



Applied Data Analysis

Module 3 Lab: Education Data Walkthrough

Learning Objectives

- Rearrange and sort data in Excel.
- Use Excel's COUNTIF and COUNTIFS functions to turn categorical data into numerical counts.
- Create and interpret line graphs in Excel.
- Ensure that visualizations are properly labeled and readable.

Data Set

Mod3Lab.csv

Note: We're using a very large data set for this lab, so make sure you copy and paste **all 7803 rows** of data into a new Excel Online worksheet. (See Exercise 1 for special instructions on this.)

What You'll Need

To complete the lab, you will need the online version of Microsoft Excel.

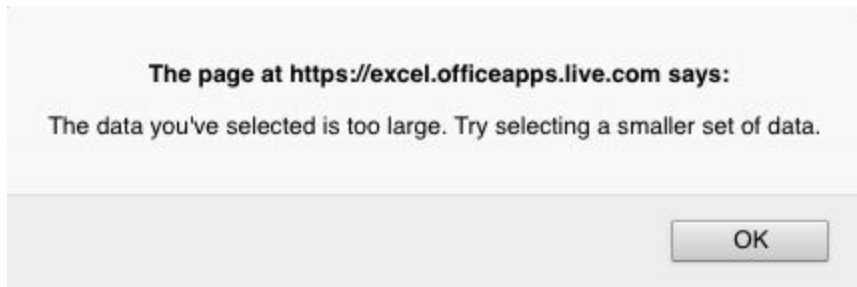
Overview

Imagine you're a data analyst working for the College of Weaving and Analytics. The college has assigned you to create reports on the school's enrollment by year, broken out by different factors. In this lab, you'll work on several strategies for visualizing and arranging data for this type of report.

Exercise 1: Total Enrollment by Year

Like we saw in the previous lab, preparing visualizations is a major part of the data analyst's job. So let's break down some of the enrollment data from this data set and see what it looks like visually.

1. Open the data set in Excel Online, which shows college degree information on 7802 different students at the College of Weaving and Analytics. **Note:** You might get the following message if you try to copy and paste this enormous data set into Excel all at once:



If that happens, then carefully copy and paste the data about 2000 rows at a time until you have all 7803 rows in a new Excel Online worksheet (again, that's 7802 students, plus the top row with the column titles—the bottom student's ID number should be 7802). It's a little tedious, but it's very important to make sure you have the *entire* data set copied over.

Here's a quick snapshot of the first few rows of the data set:

	A	B	C	D	E	F	G	H
1	id	year	field of study	degree	gpa	aid	name	grad
2	1	2010	Basket Weaving	Minor	3.135035	1	Koren, Logan	Grad
3	2	2010	Basket Weaving	BA	3.095205	0	Arndt, Andrew	UG
4	3	2010	Basket Weaving	BA	3.006216	1	Allen, Joshua	UG
5	4	2010	Basket Weaving	BA	2.957733	0	Barrera, David	UG
6	5	2010	Basket Weaving	Doctoral	2.972575	0	Rosa, Mark	Grad
7	6	2010	Data Analytics	Doctoral	2.583632	0	Hansen, Jesse	Grad
8	7	2010	Basket Weaving	BA	2.989816	0	Franklin, Mustafa	UG
9	8	2010	Basket Weaving	Minor	3.064919	1	Kurtz, Dustin	Grad
10	9	2010	Rug Weaving	BA	2.568785	0	Clark, Clayton	UG
11	10	2010	Basket Weaving	Masters	3.077532	1	Sheafe, Raieev	Grad

Each row represents one student. Here's what each column/variable represents:

id = a number representing the individual for ID purposes (i.e. Student 1, Student 2, etc.)

year = the year that the student enrolled in the college

field of study = the field that the student's degree is in (either Basket Weaving, Container Design, Data Analytics, or Rug Weaving)

degree = the type of degree (either BA, Masters, Doctoral, or Minor)

gpa = the student's grade point average

aid = whether the student needs financial aid (1 = needs financial aid, 0 = does not need)

name = the student's name

grad = the student's credit type (Grad = graduate degree, UG = undergraduate degree)

- Before you can create your first graph, you'll need to rearrange the data slightly. Off to the side of the data set, in columns J and K, set up a mini-table to show the enrollment counts by year, with one row for each year from 2010 to 2018. It should look like this:

	A	B	C	D	E	F	G	H	I	J	K
1	id	year	field of study	degree	gpa	aid	name	grad		year	count
2	1	2010	Basket Weaving	Minor	3.135035	1	Koren, Logan	Grad		2010	
3	2	2010	Basket Weaving	BA	3.095205	0	Arndt, Andrew	UG		2011	
4	3	2010	Basket Weaving	BA	3.006216	1	Allen, Joshua	UG		2012	
5	4	2010	Basket Weaving	BA	2.957733	0	Barrera, David	UG		2013	
6	5	2010	Basket Weaving	Doctoral	2.972575	0	Rosa, Mark	Grad		2014	
7	6	2010	Data Analytics	Doctoral	2.583632	0	Hansen, Jesse	Grad		2015	
8	7	2010	Basket Weaving	BA	2.989816	0	Franklin, Mustafa	UG		2016	
9	8	2010	Basket Weaving	Minor	3.064919	1	Kurtz, Dustin	Grad		2017	
10	9	2010	Rug Weaving	BA	2.568785	0	Clark, Clayton	UG		2018	
11	10	2010	Basket Weaving	Masters	3.077532	1	Sheafe, Rajeev	Grad			

3. Now populate the counts in this mini-table using Excel's COUNTIF function. (You'll be getting a lot of mileage out of this function, since it lets you count the number of times a particular value shows up in a column without having to scroll through all 7802 entries.) Here's the syntax: **=COUNTIF(range, criteria)**. The range takes the form **firstcell:lastcell** (with a colon in between) and the criteria is whatever value you're looking for.

So in this case, you want to find out how many times the year 2010 shows up in the "year" column (column B). Your range, then, is B2:B7803. Note that even though there are 7802 students in this data set (not 7803), the first row in the spreadsheet contains the column titles, which is why your students start at B2 and end at B7803. So use B2:B7803 for the range and 2010 for the criteria. Type this into cell K2:

K2

When you hit Enter, Excel will count the number of times "2010" shows up in column B.

J	K
year	count
2010	874
2011	
2012	
2013	
2014	
2015	
2016	
2017	
2018	

So 874 students enrolled in 2010.

4. Repeat Step 3 for the other years as well. The range will always be B2:B7803, and the criteria will be whatever year you're looking for.

K3	▼	<i>fx</i>	=COUNTIF(B2:B7803, 2011)
K4	▼	<i>fx</i>	=COUNTIF(B2:B7803, 2012)
K5	▼	<i>fx</i>	=COUNTIF(B2:B7803, 2013)
K6	▼	<i>fx</i>	=COUNTIF(B2:B7803, 2014)
K7	▼	<i>fx</i>	=COUNTIF(B2:B7803, 2015)
K8	▼	<i>fx</i>	=COUNTIF(B2:B7803, 2016)
K9	▼	<i>fx</i>	=COUNTIF(B2:B7803, 2017)
K10	▼	<i>fx</i>	=COUNTIF(B2:B7803, 2018)

And here's what your final table should look like:

J	K
year	count
2010	874
2011	901
2012	889
2013	904
2014	910
2015	860
2016	840
2017	810
2018	814

5. You can eyeball that table to see that 2014 had the highest enrollment, but a graph will make it much easier to tell things like that. Highlight that mini-table you just created, including the column titles. (But do *not* highlight the entire spreadsheet.)

