License](https://creativecommons.org/licenses/by-nc-sa/4.0/), except where otherwise noted.*

# Contents

## [Part I. Lab 1: Introduction to Using Excel](#)

<a href="#"><u>Using Excel: Lab 1, Part 1</u></a>	3
<a href="#"><u>Using Excel: Lab 1, Part 2</u></a>	12
<a href="#"><u>Using Excel: Supporting Documents</u></a>	16



## PART I

# LAB 1: INTRODUCTION TO USING EXCEL

In this lab, we will be working with entering, formatting, and analyzing data in Excel. Please note: this lab is written for a beginner in Excel and meant to introduce you to various capabilities of Excel. You may feel the need to skip through some steps if you are experienced with Excel, and that is fine. Just make sure you understand the content of the lab! Future work will build on these skills.





# Using Excel: Lab 1, Part 1

Part 1 of the lab will utilize data for the number of homicides in Baltimore between 2010 and 2019. All crime data is derived from [The Baltimore Sun's reporting of homicides in the city](#). The population estimates are derived from the [U.S. Census](#) and the American Community survey comes from the [Bureau of Justice Statistics report](#). In this part of the lab, you will be computing the homicide rate for Baltimore.

## Part 1: Homicides in Baltimore

### *Data Entry*

1. Open up a new Excel worksheet. You will enter a new set of data into Excel in this lab.
  - a. I will refer to a cell by its name in Excel. For example, Cell B4 is in column B and row 4.
  - b. A range of cells selected together is defined by its "address," which is the first cell and last cell in the range of selected cells. So, if we select all the cells B4, B5, C4, and C5, the address would be "B4:C5" because it contains the cells from B4 to C5.
2. **Click cell B4** to make it the active cell.
  - a. Type ***Homicide Rates in Baltimore, 2010–2019***. Press **Enter**.
    - i. Note: The title does not fit in the cell B4 and spreads across several columns. If a label does not fit in a cell, it will display the remaining text in the

next cell(s) as long as they are empty. Otherwise, the label is truncated or cut off.

b. **Click cell B5** to make it the active cell and type **Year**.

c. **Click cell C5** and type **# of homicides**.

d. **Click cell D5** and type **Estimated Population**.

3. Notice that the labels truncated (or cut off). However, if you place the cursor on the cell, the full text appears in the formula bar. Don't worry about the truncation for now; we will fix it later.

4. **Enter the data** from the table provided below into the worksheet in the appropriate cells of the table. The placement and formatting may not be exactly like the picture below—that is okay. We will format the table later.

a. Some of the population figures will be too large for the standard cell width, so they will be displayed with a series of number signs: #####. The data are there; it's just that the column is too small to display all of the numbers.

	A	B	C	D
1				
2				
3				
4	<b>Homicide Rates in Baltimore, 2010-2019</b>			
5				
6		<b>Year</b>	<b># of homicides</b>	<b>Estimated population</b>
7		2010	223	620,915
8		2011	196	620,410
9		2012	218	622,895
10		2013	233	622,391
11		2014	211	623,587
12		2015	344	622,522
13		2016	318	616,226
14		2017	343	610,481
15		2018	309	602,443
16		2019	348	593,490
17				

5. You may notice in the picture that the title is separated from the data. To do this, we will insert a row.

- a. **To insert a row**, move the cursor to row number 5. At the beginning of the row is the shaded box with the row number 5 inside. **Click on the shaded box 5** and the whole row will become highlighted. **Right click on the row** and select **Insert** to add in a new row.
6. Now we will format the cells so that they display the data better. First, center the **Year** label and the data in those cells.
  - a. **Select the range** beginning with the **Year** label down to the cell containing the last year of 2019 (cell range B6:B16). Under the **Home** menu at the top of the page, with the range highlighted, **select Center from the Alignment group** in order to center the text in this group.
7. Now we want to make the titles for the homicides and population columns more readable and we want to see all of the population figures displayed in the cells.
  - a. First, we will **extend the width of these two columns**. To do this, **select the range of cells** from C6:D16. Select **Format** from the **Cells** group at the top of the page, and then select **Column Width**. A box appears with the default width. Press the **delete** key to clear the box and type 22 to make it the new column width, then select **OK**.
8. Next, we want to wrap the text of the labels for the homicide and population columns.
  - a. To do this, **click on the cell which has the label for the # of homicides** column. Select the **Wrap Text** button from the **Alignment group** at the top of the page. Do the same for the label for **Estimated Population**.
9. Now, make a new column for our calculation of the Homicide Rates.
  - a. In cell E6, **type in Homicide Rate** and with the cell active, select **Wrap Text**. Save your workbook again, and now we'll move onto something slightly more complicated.

