Name: ______________________________________ Date: ______________________ Class: ___________________

# Graphing Data and Statistical Analysis with Excel Practice

*Instructions*: In this practice, you will apply your basic knowledge of Microsoft Excel to analyze data using Excel graphing tools and its built-in statistical functions. From the data tables, you will create scatter plots, calculate and graph averages and standard deviations, compute other central tendency numbers, and calculate *p*-values using the T-distribution.

*Set up a work session:*

1. Open a new Excel session. Use a full screen window.
2. Use the data sets provided below.

## <u>Guided Practice</u>: *Average Faculty Salaries, Males vs. Females*

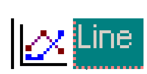
*Instructions*. For the next data set, *Average Faculty Salaries, Males vs. Females*, perform Exercises 1 - 6.
Correctly label all your formatted graphs and tables with results.
Save your practice in an Excel file named like this: Salaries_YourFullName_Period.xls.

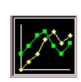
| College ID | Male AP | Female AP |
|---|---|---|
| C-1 | 34.5 | 33.9 |
| C-2 | 30.5 | 31.2 |
| C-3 | 35.1 | 35.0 |
| C-4 | 35.7 | 34.2 |
| C-5 | 31.5 | 32.4 |
| C-6 | 34.4 | 34.1 |
| C-7 | 32.1 | 32.7 |
| C-8 | 30.7 | 29.9 |
| C-9 | 33.7 | 31.2 |
| C-10 | 35.3 | 35.5 |
| C-11 | 30.7 | 30.2 |
| C-12 | 34.2 | 34.8 |
| C-13 | 39.6 | 38.7 |
| C-14 | 30.5 | 30.0 |
| C-15 | 33.8 | 33.8 |
| C-16 | 31.7 | 32.4 |
| C-17 | 32.8 | 31.7 |
| C-18 | 38.5 | 38.9 |
| C-19 | 40.5 | 41.2 |
| C-20 | 25.3 | 25.5 |
| C-21 | 28.6 | 28.0 |
| C-22 | 35.8 | 35.1 |

***Exercises:***

1. *Creating a graph*

   For the paired data set 1, create a line graph. Place this graph *as a new sheet.*

   (Hint: Select data columns *Males – Females* ►  

 )

   To make the values in column *College* be the *x*-values in this graph:

   - In the Chart Wizard – Step 2 of 4 – Chart Source Data , select tab Series.
   - Click on box: 

 click here
   - Using the mouse, select only the data in column *College* ► press Enter.

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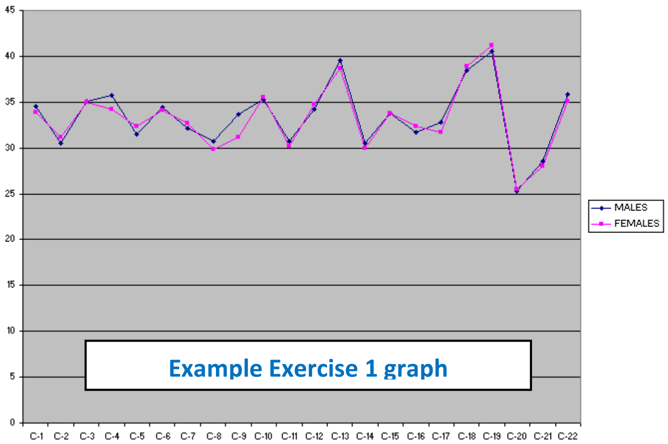
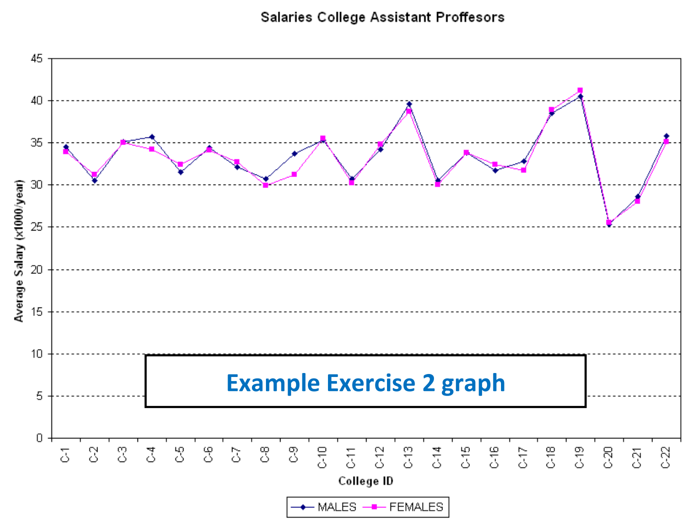