J	K
year	count
2010	874
2011	901
2012	889
2013	904
2014	910
2015	860
2016	840
2017	810
2018	814

- With the table highlighted, click Insert > Scatter > Scatter with Straight Lines (it's usually the last icon in the Scatter dropdown menu).

The screenshot shows the Excel Online interface with the 'Insert' tab selected. The 'Charts' group is expanded, showing the 'Scatter' dropdown menu. The 'Scatter with Straight Lines' icon is circled in red. A red arrow points from the text instruction to this icon.

Excel Online | OneDrive > Documents | Book 2

File Home Insert Data Review View Tell me what you want to do Open in Excel

Function Survey Table PivotTable Picture Shapes Office Add-ins Column Line Pie Bar Area Scatter Other Charts Hyperlink Comment

Functions Tables Illustrations Add-ins Charts

J1 year

	A	B	C	D	E	F	G
1	id	year	field of study	degree	gpa	aid	name
2	1	2010	Basket Weaving	Minor	3.135035	1	Koren, Logan
3	2	2010	Basket Weaving	BA	3.095205	0	Arndt, Andrew
4	3	2010	Basket Weaving	BA	3.006216	1	Allen, Joshua
5	4	2010	Basket Weaving	BA	2.957733	0	Barrera, David
6	5	2010	Basket Weaving	Doctoral	2.972575	0	Rosa, Mark
7	6	2010	Data Analytics	Doctoral	2.583632	0	Hansen, Jesse
8	7	2010	Basket Weaving	BA	2.989816	0	Franklin, Mustafa
9	8	2010	Basket Weaving	Minor	3.064919	1	Kurtz, Dustin
10	9	2010	Rug Weaving	BA	2.568785	0	Clark, Clayton
11	10	2010	Basket Weaving	Masters	3.077532	1	Sheafe, Rajeev
12	11	2010	Rug Weaving	BA	3.081246	1	Strickler, Corrieann

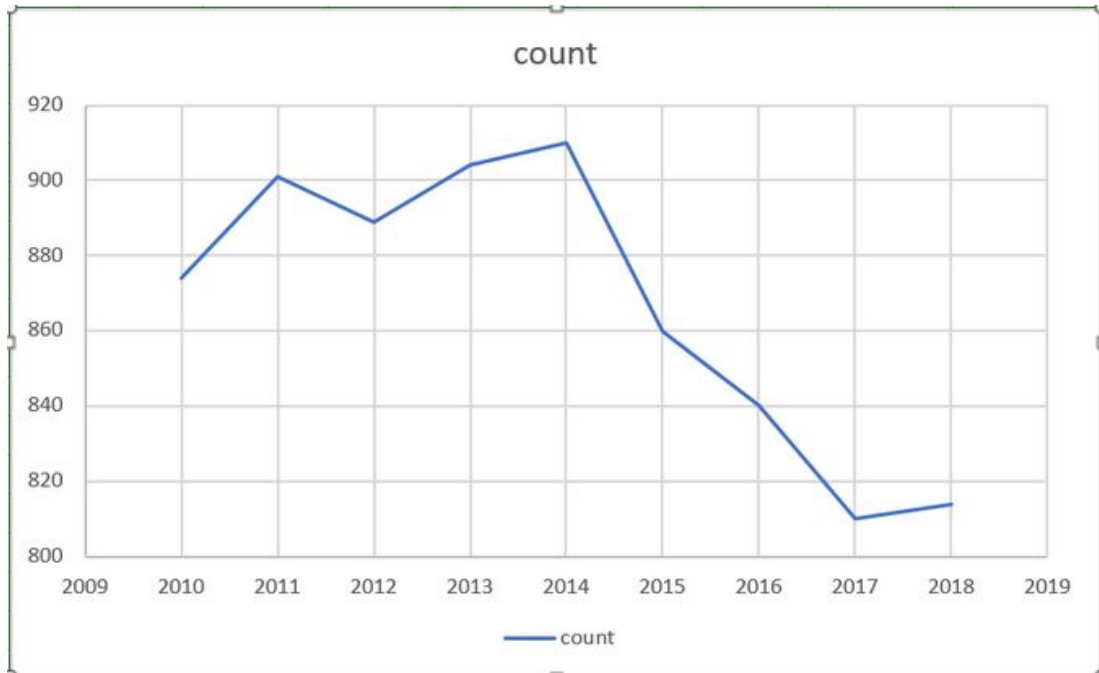
Scatter

Scatter with Straight Lines

Compare pairs of values.

Use it when there are many data points in x-axis order and the data represents separate samples.

When you click the icon, a new chart will pop up.



This shows the number of students who enrolled each year.

7. Now you should add some helpful titles to your chart. Click on the graph and do the following:

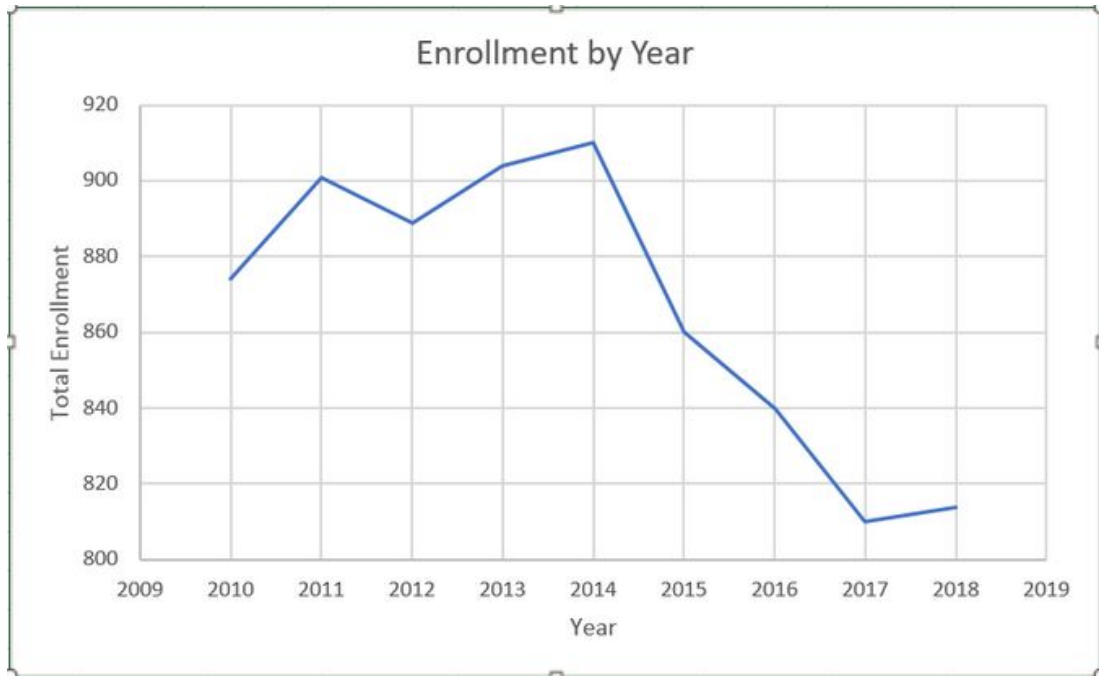
Horizontal axis title: **Chart Tools > Axis Titles > Primary Horizontal Axis Title > Edit Horizontal Axis Title**, then type "Year"

Vertical axis title: **Chart Tools > Axis Titles > Primary Vertical Axis Title > Edit Vertical Axis Title**, then type "Total Enrollment"

Chart title: **Chart Tools > Chart Title > Edit Chart Title**, then type "Enrollment by Year"

You also don't need that annoying blue "count" legend at the bottom for this particular graph, so hide it by clicking **Chart Tools > Legend > None**.