## Entering Formulas

10. Formulas are used to perform numeric calculations such as adding, multiplying, and averaging. Formulas *always* begin with a prefix of an equal sign (=), and use arithmetic operations (+, -, \*, /) to perform calculations: (+) performs addition, (-) performs subtraction, (\*) performs multiplication, and (/) performs division.

a. Formulas can contain more than one arithmetic operator and allow for the use of parentheses. In these circumstances, Excel decides which operations to perform first. Multiplication and division are done first, based on a left-to-right flow. Addition and subtraction are performed after that.

11. Formulas often contain cell addresses and ranges. Using a cell address or range name in a formula is called *cell referencing*. Use cell references to keep your worksheet up-to-date and accurate. If you change a value in a cell, the formula containing that cell reference will automatically be recalculated using the new value.

12. **Calculating Rates:** Rates are one of the most common formulas in criminal justice. A rate is essentially the number of times something happens per X number of people in the population.

a. Example: 25 motor vehicle thefts per 100,000 people each year.

13. The formula for calculating rates is:

$$Rate = \left( \frac{\text{number of reported crimes}}{\text{total population}} \right) \times 100,000$$

a. Note: this is for rates per 100,000 people, which we will be using in this lab. However, this can be changed to represent any other interval of people we want, like 1,000 or 100.

14. For the year 2010, how do you calculate the Homicide Rate?

$$Rate = \left( \frac{233}{620,915} \right) \times 100,000 = 35.9$$

homicides per 100,000 people.

15. How would you construct the formula using cell referencing?

$$Formula = \left( \frac{C7}{D7} \right) \times 100,000$$

16. Now we want to have a rate for each year. Essentially, we want a fourth column of data which contains the rate for each year. This is our **Homicide Rate** column. Label cell E6 with this label and adjust the width as needed to make sure it can be visible.

a. Make E7 the active cell. In that cell, type: **= (c7/d7)\*100000**

b. Then hit **Enter**.

c. Using cell referencing in formulas is convenient because instead of having to type a new formula for each additional year, Excel can now transfer the same formula down the rows for the same column, which saves you from writing a new formula for each year.

d. To use cell referencing in formulas, make E7 the active cell. Select **Copy** from the **Clipboard** group (the icon is right below the cut icon and looks like two overlapping pieces of paper). [Note: You can also 1) simultaneously hold down the **CTRL** and **C** buttons or 2) right click and select **Copy**].

e. Now select the range E8:E16. When the range is highlighted, select **Paste** from the **Clipboard** group.

f. The formulas for the rate for each year are now created, and the rates are displayed. Excel simply updated your original formula for each row, which saves you a lot of time and effort. Press **ESC** so that the cell you just copied is no longer active.

17. Let's say we only want one decimal place for the rate.

a. To change the decimal place and round the numbers off, select the range E7:E17.

b. Under the **Home** category, in the **Number** group, find the button for decreasing the decimal place (called **Decrease Decimal**). Keep clicking on the button until only one decimal place is displayed. Save your work.

18. Your table should now look like this:

	A	B	C	D	E
1					
2					
3					
4	<b>Homicide Rates in Baltimore, 2010-2019</b>				Vertical (Value) Axis
5					
6		<b>Year</b>	<b># of homicides</b>	<b>Estimated population</b>	<b>Homicide Rate</b>
7		2010	223	620,915	35.9
8		2011	196	620,410	31.6
9		2012	218	622,895	35.0
10		2013	233	622,391	37.4
11		2014	211	623,587	33.8
12		2015	344	622,522	55.3
13		2016	318	616,226	51.6
14		2017	343	610,481	56.2
15		2018	309	602,443	51.3
16		2019	348	593,490	58.6
17					

## Using Excel Functions

19. Functions are predetermined worksheet formulas that enable you to do complex calculations easily without writing formulas. Functions begin with the prefix (=). We will use the **Sum** function to add up the total number of deaths for all the years.

20. Make cell B19 active. Type **Total** into the cell in order to label this row. Now, make cell C19 active so we can use our first Function.

a. In the top ribbon, select the **Formulas** tab. In that tab, position the cursor over the **Auto-Sum** button, the **box with the capital Greek letter E (Σ)**, and click/select it.

b. **Auto-Sum** sets up the sum function to add values in the cells above the cell pointer.

c. Here the formula =SUM (C7:C18) appears in the cell, which is the full column under the label. Verify this range and press **Enter**. The results now appear in the cell: 2,743 is our total number of homicides from 2010–2019.