Example Exercise 1 graph




Example Exercise 2 graph

2. *Formatting a graph*
    a. Place the graph legend at the bottom of the graph.
    b. Eliminate the plot area default gray color. (*Hint*: Click on Plot Area ▶ Format ▶ Select Plot Area or double click on Plot Area.)
    c. Change the major gridlines to a broken line. (*Hint*: *Double click in one of the gridlines.*)
    d. Insert the next labels. For *x*-axis: *College ID*; for *y*-axis: *Average Salary* (x*1,000/year*) (*Hint:* Chart ▶ Chart Options ▶ Titles)
    e. Include in the graph title: *College Assistant Professor Salaries. Males vs. Females*

3. *Calculating statistics*
    a. Compute the data differences.
    b. Compute samples/differences means. [*Hint*: use function =average()]
    c. Compute sample/differences standard deviations. [*Hint*: use function =stdev()]
    d. Find the sample/differences maximum values. [*Hint*: use function =max()]
    e. Find the sample/differences minimum values. [*Hint*: use function =min()]
    f. Find the sample/differences ranges.
    g. Find the sample/differences medians. [*Hint*: use function =median()]

Example Exercise 3 results

| | A | B | C | D |
|---|---|---|---|---|
| 8 | College | MALES | FEMALES | Difference |
| 9 | C-1 | 34.5 | 33.9 | 0.6 |
| 10 | C-2 | 30.5 | 31.2 | -0.7 |
| 11 | C-3 | 35.1 | 35 | 0.1 |
| 12 | C-4 | 35.7 | 34.2 | 1.5 |
| 13 | C-5 | 31.5 | 32.4 | -0.9 |
| 14 | C-6 | 34.4 | 34.1 | 0.3 |
| 15 | C-7 | 32.1 | 32.7 | -0.6 |
| 16 | C-8 | 30.7 | 29.9 | 0.8 |
| 17 | C-9 | 33.7 | 31.2 | 2.5 |
| 18 | C-10 | 35.3 | 35.5 | -0.2 |
| 19 | C-11 | 30.7 | 30.2 | 0.5 |
| 20 | C-12 | 34.2 | 34.8 | -0.6 |
| 21 | C-13 | 39.6 | 38.7 | 0.9 |
| 22 | C-14 | 30.5 | 30 | 0.5 |
| 23 | C-15 | 33.8 | 33.8 | 0 |
| 24 | C-16 | 31.7 | 32.4 | -0.7 |
| 25 | C-17 | 32.8 | 31.7 | 1.1 |
| 26 | C-18 | 38.5 | 38.9 | -0.4 |
| 27 | C-19 | 40.5 | 41.2 | -0.7 |
| 28 | C-20 | 25.3 | 25.5 | -0.2 |
| 29 | C-21 | 28.6 | 28 | 0.6 |
| 30 | C-22 | 35.8 | 35.1 | 0.7 |
| 31 | | Males | Females | Difference |
| 32 | Mean | 33.4318 | 33.2 | 0.23182 |
| 33 | St Dev | 3.54621 | 3.60119 | 0.84594 |
| 34 | Max | 40.5 | 41.2 | 2.5 |
| 35 | Min | 25.3 | 25.5 | -0.9 |
| 36 | Range | 15.2 | 15.7 | 3.4 |
| 37 | Median | 33.75 | 33.25 | 0.2 |

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4. *Graphing data differences*