8. Gaze on your beautiful new data visualization!



Now you can see that college enrollment was fairly steady from 2010 to 2014, but then it started falling after 2014. In 2017, enrollment was at its lowest point.

Exercise 2: Enrollment by Credit Type

As a data analyst, it's useful to further break down this enrollment data into different subcategories and make more graphs to visualize different insights into the data. Now we'll look at graduate enrollment versus undergraduate enrollment, which might help us better understand that huge dip in enrollment we saw in the previous exercise.

1. Off to the side of the table you created in Exercise 1, create a new mini-table (in columns M, N, and O this time) showing the enrollment counts by year for Grad and UG, with one row for each year from 2010 to 2018. Like this:

	M	N	O
1	year	Grad	UG
2	2010		
3	2011		
4	2012		
5	2013		
6	2014		
7	2015		
8	2016		
9	2017		
10	2018		

- Since you're looking at enrollment by *two* different factors this time (year and graduate/undergraduate), you'll need to use Excel's COUNTIFS function to populate the table. (Note the "S" at the end—this function is a bit fancier than the regular COUNTIF function that we used in Exercise 1.)

The syntax is **=COUNTIFS(criteria_range1, criteria1, criteria_range2, criteria2)**. It's like using two COUNTIF functions at the same time.

Both ranges take the form **firstcell:lastcell** (with a colon in between). The first range will be the "year" data in column B (B2:B7803), and the second range will be the "grad" data in column H (H2:H7803).

The first criteria (criteria1) is whatever year you're looking at (2010, 2011, etc.). The second criteria (criteria2) is either "Grad" or "UG" (in quotation marks) from the "grad" column (column H).

Note: The criteria part **MUST** be in quotation marks if you're looking for a text value (instead of a number).

So the first cell in your new mini-table (cell N2) is for the number of students who enrolled in 2010 to get a graduate (Grad) degree. Here's what you should type into cell N2:

N2  =COUNTIFS(B2:B7803, 2010, H2:H7803, "Grad")

Essentially, you're asking Excel to count the number of people who had both a 2010 in column B *and* a "Grad" in column H, *at the same time*.

M	N	O
year	Grad	UG
2010	339	535
2011		
2012		
2013		
2014		
2015		
2016		
2017		
2018		

There were 535 undergrad students who enrolled in 2010.

- Repeat steps 2 and 3 for the 2011 row of your mini-table. The ranges in the COUNTIFS function will stay exactly the same, but you'll use 2011 for the first criteria and either "Grad" or "UG" for the second criteria.

N3		=COUNTIFS(B2:B7803, 2011, H2:H7803, "Grad")
O3		=COUNTIFS(B2:B7803, 2011, H2:H7803, "UG")

M	N	O
year	Grad	UG
2010	339	535
2011	411	490
2012		
2013		
2014		
2015		
2016		
2017		
2018		

- Repeat Steps 2 and 3 again for 2012, 2013, 2014, 2015, 2016, 2017, and 2018. Don't rush! Take your time to make sure everything's entered properly.

Here's what you'll enter for **2012**:

N4	▼	<i>fx</i>	=COUNTIFS(B2:B7803, 2012, H2:H7803, "Grad")
O4	▼	<i>fx</i>	=COUNTIFS(B2:B7803, 2012, H2:H7803, "UG")

Here's **2013**:

N5	▼	<i>fx</i>	=COUNTIFS(B2:B7803, 2013, H2:H7803, "Grad")
O5	▼	<i>fx</i>	=COUNTIFS(B2:B7803, 2013, H2:H7803, "UG")

Here's **2014**:

N6	▼	<i>fx</i>	=COUNTIFS(B2:B7803, 2014, H2:H7803, "Grad")
O6	▼	<i>fx</i>	=COUNTIFS(B2:B7803, 2014, H2:H7803, "UG")

Here's **2015**:

N7	▼	<i>fx</i>	=COUNTIFS(B2:B7803, 2015, H2:H7803, "Grad")
O7	▼	<i>fx</i>	=COUNTIFS(B2:B7803, 2015, H2:H7803, "UG")

Here's **2016**:

N8	▼	<i>fx</i>	=COUNTIFS(B2:B7803, 2016, H2:H7803, "Grad")
O8	▼	<i>fx</i>	=COUNTIFS(B2:B7803, 2016, H2:H7803, "UG")

Here's **2017**:

N9	▼	<i>fx</i>	=COUNTIFS(B2:B7803, 2017, H2:H7803, "Grad")
O9	▼	<i>fx</i>	=COUNTIFS(B2:B7803, 2017, H2:H7803, "UG")

And finally, **2018**:

N10	▼	<i>fx</i>	=COUNTIFS(B2:B7803, 2018, H2:H7803, "Grad")
O10	▼	<i>fx</i>	=COUNTIFS(B2:B7803, 2018, H2:H7803, "UG")

Your final table should look like this:

M	N	O
year	Grad	UG
2010	339	535
2011	411	490
2012	423	466
2013	461	443
2014	469	441
2015	447	413
2016	446	394
2017	453	357
2018	478	336

- Highlight that entire mini-table, including the column titles.

M	N	O
year	Grad	UG
2010	339	535
2011	411	490
2012	423	466
2013	461	443
2014	469	441
2015	447	413
2016	446	394
2017	453	357
2018	478	336

- Click Insert > Scatter > Scatter with Straight Lines (usually the last icon in the Scatter dropdown menu).

Excel Online | OneDrive > Documents | Book 2

File Home Insert Data Review View Tell me what you want to do Open in Excel

Function Survey Table PivotTable Picture Shapes Office Add-ins Column Line Pie Bar Area Scatter Other Hyper

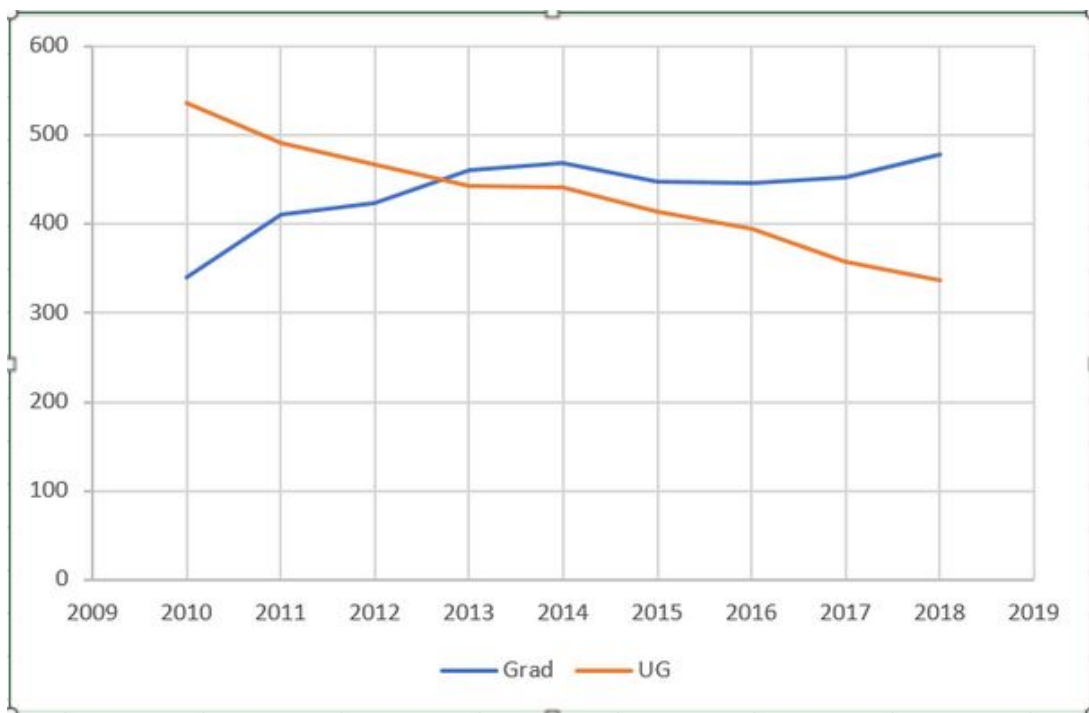
Functions Tables Illustrations Add-ins Charts