21. Another function Excel provides is the averaging function, which would allow you, for example, to calculate the average population for all the years. Let's try that.

a. Make cell B20 active and type **Average** into the cell to label this row.

b. Instead of typing in a formula to do an average, you can use the **Function Wizard** for fast and accurate calculation.

c. To use the **Function Wizard**, make the D20 cell active (we'll be replicating something similar what we just did for Sum).

d. Now, we will want to calculate the average for this column. To do this, go back to the **Auto Sum** box but now click on the little arrow next to it. You will get a few options for formulas. Select **Average**.

e. Here the formula =AVERAGE(D7:D19) appears in the cell, which is the full column under the label. Verify this range and press **Enter**. The results now appear in the cell: 615,536 is our average estimated population per year.

22. We're also interested in finding the percent change in the homicide rate from 2010 to 2019 (note that this is for the entire time frame, not from year to year). What is the formula for calculating the percent change from 2010 to 2019?

$$\begin{aligned} \text{Formula} &= \left( \frac{\text{Time2}-\text{Time1}}{\text{Time1}} \right) \times 100 = \left( \frac{2019\text{rate}-2010\text{rate}}{2010\text{rate}} \right) \times 100 \\ &= \left( \frac{58.6-35.9}{35.9} \right) \times 100 = 63.3 \end{aligned}$$

How would you construct the formula using the Excel cell reference method?

$$\text{Formula} = \left( \frac{\text{Time2}-\text{Time1}}{\text{Time1}} \right) \times 100 = \left( \frac{E16-E7}{E7} \right) \times 100$$

23. Fortunately, Excel can perform complex operations involving numerous steps; in this case, subtraction, multiplication, and division to calculate the percent change.

a. Click cell B21 to make it active and type **% Change** in order to label the row.

b. Select cell E21. Based on the percent change formula, we need to subtract the most recent date (2019, time 2) and the first date (2010, time 1) and then divide it from the first data point we have (2010, time 1). We also have to make sure to follow order of operations; if we do not use parentheses, Excel will give us a meaningless answer.

c. As such, we need to type in cell E21:  **$= (E16 - E7) / E7 * 100$**

d. Then hit **enter**. This calculates the percent change in the homicide rate from 2010 to 2019.

e. Here, this answer is 63.3%, thus we had a 63.3 % increase in homicide rate from 2010–2019.

24. The final results should look like the table below. Please check your work to make sure the numbers and equations are the same!



	A	B	C	D	E
1					
2					
3					
4		<b>Homicide Rates in Baltimore, 2010-2019</b>			
5					
6		<b>Year</b>	<b># of homicides</b>	<b>Estimated population</b>	<b>Homicide Rate</b>
7		2010	223	620,915	35.9
8		2011	196	620,410	31.6
9		2012	218	622,895	35.0
10		2013	233	622,391	37.4
11		2014	211	623,587	33.8
12		2015	344	622,522	55.3
13		2016	318	616,226	51.6
14		2017	343	610,481	56.2
15		2018	309	602,443	51.3
16		2019	348	593,490	58.6
17					
18					
19		<b>Total</b>	2,743		
20		<b>Average</b>		615,536	
21		<b>% Change</b>			63.3
22					
23					
24					

# Using Excel: Lab 1, Part 2

In Lab 1, Part 2 we will work with formatting and analyzing data in Excel. Part 2 of the lab will compare the number of violent crimes in Baltimore between 2010 and 2016. All crime data is derived from the [Uniform Crime Report \(UCR\)](#) and the [2018 Baltimore Police Department Staffing Study Report](#).<sup>1</sup>

## Part 2: Violent Crime in Baltimore

1. Download and open up the following Microsoft Excel worksheet: [Lab 1 Part 2 Worksheet](#)

2. Let's examine how the amount of violent crime in total during the 2010–2016 timeframe and what percentage of the total was within each category.

3. To do this, first we will calculate the sum for each crime type across the 2010–2016 timeframe. Label cell B15 with the name **Total per Crime**.

a. To calculate the totals, we will create a formula in excel. These always start with an equal sign (=).

b. For a total, we will need to sum (or add) all of the numbers.

c. The formula is: **=Sum(firstcell : last cell)**—this formula will sum all of the numbers between the two cells in the column or row.