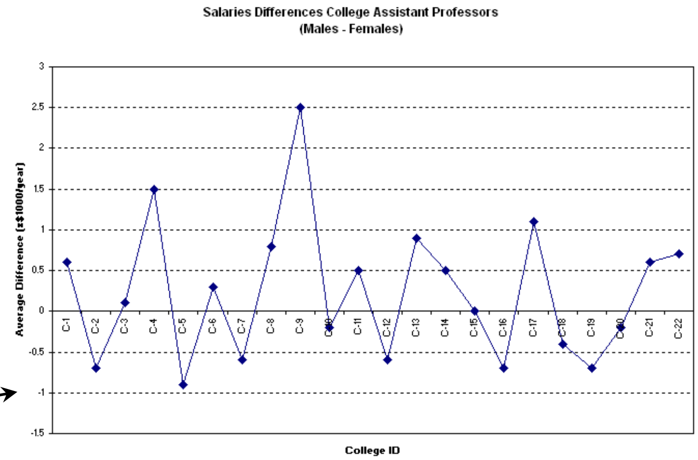
   Repeat Exercises 1 and 2 for the data differences obtained in Exercise 3, with the next changes:

   a. Delete the graph legend.

   b. Add a y-axis label: *Average Differences* (x *$1,000/year*)

   c. Title the graph: *College Assistant Professor Salary Differences: Males vs. Females*

**Example Exercise 4 results**




5. *Graphing mean and standard deviation for the differences*

   a. Include in the graph a horizontal line representing the sample mean. (*Hint:* Create a list with *mean values,* then Chart ▶ Source Data ▶ Add [*Select created data*].)

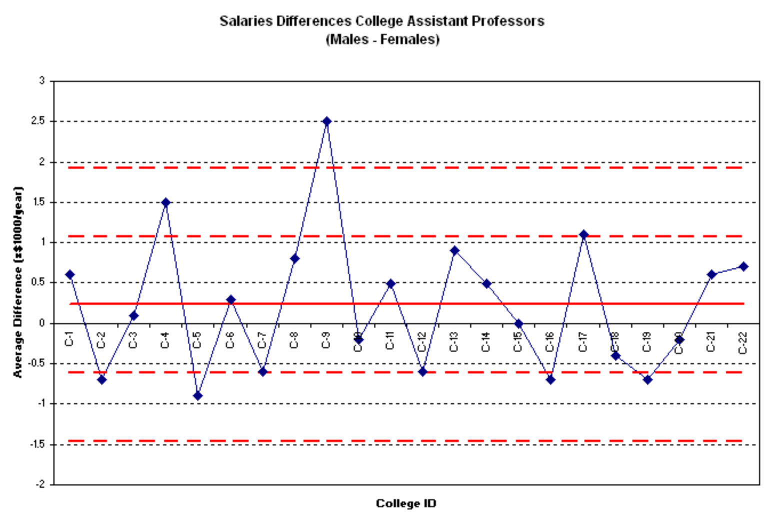
   b. Include in the graph horizontal lines representing mean ± 1 standard deviation. (Hint: Create list with ± SD, then ▶ Source Data ▶ Add [*Select created data].*)

   c. Include in the graph a horizontal line representing mean ± 2 standard deviations.

   d. Format the sample mean line: Change the color to red and select the next thicker line. (*Hint*: Double click on line.)

   e. Format the standard deviation lines: Change the color to red and select a broken thicker line (*Hint*: Double click on line.)

**Example Exercise 5 graph**



6. *Compute the sample differences t-value, p-value and sampling standard deviation*

   a. Compute the sample associated $t$-value or sample test statistic.
   *Use equation:* $t = \bar{d} \cdot \sqrt{n} / s_d$, *where* $\bar{d}$ *is difference mean, n is sample size, and* $S_d$ *is difference standard deviation. Using the values in the table:*

$$t = \frac{0.23182 \cdot \sqrt{22}}{0.84594} = 1.28535$$

   b. Compute $p$-value using T-distribution.
   *Use function ttest*() *with the values in table shown in step* 2

   =ttest(B8:B30,C8:C30,1,1)

   *where the first* "1" *indicates one-tail test, and the second* "1" *indicates a paired test.*

   c. Compute the sampling standard deviation for this difference.
   *Use equation*: $s_{\bar{d}} = s_d / \sqrt{n}$ :

$$S_{\bar{d}} = \frac{0.84594}{\sqrt{22}} = 0.18035$$

   d. Do your results support the claim that no significant salary difference exists between male and female college professors…
   …at the 5% level of significance?
   …at the 10% level of significance?