J1 fx year

	A	B	C	D	E	F	G
1	id	year	field of study	degree	gpa	aid	name
2	1	2010	Basket Weaving	Minor	3.135035	1	Koren, Logan
3	2	2010	Basket Weaving	BA	3.095205	0	Arndt, Andrew
4	3	2010	Basket Weaving	BA	3.006216	1	Allen, Joshua
5	4	2010	Basket Weaving	BA	2.957733	0	Barrera, David
6	5	2010	Basket Weaving	Doctoral	2.972575	0	Rosa, Mark
7	6	2010	Data Analytics	Doctoral	2.583632	0	Hansen, Jesse
8	7	2010	Basket Weaving	BA	2.989816	0	Franklin, Mustafa

Scatter with Straight Line

And take a gander at your new graph:



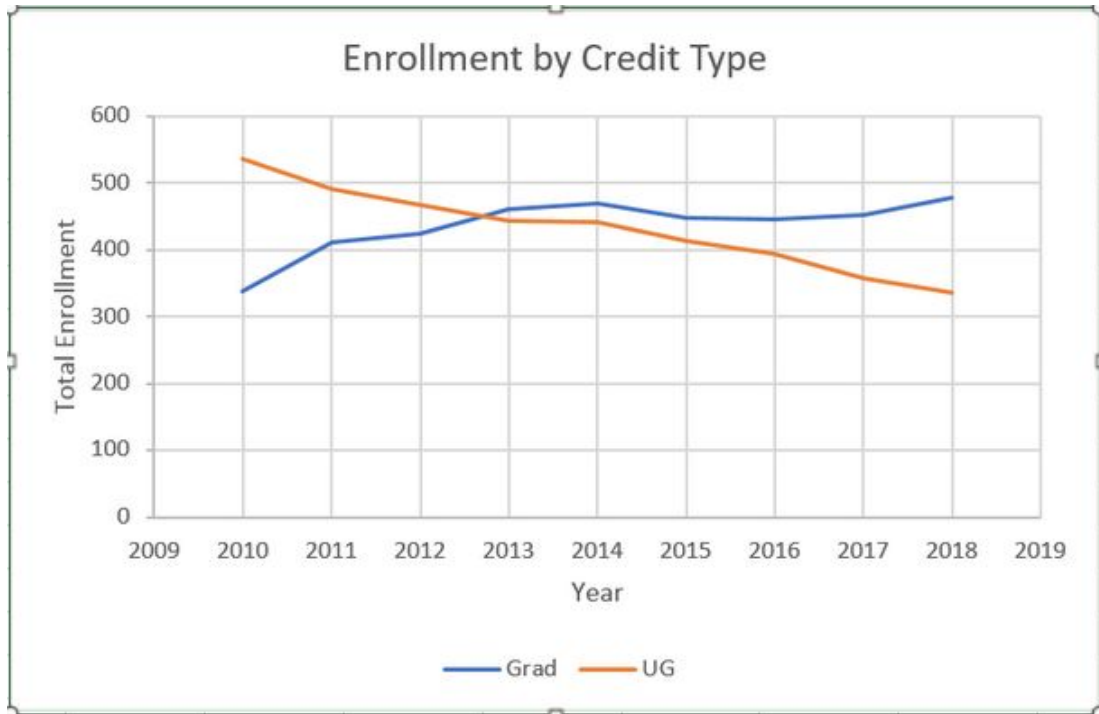
- As usual, though, you should add some helpful titles to your chart. Click on the graph and do the following:

Horizontal axis title: **Chart Tools > Axis Titles > Primary Horizontal Axis Title > Edit Horizontal Axis Title**, then type "Year"

Vertical axis title: **Chart Tools > Axis Titles > Primary Vertical Axis Title > Edit Vertical Axis Title**, then type “Total Enrollment”

Chart title: **Chart Tools > Chart Title > Edit Chart Title**, then type “Enrollment by Credit Type”

Now you’ve got another way to visualize your data:



It’s easy to see now that graduate enrollment is going up, while undergraduate enrollment is going down. Graduate enrollment used to be quite a bit lower than undergrad, but the two enrollment rates crossed paths between 2012 and 2013, and now graduate enrollment is outstripping undergrad.

Back in Exercise 1, we saw that total enrollment for all credit types dropped sharply between 2014 and 2017. But with this new graph, we can see that undergraduate enrollment was largely responsible for that drop—graduate enrollment stayed fairly steady between 2014 and 2017.

Exercise 3: Enrollment by Degree Type

Now we’ll break down these enrollment rates even further by degree type.

1. Once again, you’ll need to arrange the data into a new table before crafting a beautiful new graph. Off to the side of the table you created in Exercise 2, create a new mini-table (in columns Q, R, S, T, and U this time) showing the enrollment counts by year for the four degree types: BA, Masters, Doctoral, and Minor. Your new table should look like this:

	Q	R	S	T	U
1	year	BA	Masters	Doctoral	Minor
2	2010				
3	2011				
4	2012				
5	2013				
6	2014				
7	2015				
8	2016				
9	2017				
10	2018				

- You're looking at enrollment by two different factors again (year and degree type), so you'll need to use Excel's COUNTIFS function to populate the table again.

As a refresher, the syntax is **=COUNTIFS(criteria_range1, criteria1, criteria_range2, criteria2)**.

Both ranges take the form **firstcell:lastcell** (with a colon in between). The first range will be the "year" data in column B (B2:B7803), and the second range will be the "degree" data in column D (D2:D7803).

Note: The criteria part **MUST** be in quotation marks if you're looking for a text value (instead of a number).

In the first cell of your new mini-table (cell R2), find the number of students who enrolled in 2010 to get a BA degree. Here's what you should type into R2 (be sure to put "BA" in quotation marks):

R2									
	A	B							
1	id	year	field of study	degree	gpa	aid	name	grad	
2	1	2010	Basket Weaving	Minor	3.135035	1	Koren, Logan	Grad	
3	2	2010	Basket Weaving	BA	3.095205	0	Arndt, Andrew	UG	
4	3	2010	Basket Weaving	BA	3.006216	1	Allen, Joshua	UG	
5	4	2010	Basket Weaving	BA	2.957733	0	Barrera, David	UG	
6	5	2010	Basket Weaving	Doctoral	2.972575	0	Rosa, Mark	Grad	
7	6	2010	Data Analytics	Doctoral	2.583632	0	Hansen, Jesse	Grad	

Press Enter to get the count.

Q	R	S	T	U
year	BA	Masters	Doctoral	Minor
2010	535			
2011				
2012				
2013				
2014				
2015				
2016				
2017				
2018				

Nice—looks like there were 535 students who enrolled in the BA degree program in 2010.

- Repeat Step 2 for the Masters, Doctoral, and Minor degrees in 2010. The COUNTIFS syntax will be nearly identical to Step 2—just change the second criteria to either Masters, Doctoral, or Minor.

