



## Statistics of Top 25 NFL Football Players

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### Purpose

- Demonstrate to students that computation is essential to process large amounts of information accurately
- Demonstrate that randomness occurs in nature and visualize randomness using a histogram
- Instruct students on the basics of excel (an introduction to basic math features, cells, and functions)

### Overview

The lesson serves as a formal introduction to functions in excel, and demonstrates the application of computation in everyday statistics. In part 1 (1.5 days), students will review basic statistical concepts such as mean, median, and mode. In previous lessons, students should have done an assignment where they calculated these quantities by hand for a small sample of numbers. This lesson demonstrates an alternative way to calculate these quantities in a quicker way using excel. Students will explore this method using a dataset generated from the web (the top 25 salaries for NFL quarterbacks).

We will show students that Excel is an easy and widely used way to calculate statistics of a given dataset. Students will graph a histogram of the top 25 salaries for NFL quarterbacks, and mark the location of the mean and standard deviation on the histogram. The final assignment is an independent homework assignment that tests all the skills learned from the exercise done in class. Students will independently use several functions to calculate statistics, graph a histogram, and answer questions about the distribution for 470 measurements.

### Student Outcomes

- The definitions of mean, median, standard deviation, range, and mode will be reinforced
- Students will be able to use functions in excel and demonstrate their knowledge of its basic functions by formatting a useful worksheet as homework
- Students will be able to identify a histogram (by its x and y-axis), the mean in a histogram, and plot a histogram for an engineering application

### Standards Addressed

- Represent data with plots on the real number line (dot plots, histograms, and box plots).
- Use statistics appropriate to the shape of the data distribution to compare center (median, mean) and spread (standard deviation) of two or more different data sets.
- Interpret differences in shape, center, and spread in the context of the data sets, accounting for possible effects of extreme data points (outliers).
- Use data from a sample survey to estimate a sample mean



## Materials and Tools

- Students will need Excel with the Analysis Toolpak (add-in)
- Students will need to measure a fairly homogenously manufactured object (candy, wooden blocks, pencils, etc...)
- Google Forms created by teacher
- [Excel Instructions Worksheet](#)
- [Block Measurement Spreadsheet \(created by teacher; example is attached\)](#)
- [NFL Statistics Spreadsheet](#)

## Preparation

- **Create a Google form to record block measurements (online):** Students from all classes will submit their measurement results to this form. See the Block Measurement Spreadsheet, with example data.
- **Download and distribute “Excel Instructions Worksheet”:** This worksheet walks students through excel.

## Prerequisites

- Students will need to be prepared to discuss statistical properties
- An understanding of mean, mode, range, standard deviation

## Background

To construct a histogram: The ranges within which you want to sort values are the bins. You can specify the bins into which you want your raw data values placed, or you can let the Analysis Toolpak (ATP) choose bins. The ATP simply divides the range of data, from the minimum to the maximum, into five equally spaced bins. A value is placed into the first bin with an equal or higher value.

## Teaching Notes

### 1. *Preparation*

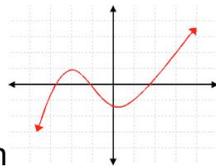
- a. Ask students to measure 10 blocks each with a caliper in one indicated dimension (ie: they should measure the side marked in red to be consistent), to three decimal points. Alternatively, students can collect measurements of other objects that are varied in nature.
- b. Record the measurements in a Google form.
- c. Teacher compiles dataset into excel file; Block Measurement Spreadsheet has an example set. Replace that data with your students' data.

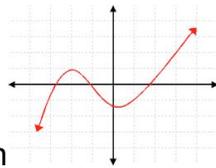
### 2. *Learning Excel*

- a. **Day 1:** Instruct students to log into computer with Excel and Excel Worksheet (word document) downloaded.
- b. Introduction (10 minutes): Demonstrate that randomness naturally occurs in nature and machines. “The complexity of many components working together creates somewhat random outcomes. How do engineers begin to improve a component of a machine? Engineers undergo thorough testing and experiments to characterize a system (stress tests). Engineers often use computational

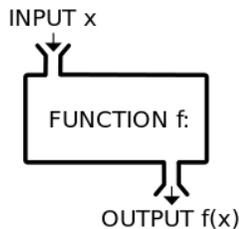
methods to analyze their data. Today, we will be using excel, a widely used and simple software, to analyze data”.

- c. Perform a demo (10 minutes) highlighting basic functions of excel on a blank worksheet. Perform simple addition “= 1 + 1”. Show students how to identify the row and column number of a cell. Create columns of numbers and demonstrate how to add two columns using cell locations “= A1 + A2”. Demonstrate how to copy numbers to multiple cells using the drag-and-drop method. Show them how to create columns of numbers. Emphasize how we can use excel to organize numbers and simplify math.
- d. Allow students to open the “NFL Statistics Spreadsheet” with 25 NFL quarterback salaries and statistics. Instruct them to copy and paste
- e. Ask students “what is a function?” (5 minutes). A variety of answers can be given.



A math function  , programming function (mean() on a graphing calculator)

If there are a variety of answers, reinforce that all these things are functions, and ask what they have in common. A key point is that a function has an input and an output.



The function can be seen as a “black box”. **We may or may not have to worry about what is inside the box (we simplify the inner workings).** We can link functions together to create a more complex process. In excel, you will put your input values in the parentheses, and excel will automatically highlight your input with a [blue box](#).

- f. **Explain that to define a function, first an “=” must be typed, and then the function\_name(input).** Hand over the action to the students. Ask them to work with a partner to figure out how to use the function sum() to calculate the sum of the salaries.
- g. Hand over class to students (25 minutes). Encourage them to look in the Official Help manual or use online resources to find functions that can calculate the range, median, mode, maximum, and minimum values.
- h. **Day 2: (10 minutes)** Recap of the previous day. Ask students to discuss with their neighbors what a function is in a general sense. Before diving into the next exercise, ask a student to demonstrate to the class how to use the **sum()** function in excel.
- i. Learning to plot graphs: Ask a couple students to come up and form a normal distribution. What does the x-axis represent? (a measurement). What does the y-axis represent? (their heights).

- j. Demo: Introduce the data analysis toolbox, where to input the x-axis, and y-axis. Plot the data. Does the graph look weird? Ask them to troubleshoot their inputs. (They should be able to find an outlier). Have them remove the outlier and plot the data again. They should be able to identify where the mean, median, and standard deviation on the x-axis.
- k. Exercise 2 (last 10 minutes): Instruct students to open the “Block Measurement Spreadsheet”. Explain that the next assignment is to analyze and graph the block measurements they made the other week. They will be using blocks that are within 2 SD of the mean to identify blocks that are too large.

### **Assessment**

Students will turn in 2 worksheets. The first worksheet will walk students through the procedure to perform calculations in Excel. The second worksheet will test the students' understanding by allowing students to apply what they learned to the block measurements they made the previous week. There is an extra-credit and extension component to the assignment. In the extra credit, students will graph the distribution for three class periods and compare the shape of the distribution. Why would measurements vary differently from class to class?