|  | A | B | C | D |
|---|---|---|---|---|
| 20 | C-12 | 34.2 | 34.8 | -0.6 |
| 21 | C-13 | 39.6 | 38.7 | 0.9 |
| 22 | C-14 | 30.5 | 30 | 0.5 |
| 23 | C-15 | 33.8 | 33.8 | 0 |
| 24 | C-16 | 31.7 | 32.4 | -0.7 |
| 25 | C-17 | 32.8 | 31.7 | 1.1 |
| 26 | C-18 | 38.5 | 38.9 | -0.4 |
| 27 | C-19 | 40.5 | 41.2 | -0.7 |
| 28 | C-20 | 25.3 | 25.5 | -0.2 |
| 29 | C-21 | 28.6 | 28 | 0.6 |
| 30 | C-22 | 35.8 | 35.1 | 0.7 |
| 31 |  | Males | Females | Difference |
| 32 | Mean | 33.4318 | 33.2 | 0.23182 |
| 33 | St Dev | 3.54621 | 3.60119 | 0.84594 |
| 34 | Max | 40.5 | 41.2 | 2.5 |
| 35 | Min | 25.3 | 25.5 | -0.9 |
| 36 | Range | 15.2 | 15.7 | 3.4 |
| 37 | Median | 33.75 | 33.25 | 0.2 |
| 38 |  |  |  |  |
| 39 |  |  | t-value | 1.28535 |
| 40 |  |  | p-value | 0.10633 |
| 41 |  |  | S-StDev | 0.18035 |

**Example Exercise 6 results**

(*Write your conclusions in a textbox on the results spreadsheet. Include an explanation. Example:*)

Because $p$-value = 0.10633 is greater than 0.05 or 0.10, we have no evidence at the 5% or 10% level of significance to reject the original assumption ($H_0$) that female assistant professors receive, on average, the same salary as the male assistant professors.

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**Exercises:**

1. Create a graph
2. Format a graph (a-e)
3. Calculate statistics (a-g)
4. Graph data differences (a-c)
5. Graph mean and standard deviation for the differences (a-e)
6. Compute the sample differences t-value, p-value and sampling standard deviation (a-d)

## <u>Independent Practice</u>: *Unemployment: College vs. High School Graduates*

*Instructions:* For the next data set, *Unemployment: College vs. High School Graduates*, perform Exercises 1 - 6.
Correctly label all your formatted graphs and tables with results.
Save your practice in an Excel file named like this: Unemployment_YourFullName_Period.xls.

| Year | College | High School |
|---|---|---|
| 1999 | 2.8 | 5.9 |
| 2000 | 2.2 | 4.9 |
| 2001 | 2.2 | 4.8 |
| 2002 | 1.7 | 5.4 |
| 2003 | 2.3 | 6.3 |
| 2004 | 2.3 | 6.9 |
| 2005 | 2.4 | 6.9 |
| 2006 | 2.7 | 7.2 |
| 2007 | 3.5 | 10.0 |
| 2008 | 3 | 8.5 |
| 2009 | 1.9 | 5.1 |
| 2010 | 2.5 | 6.9 |

## <u>Independent Practice</u>: *Birth Rates vs. Death Rates*

*Instructions*. For the data set, *Birth Rates vs. Death Rates*, perform Exercises 1 - 6.
Correctly label all your formatted graphs and tables with results.
Save your practice in an Excel file named like this: BDRates_YourFullName_Period.xls.

| County ID | Birth | Death |
|---|---|---|
| CO-01 | 12.7 | 9.8 |
| CO-02 | 13.4 | 14.5 |
| CO-03 | 12.8 | 10.7 |
| CO-04 | 12.1 | 14.2 |
| CO-05 | 11.6 | 13.0 |
| CO-06 | 11.1 | 12.9 |
| CO-07 | 14.2 | 10.9 |
| CO-08 | 12.5 | 14.1 |
| CO-09 | 12.3 | 13.6 |
| CO-10 | 13.1 | 9.1 |
| CO-11 | 15.8 | 10.2 |
| CO-12 | 10.3 | 17.9 |
| CO-13 | 12.7 | 11.8 |
| CO-14 | 11.1 | 7.0 |