2010 Masters:

S2 =COUNTIFS(B2:B7803, 2010, D2:D7803, "Masters")

2010 Doctoral:

T2 =COUNTIFS(B2:B7803, 2010, D2:D7803, "Doctoral")

2010 Minor:

U2 =COUNTIFS(B2:B7803, 2010, D2:D7803, "Minor")

The table should now look like this:

Q	R	S	T	U
year	BA	Masters	Doctoral	Minor
2010	535	158	94	87
2011				
2012				
2013				
2014				
2015				
2016				
2017				
2018				

- Repeat Steps 2 and 3 again for all the other years. This will probably take a while! But go nice and slow, making sure to double-check the syntax every time. Basically, you can repeat all the syntax from the previous two steps, only changing the year criteria every time. In other words, use the following syntax, changing the stuff in bold for each new cell:

=COUNTIFS(B2:B7803, **YEAR**, D2:D7803, "**Degree**")

Don't forget to put the degree ("BA" etc.) in quotation marks every time! If you don't do this, Excel will return a count of 0.

Note: We do *not* recommend using Excel's "fill series" trick to drag the formulas into the entire table. While it might seem like it'll save time, this trick will actually slightly change each of the formulas so that you'll have to go through every individual cell and re-type the ranges anyway. You *can*, however, copy an individual formula from a cell and paste it into a new cell, as long as you copy from the function bar instead of the cell itself, and remember to click into the new cell and change the formula to the proper year.

Honestly, it's probably easier to just go cell by cell. We've got you covered:

2011 degrees:

R3	fx	=COUNTIFS(B2:B7803, 2011, D2:D7803, "BA")
S3	fx	=COUNTIFS(B2:B7803, 2011, D2:D7803, "Masters")
T3	fx	=COUNTIFS(B2:B7803, 2011, D2:D7803, "Doctoral")
U3	fx	=COUNTIFS(B2:B7803, 2011, D2:D7803, "Minor")

2012 degrees:

R4	▼	<i>fx</i>	=COUNTIFS(B2:B7803, 2012, D2:D7803, "BA")
S4	▼	<i>fx</i>	=COUNTIFS(B2:B7803, 2012, D2:D7803, "Masters")
T4	▼	<i>fx</i>	=COUNTIFS(B2:B7803, 2012, D2:D7803, "Doctoral")
U4	▼	<i>fx</i>	=COUNTIFS(B2:B7803, 2012, D2:D7803, "Minor")

2013 degrees:

R5	▼	<i>fx</i>	=COUNTIFS(B2:B7803, 2013, D2:D7803, "BA")
S5	▼	<i>fx</i>	=COUNTIFS(B2:B7803, 2013, D2:D7803, "Masters")
T5	▼	<i>fx</i>	=COUNTIFS(B2:B7803, 2013, D2:D7803, "Doctoral")
U5	▼	<i>fx</i>	=COUNTIFS(B2:B7803, 2013, D2:D7803, "Minor")

2014 degrees:

R6	▼	<i>fx</i>	=COUNTIFS(B2:B7803, 2014, D2:D7803, "BA")
S6	▼	<i>fx</i>	=COUNTIFS(B2:B7803, 2014, D2:D7803, "Masters")
T6	▼	<i>fx</i>	=COUNTIFS(B2:B7803, 2014, D2:D7803, "Doctoral")
U6	▼	<i>fx</i>	=COUNTIFS(B2:B7803, 2014, D2:D7803, "Minor")

2015 degrees:

R7	▼	<i>fx</i>	=COUNTIFS(B2:B7803, 2015, D2:D7803, "BA")
S7	▼	<i>fx</i>	=COUNTIFS(B2:B7803, 2015, D2:D7803, "Masters")
T7	▼	<i>fx</i>	=COUNTIFS(B2:B7803, 2015, D2:D7803, "Doctoral")
U7	▼	<i>fx</i>	=COUNTIFS(B2:B7803, 2015, D2:D7803, "Minor")

2016 degrees:

R8	▼	<i>fx</i>	=COUNTIFS(B2:B7803, 2016, D2:D7803, "BA")
S8	▼	<i>fx</i>	=COUNTIFS(B2:B7803, 2016, D2:D7803, "Masters")
T8	▼	<i>fx</i>	=COUNTIFS(B2:B7803, 2016, D2:D7803, "Doctoral")

U8	▼	<i>fx</i>	=COUNTIFS(B2:B7803, 2016, D2:D7803, "Minor")
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2017 degrees:

R9	▼	<i>fx</i>	=COUNTIFS(B2:B7803, 2017, D2:D7803, "BA")
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S9	▼	<i>fx</i>	=COUNTIFS(B2:B7803, 2017, D2:D7803, "Masters")
----	---	-----------	--

T9	▼	<i>fx</i>	=COUNTIFS(B2:B7803, 2017, D2:D7803, "Doctoral")
----	---	-----------	---

U9	▼	<i>fx</i>	=COUNTIFS(B2:B7803, 2017, D2:D7803, "Minor")
----	---	-----------	--

2018 degrees:

R10	▼	<i>fx</i>	=COUNTIFS(B2:B7803, 2018, D2:D7803, "BA")
-----	---	-----------	---

S10	▼	<i>fx</i>	=COUNTIFS(B2:B7803, 2018, D2:D7803, "Masters")
-----	---	-----------	--

T10	▼	<i>fx</i>	=COUNTIFS(B2:B7803, 2018, D2:D7803, "Doctoral")
-----	---	-----------	---

U10	▼	<i>fx</i>	=COUNTIFS(B2:B7803, 2018, D2:D7803, "Minor")
-----	---	-----------	--

When you're finally done with this extra-long step, your table should look like this:

Q	R	S	T	U
year	BA	Masters	Doctoral	Minor
2010	535	158	94	87
2011	490	237	81	93
2012	466	233	104	86
2013	443	185	109	167
2014	441	208	93	168
2015	413	217	83	147
2016	394	227	119	100
2017	357	216	121	116
2018	336	282	104	92

- Highlight that entire mini-table, including the column titles. (Do *not* use "Select All" to highlight the entire spreadsheet.)

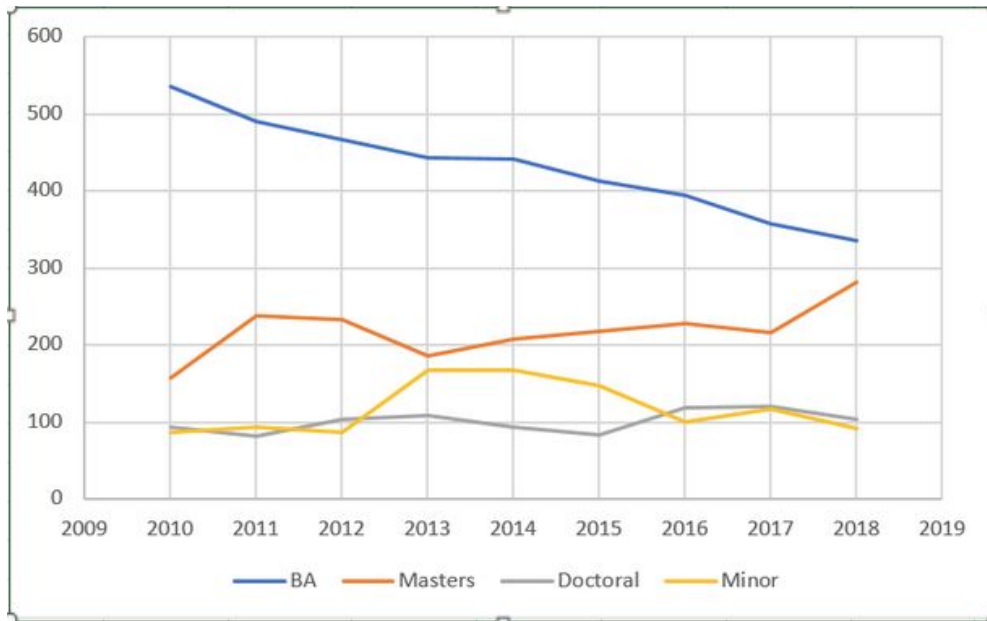
	Q	R	S	T	U
	year	BA	Masters	Doctoral	Minor
	2010	535	158	94	87
	2011	490	237	81	93
	2012	466	233	104	86
	2013	443	185	109	167
	2014	441	208	93	168
	2015	413	217	83	147
	2016	394	227	119	100
	2017	357	216	121	116
	2018	336	282	104	92

6. With the table highlighted, do the same thing you did in the previous exercises: Click Insert > Scatter > Scatter with Straight Lines (usually the last icon in the Scatter dropdown menu).