1. More data and information on crime reporting by the FBI can be found at: <https://www.fbi.gov/services/cjis/ucr/>

d. Type this formula into the **Total** cell for each government entity column.

e. For example, under **Murder** in cell C15, we will type: =Sum(C5 : C14).

f. Repeat this for **Rape**, **Robbery**, and **Agg. Assault**.

4. Next, create a new column title in G6 and call it **Yearly Totals**. Now, we will sum the totals for each year across the four crime types.

a. So, in cell G7, we will sum the four values for 2010 (be sure *not* to include the cell with the year in the formula!).

b. In cell G7, you should type: =Sum(C7 : F7)

c. You should then repeat this for each year. This may seem tedious, so shortcuts are available. When you copy a formula and paste it in a different cell, Excel applies this formula to equivalent cells in relation to the cell you are pasting in.

d. So, if we copy the formula from cell G7 (which is summing all the values in our Row 7), and paste it into G8, it will transfer the formula to equal the cells in row 8. Try the copy and paste shortcut to fill in the values for the rest of the years.

e. Finally, we want to calculate an overall total for the number of violent crimes in the entire 2010–2016 time span. Thus, you will be calculating the sum of the rows for each year. In cell G15, sum all of the yearly totals of G7–G13 to get a total value.

i. This gives us the total of the yearly totals.

5. At this point, your worksheet should look like this:

	A	B	C	D	E	F	G
1							
2							
3							
4		<b>Baltimore Violent Crimes, 2010-2016</b>					
5							
6		<b>Year</b>	<b>Murder</b>	<b>Rape</b>	<b>Robbery</b>	<b>Agg. Assault</b>	<b>Yearly Totals</b>
7		2010	223	265	3336	5492	9316
8		2011	197	341	3457	4891	8886
9		2012	218	315	3605	4651	8789
10		2013	233	298	3734	4460	8725
11		2014	211	245	3677	4213	8346
12		2015	344	287	4313	4598	9542
13		2016	318	299	5236	5157	11010
14							
15		<b>Total per Crime</b>	1744	2050	27358	33462	64614
16							
17							
18							

6. Now, let's calculate the percentage of the total number of violent crimes for each of the four crime types.

a. In row 16, cells C16–F16, use a formula to calculate the percentage from each column from the grand total of crime over the 2010–2016 time span. Thus, label cell B16 with the name **% of total crime**. The formula will be:

$$\left( \frac{\text{total per crime}}{\text{total over all number of crimes}} \right) \times 100$$

b. Use the cell reference in constructing the formula (example: =c15/g15\*100) for each percentage you calculate.

i. **\*\*NOTE\*\***You will **not** be able to cut and paste this formula across the rows, since G15 will be your denominator in each one and Excel will automatically replace it if you cut and paste the equation.

c. Thus, you must retype the formula for each percentage. Once you have calculated these percentages, decrease the number of decimals so you have **one** decimal place.

i. You can do this by going to the **Number** group under **Home**, find the button for decreasing the decimal place (called **Decrease Decimal**). Keep

clicking on the button until no decimal place is displayed.

d. Below is what the final result of the table should look like. Check your numbers against the table to make sure it is accurate.

	A	B	C	D	E	F	G	H
4		<b>Baltimore Violent Crimes, 2010-2016</b>						
5								
6		<b>Year</b>	<b>Murder</b>	<b>Rape</b>	<b>Robbery</b>	<b>Agg. Assault</b>	<b>Yearly Totals</b>	
7		2010	223	265	3336	5492	9316	
8		2011	197	341	3457	4891	8886	
9		2012	218	315	3605	4651	8789	
10		2013	233	298	3734	4460	8725	
11		2014	211	245	3677	4213	8346	
12		2015	344	287	4313	4598	9542	
13		2016	318	299	5236	5157	11010	
14								
15		<b>Total per Crime</b>	1744	2050	27358	33462	64614	
16		<b>% of the total crime</b>	2.7	3.2	42.3	51.8		
17								
18								

# Using Excel: Supporting Documents

## Lab 1, Part 1

For this portion of the lab, you will start with a blank Excel sheet and enter the data as instructed in the Lab 1 Part 1 Instructions.

- [Lab 1 Part 1 Instructions \(PDF\)](#)
- 

## Lab 1, Part 2

For this portion of the lab, you will start with the Excel sheet below and complete it as instructed in the Lab 1 Part 2 instructions.

- [Lab 1 Part 2 Worksheet \(Excel\)](#)
  - [Lab 1 Part 2 Instructions \(PDF\)](#)
-

## Additional Resources

[Math and Statistics Guides from UBalt's Math & Statistics Center](#)