The screenshot shows the Excel Online interface with the 'Insert' tab selected. The 'Charts' group on the ribbon includes icons for Scatter, Other Charts, and Hyperlinks. A red arrow points from the 'Scatter' icon to a dropdown menu that is open, showing various scatter plot options. The option 'Scatter with Straight Lines' is circled in red at the bottom of the dropdown menu.

	A	B	C	D	E	F	G
1	id	year	field of study	degree	gpa	aid	name
2	1	2010	Basket Weaving	Minor	3.135035	1	Koren, Logan
3	2	2010	Basket Weaving	BA	3.095205	0	Arndt, Andrew
4	3	2010	Basket Weaving	BA	3.006216	1	Allen, Joshua
5	4	2010	Basket Weaving	BA	2.957733	0	Barrera, David
6	5	2010	Basket Weaving	Doctoral	2.972575	0	Rosa, Mark
7	6	2010	Data Analytics	Doctoral	2.583632	0	Hansen, Jesse
8	7	2010	Basket Weaving	BA	2.989816	0	Franklin, Mustafa

Your graph should pop up:



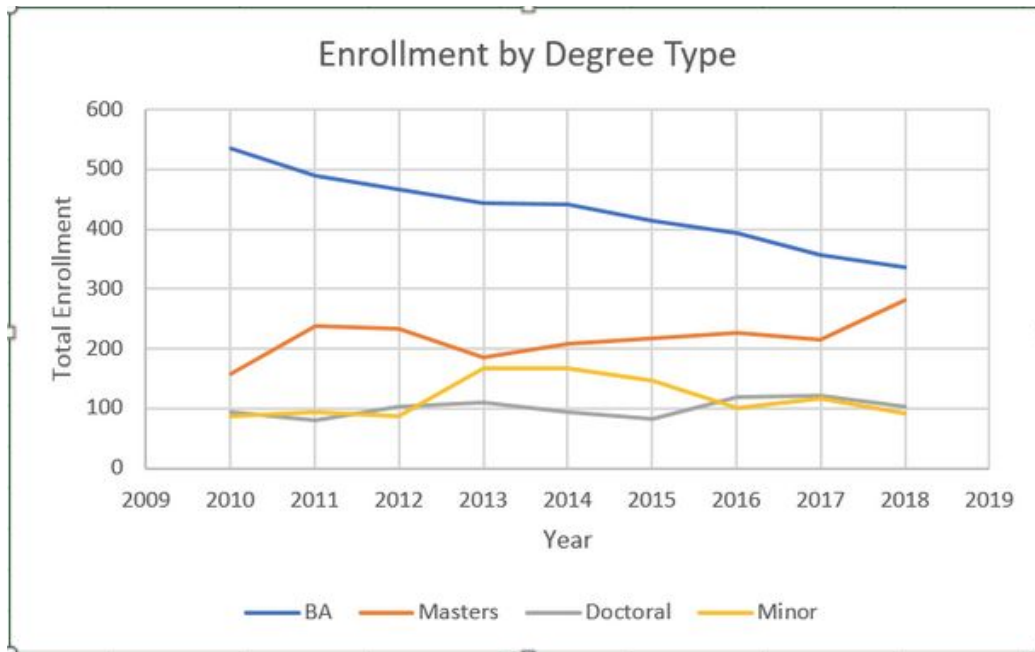
7. Last step! Add titles to your chart. Click on the graph and do the following:

Horizontal axis title: **Chart Tools > Axis Titles > Primary Horizontal Axis Title > Edit Horizontal Axis Title**, then type "Year"

Vertical axis title: **Chart Tools > Axis Titles > Primary Vertical Axis Title > Edit Vertical Axis Title**, then type "Total Enrollment"

Chart title: **Chart Tools > Chart Title > Edit Chart Title**, then type "Enrollment by Degree Type"

That was a ton of work, but you got a really useful data visualization out of it:



Now you can see there's more to the story. The only degree type that's been steadily decreasing in enrollment is the BA (Bachelor of Arts) degree. The other degrees do sometimes rise and fall, but it looks like BA enrollment is probably more responsible for the college's steep drop in total enrollment (which we looked at in Exercise 1). Armed with these data insights, we can recommend that the college focus more on increasing their BA enrollment if they want to counter these trends.

You can also see that Doctoral degree enrollment is consistently a lot lower than BA or Masters enrollment, which makes sense. The school's Doctoral program is probably a lot more competitive than the other programs, and it probably has fewer applicants (because fewer people pursue a PhD than a BA, for example).

Exercise 4: Enrollment by Field of Study

For this exercise, we'll build another graph to see what yearly enrollment in each field of study looks like.

1. By now, you probably know the drill: Off to the side of the table you created in Exercise 3, create another mini-table (in columns W, X, Y, Z, and AA this time) showing the enrollment counts by year for the four fields of study: Basket Weaving, Container Design, Data Analytics, and Rug Weaving. (It's a very niche university.)

Your new table should look like this:

	W	X	Y	Z	AA
1	year	Basket Weaving	Container Design	Data Analytics	Rug Weaving
2	2010				
3	2011				
4	2012				
5	2013				
6	2014				
7	2015				
8	2016				
9	2017				
10	2018				

- Once again, you're looking at enrollment by two different factors again (year and field of study), so you'll need to use Excel's COUNTIFS function to populate the table.

Again, the syntax is **=COUNTIFS(criteria_range1, criteria1, criteria_range2, criteria2)**.

Both ranges take the form **firstcell:lastcell** (with a colon in between). As always, the first range will be the "year" data in column B (B2:B7803). But this time, the second range will be the "field of study" data in column C (C2:C7803).

Note: The criteria part **MUST** be in quotation marks if you're looking for a text value (instead of a number).

In the first cell of your new mini-table (cell X2), find the number of students who enrolled in 2010 to get a degree in Basket Weaving. Here's what you should type into X2 (and don't forget to put "Basket Weaving" in quotation marks, since it's a text value):

X2			=COUNTIFS(B2:B7803, 2010, C2:C7803, "Basket Weaving")						
	A	B	COUNTIFS (criteria_range1, criteria1, [criteria_range2, criteria2], [criteria_range3, ...])						
1	id	year	field of study	degree	gpa	aid	name	grad	
2	1	2010	Basket Weaving	Minor	3.135035	1	Koren, Logan	Grad	
3	2	2010	Basket Weaving	BA	3.095205	0	Arndt, Andrew	UG	
4	3	2010	Basket Weaving	BA	3.006216	1	Allen, Joshua	UG	
5	4	2010	Basket Weaving	BA	2.957733	0	Barrera, David	UG	
6	5	2010	Basket Weaving	Doctoral	2.972575	0	Rosa, Mark	Grad	
7	6	2010	Data Analytics	Doctoral	2.583632	0	Hansen, Jesse	Grad	
8	7	2010	Basket Weaving	BA	2.989816	0	Franklin, Mustafa	UG	
9	8	2010	Basket Weaving	Minor	3.064919	1	Kurtz, Dustin	Grad	
10	9	2010	Rug Weaving	BA	2.568785	0	Clark, Clayton	UG	

Reminder: You're asking Excel to count the number of people who had both a 2010 in column B and "Basket Weaving" in column C. Hit Enter, and you've got your first count:

W	X	Y	Z	AA
year	Basket Weaving	Container Design	Data Analytics	Rug Weaving
2010	339			
2011				
2012				
2013				
2014				
2015				
2016				
2017				
2018				

Translation: 339 students enrolled in the Basket Weaving program in 2010.

- Repeat Step 2 for the three other fields of study in 2010. The COUNTIFS syntax will be pretty much identical to Step 2—just change the second criteria to either Container Design, Data Analytics, or Rug Weaving.

2010 Container Design:

Y2 =COUNTIFS(B2:B7803, 2010, C2:C7803, "Container Design")

2010 Data Analytics:

Z2 =COUNTIFS(B2:B7803, 2010, C2:C7803, "Data Analytics")

2010 Rug Weaving:

AA2 =COUNTIFS(B2:B7803, 2010, C2:C7803, "Rug Weaving")

With that first row done, your table should now look like this:

W	X	Y	Z	AA
year	Basket Weaving	Container Design	Data Analytics	Rug Weaving
2010	339	262	80	193
2011				
2012				
2013				
2014				
2015				
2016				
2017				
2018				

4. Crack those knuckles, take a deep breath, and repeat Steps 2 and 3 again for all the other years. Be super careful to double-check the syntax every time! That syntax should look like this, with the stuff in bold changed for each new cell:

=COUNTIFS(B2:B7803, YEAR, C2:C7803, "Field of Study")

Don't forget to put quotation marks around the field of study every time, like "Basket Weaving"—if you don't do this, Excel will return a count of 0.

Note: Again, we do *not* recommend using Excel's "fill series" trick to drag the formulas into the entire table. It'll mess things up. But copying and pasting individual formulas is fine, as long as you remember to tweak them for each cell.

Here's what each cell in the table should contain, formula-wise:

2011 fields:

X3	fx	=COUNTIFS(B2:B7803, 2011, C2:C7803, "Basket Weaving")
Y3	fx	=COUNTIFS(B2:B7803, 2011, C2:C7803, "Container Design")
Z3	fx	=COUNTIFS(B2:B7803, 2011, C2:C7803, "Data Analytics")
AA3	fx	=COUNTIFS(B2:B7803, 2011, C2:C7803, "Rug Weaving")

2012 fields:

X4	fx	=COUNTIFS(B2:B7803, 2012, C2:C7803, "Basket Weaving")
Y4	fx	=COUNTIFS(B2:B7803, 2012, C2:C7803, "Container Design")

Z4	▼	<i>fx</i>	=COUNTIFS(B2:B7803, 2012, C2:C7803, "Data Analytics")
AA4	▼	<i>fx</i>	=COUNTIFS(B2:B7803, 2012, C2:C7803, "Rug Weaving")

2013 fields:

X5	▼	<i>fx</i>	=COUNTIFS(B2:B7803, 2013, C2:C7803, "Basket Weaving")
Y5	▼	<i>fx</i>	=COUNTIFS(B2:B7803, 2013, C2:C7803, "Container Design")
Z5	▼	<i>fx</i>	=COUNTIFS(B2:B7803, 2013, C2:C7803, "Data Analytics")
AA5	▼	<i>fx</i>	=COUNTIFS(B2:B7803, 2013, C2:C7803, "Rug Weaving")

2014 fields:

X6	▼	<i>fx</i>	=COUNTIFS(B2:B7803, 2014, C2:C7803, "Basket Weaving")
Y6	▼	<i>fx</i>	=COUNTIFS(B2:B7803, 2014, C2:C7803, "Container Design")
Z6	▼	<i>fx</i>	=COUNTIFS(B2:B7803, 2014, C2:C7803, "Data Analytics")
AA6	▼	<i>fx</i>	=COUNTIFS(B2:B7803, 2014, C2:C7803, "Rug Weaving")

2015 fields:

X7	▼	<i>fx</i>	=COUNTIFS(B2:B7803, 2015, C2:C7803, "Basket Weaving")
Y7	▼	<i>fx</i>	=COUNTIFS(B2:B7803, 2015, C2:C7803, "Container Design")
Z7	▼	<i>fx</i>	=COUNTIFS(B2:B7803, 2015, C2:C7803, "Data Analytics")
AA7	▼	<i>fx</i>	=COUNTIFS(B2:B7803, 2015, C2:C7803, "Rug Weaving")

2016 fields:

X8	▼	<i>fx</i>	=COUNTIFS(B2:B7803, 2016, C2:C7803, "Basket Weaving")
Y8	▼	<i>fx</i>	=COUNTIFS(B2:B7803, 2016, C2:C7803, "Container Design")
Z8	▼	<i>fx</i>	=COUNTIFS(B2:B7803, 2016, C2:C7803, "Data Analytics")
AA8	▼	<i>fx</i>	=COUNTIFS(B2:B7803, 2016, C2:C7803, "Rug Weaving")

2017 fields:

X9	▼	<i>fx</i>	=COUNTIFS(B2:B7803, 2017, C2:C7803, "Basket Weaving")
Y9	▼	<i>fx</i>	=COUNTIFS(B2:B7803, 2017, C2:C7803, "Container Design")
Z9	▼	<i>fx</i>	=COUNTIFS(B2:B7803, 2017, C2:C7803, "Data Analytics")
AA9	▼	<i>fx</i>	=COUNTIFS(B2:B7803, 2017, C2:C7803, "Rug Weaving")

2018 fields:

X10	▼	<i>fx</i>	=COUNTIFS(B2:B7803, 2018, C2:C7803, "Basket Weaving")
Y10	▼	<i>fx</i>	=COUNTIFS(B2:B7803, 2018, C2:C7803, "Container Design")
Z10	▼	<i>fx</i>	=COUNTIFS(B2:B7803, 2018, C2:C7803, "Data Analytics")
AA10	▼	<i>fx</i>	=COUNTIFS(B2:B7803, 2018, C2:C7803, "Rug Weaving")

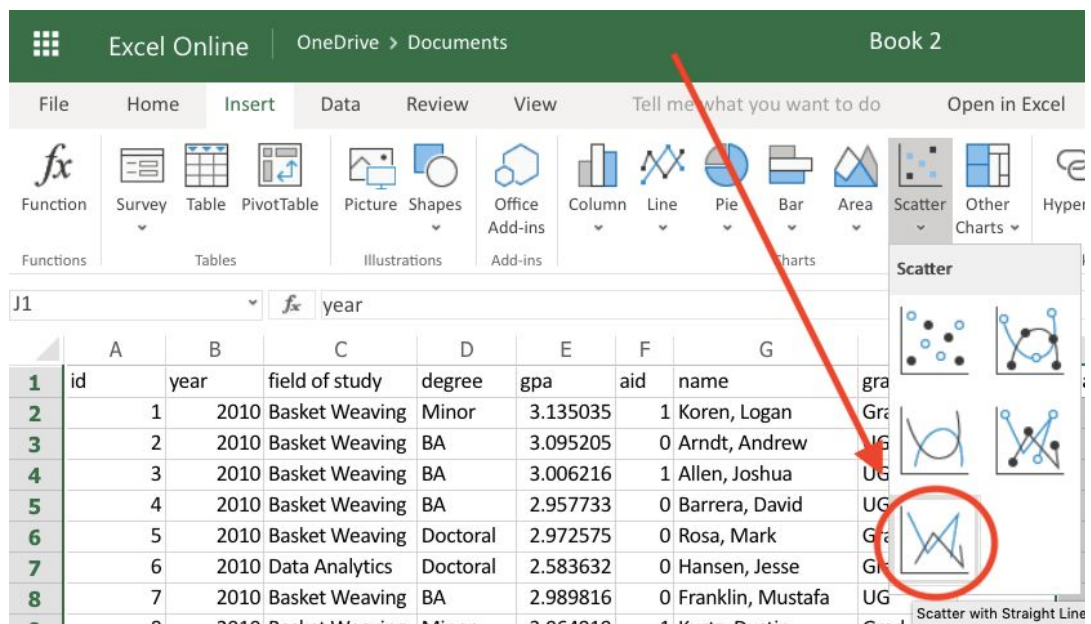
Whew! With everything filled in, your table should look like this:

W	X	Y	Z	AA
year	Basket Weaving	Container Design	Data Analytics	Rug Weaving
2010	339	262	80	193
2011	364	238	129	170
2012	313	263	144	169
2013	286	286	178	154
2014	290	290	177	153
2015	306	270	146	138
2016	246	229	228	137
2017	243	215	226	126
2018	202	215	257	140

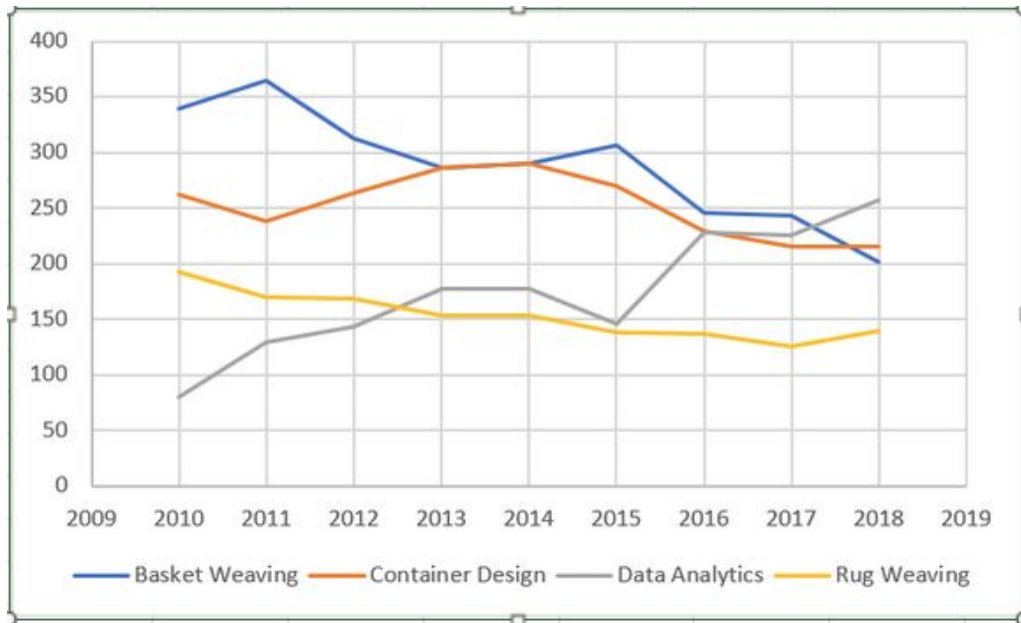
- It's finally graph time. Highlight the entire mini-table, including the column titles. (Do *not* use "Select All" to highlight the entire spreadsheet.)

W	X	Y	Z	AA
year	Basket Weaving	Container Design	Data Analytics	Rug Weaving
2010	339	262	80	193
2011	364	238	129	170
2012	313	263	144	169
2013	286	286	178	154
2014	290	290	177	153
2015	306	270	146	138
2016	246	229	228	137
2017	243	215	226	126
2018	202	215	257	140

6. With the table highlighted, once again click Insert > Scatter > Scatter with Straight Lines (usually the last icon in the Scatter dropdown menu).



A new graph should pop up:



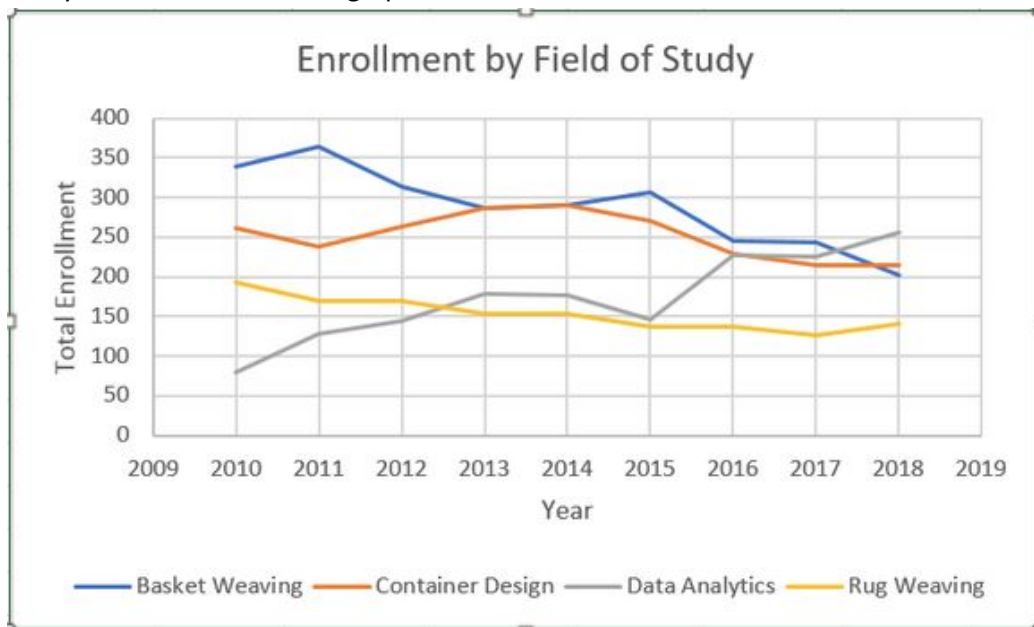
- One final step here: Add titles to your graph. Click on the graph and do this:

Horizontal axis title: **Chart Tools > Axis Titles > Primary Horizontal Axis Title > Edit Horizontal Axis Title**, then type "Year"

Vertical axis title: **Chart Tools > Axis Titles > Primary Vertical Axis Title > Edit Vertical Axis Title**, then type "Total Enrollment"

Chart title: **Chart Tools > Chart Title > Edit Chart Title**, then type "Enrollment by Field of Study"

Nicely done! Here's the final graph:



You can use this shiny new graph to glean all sorts of data insights. For example, the Data Analytics field was by far the least popular back in 2010, but now that field has surpassed all of the others to become the field with the *highest* enrollment in 2018. Basket Weaving, on the other hand, has fallen quite a bit from its heyday in 2011.

We can even combine all four graphs from these exercises into a nice, easy-to-read report and present it to the College of Weaving and Analytics. This is easy to do in Excel Online—just drag the corners of the graphs in an Excel worksheet to shrink or expand it, and drag all four graphs together. Like this:

