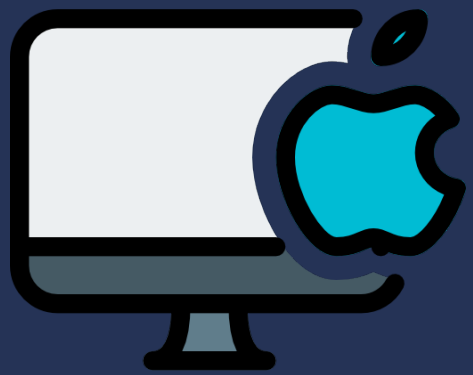
How to Interpret and Use the Statistics in Excel's Data Analysis Toolpak

Office 365 Excel | Windows version

Tracie Miller & Wendy Tietz

For Mac users…

- Generally, the steps are the same or similar
- Where there is a difference, we will mention the Mac instructions after the Windows instructions



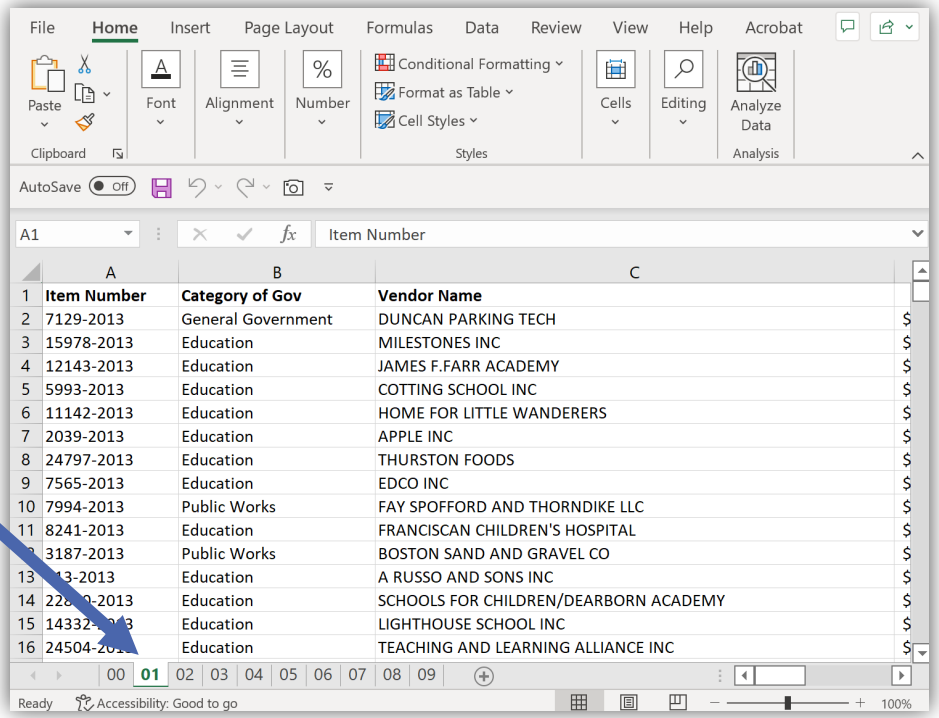
Can try it on your own later

- PDF file of today's slides also contains hands-on instructions – download at http://tiny.cc/excelpdf
- Excel working file is at http://tiny.cc/excelfile
- Excel solution file is at http://tiny.cc/excelsolutions

Excel worksheets are numbered and match slide section headers

Worksheet 01

Descriptive statistics



	A	B	C
1	**Item Number**	**Category of Gov**	**Vendor Name**
2	7129-2013	General Government	DUNCAN PARKING TECH
3	15978-2013	Education	MILESTONES INC
4	12143-2013	Education	JAMES F.FARR ACADEMY
5	5993-2013	Education	COTTING SCHOOL INC
6	11142-2013	Education	HOME FOR LITTLE WANDERERS
7	2039-2013	Education	APPLE INC
8	24797-2013	Education	THURSTON FOODS
9	7565-2013	Education	EDCO INC
10	7994-2013	Public Works	FAY SPOFFORD AND THORNDIKE LLC
11	8241-2013	Education	FRANCISCAN CHILDREN'S HOSPITAL
12	3187-2013	Public Works	BOSTON SAND AND GRAVEL CO
13	[illegible]3-2013	Education	A RUSSO AND SONS INC
14	22[illegible]-2013	Education	SCHOOLS FOR CHILDREN/DEARBORN ACADEMY
15	14332-[illegible]	Education	LIGHTHOUSE SCHOOL INC
16	24504-[illegible]	Education	TEACHING AND LEARNING ALLIANCE INC

More slides are in the PDF deck than we are covering today

- Extra slides cover the step-by-step how-to instructions
- Use those slides on your own to try out what we are showing today
- Presentation today is organized by Worksheet Divider slides

Worksheet 01

Descriptive statistics

Worksheet 02

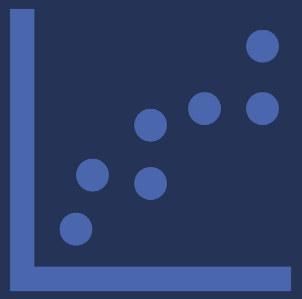
Descriptive statistics:
Measures of central tendency

Worksheet 03

Descriptive statistics: Measures of variation

Analyzing Data with the Analysis Toolpak

Analytical capability

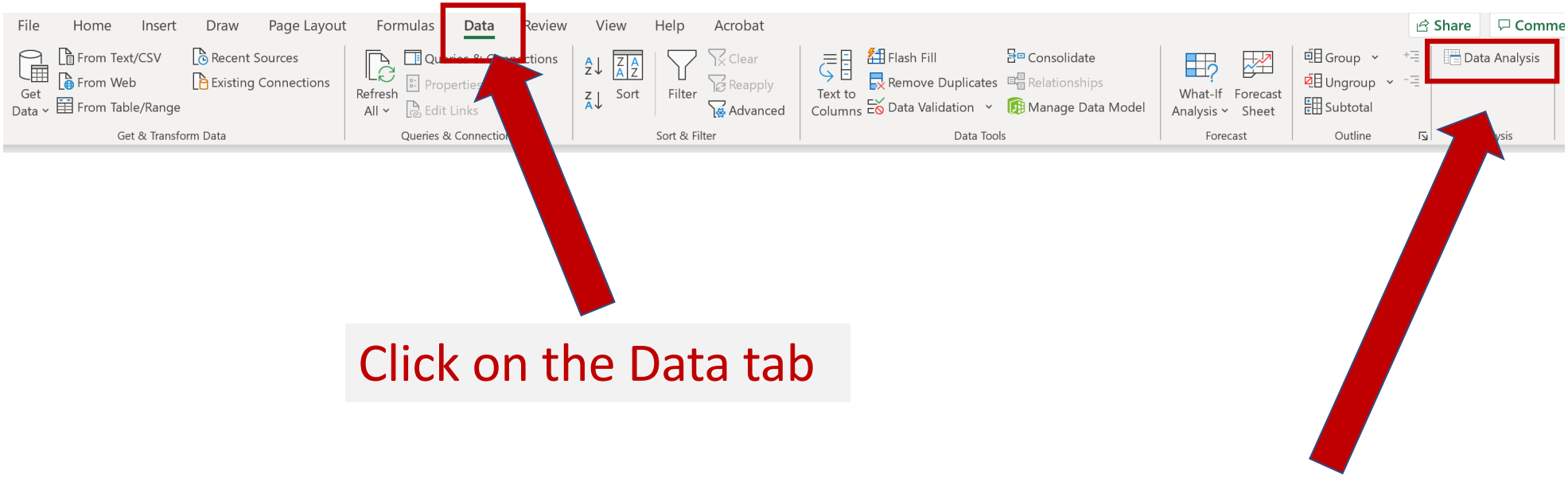


Statistical analysis

Worksheet 00

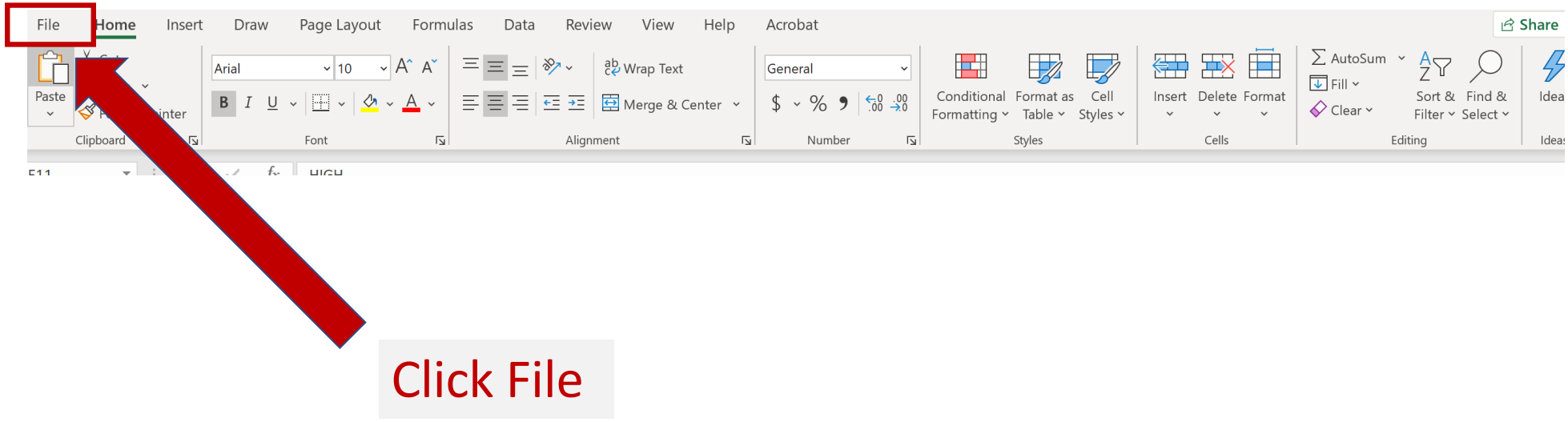
Adding the data analysis toolpak

Adding the data analysis toolpak



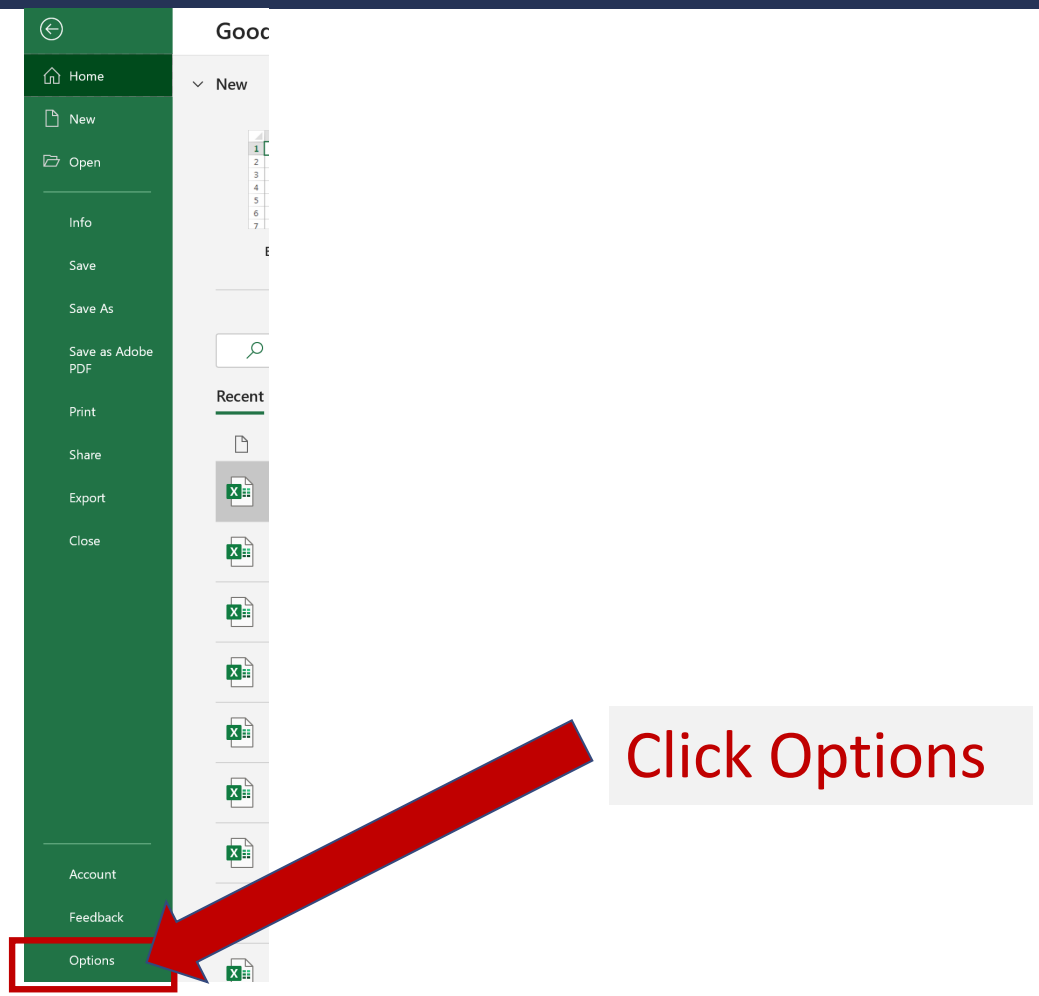
Click on the Data tab

Adding the data analysis toolpak

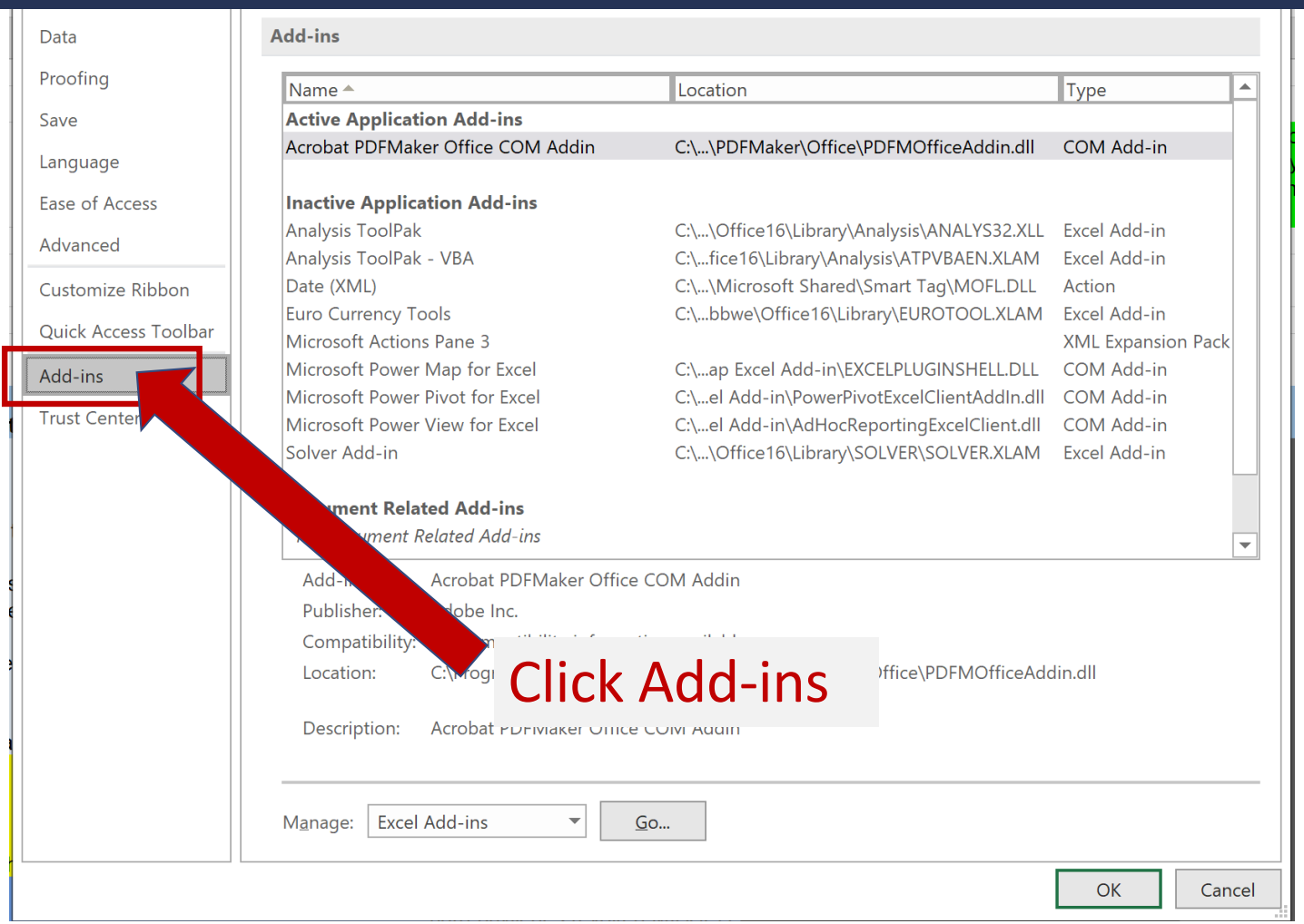


Click File

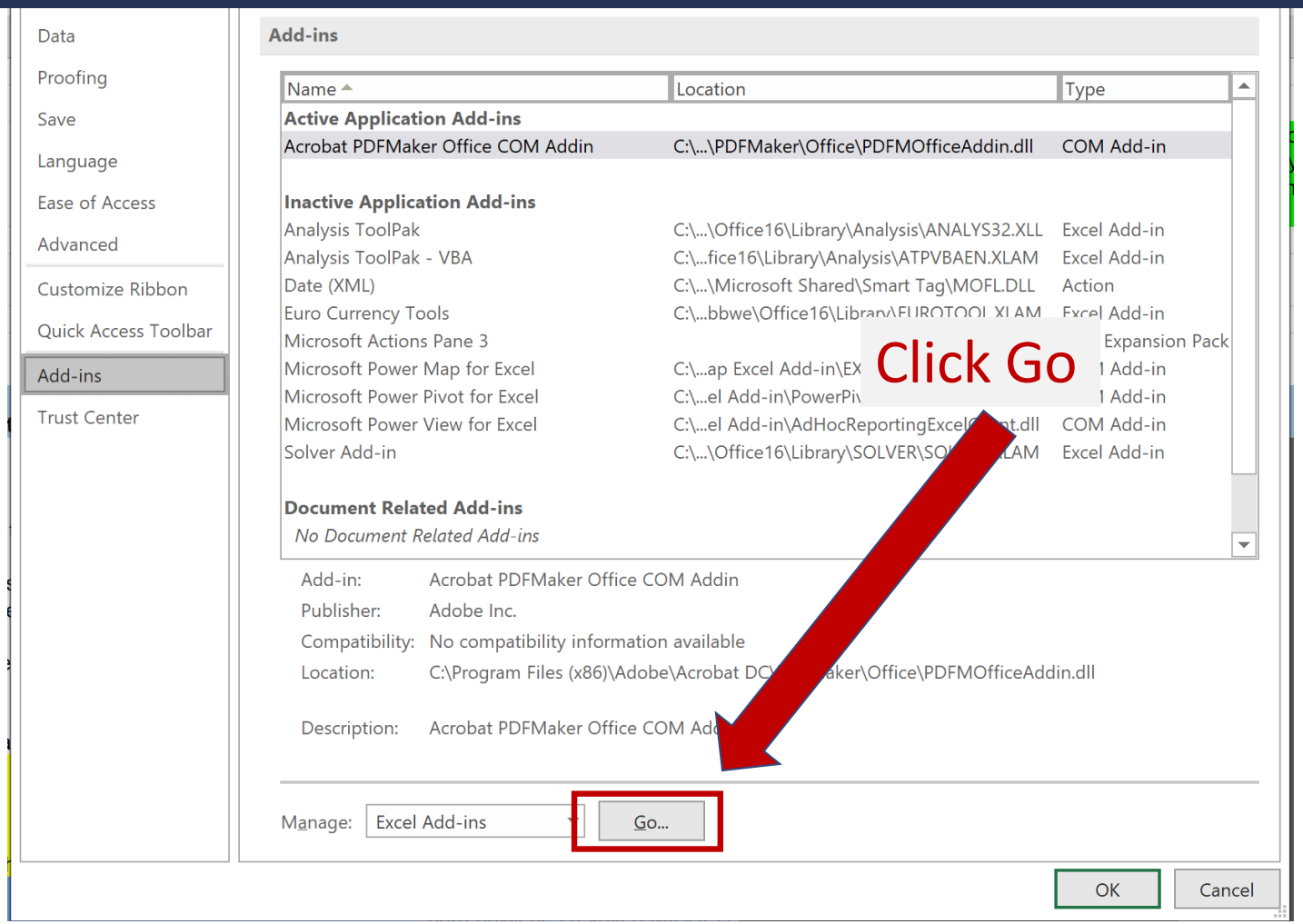
Adding the data analysis toolpak



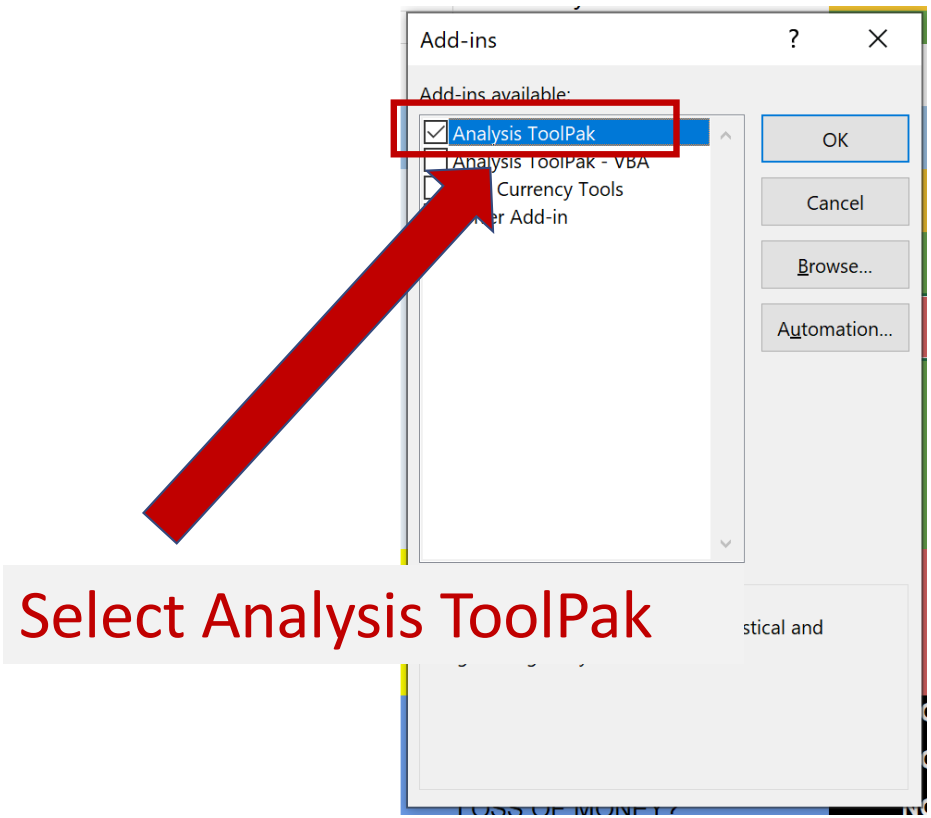
Adding the data analysis toolpak



Adding the data analysis toolpak

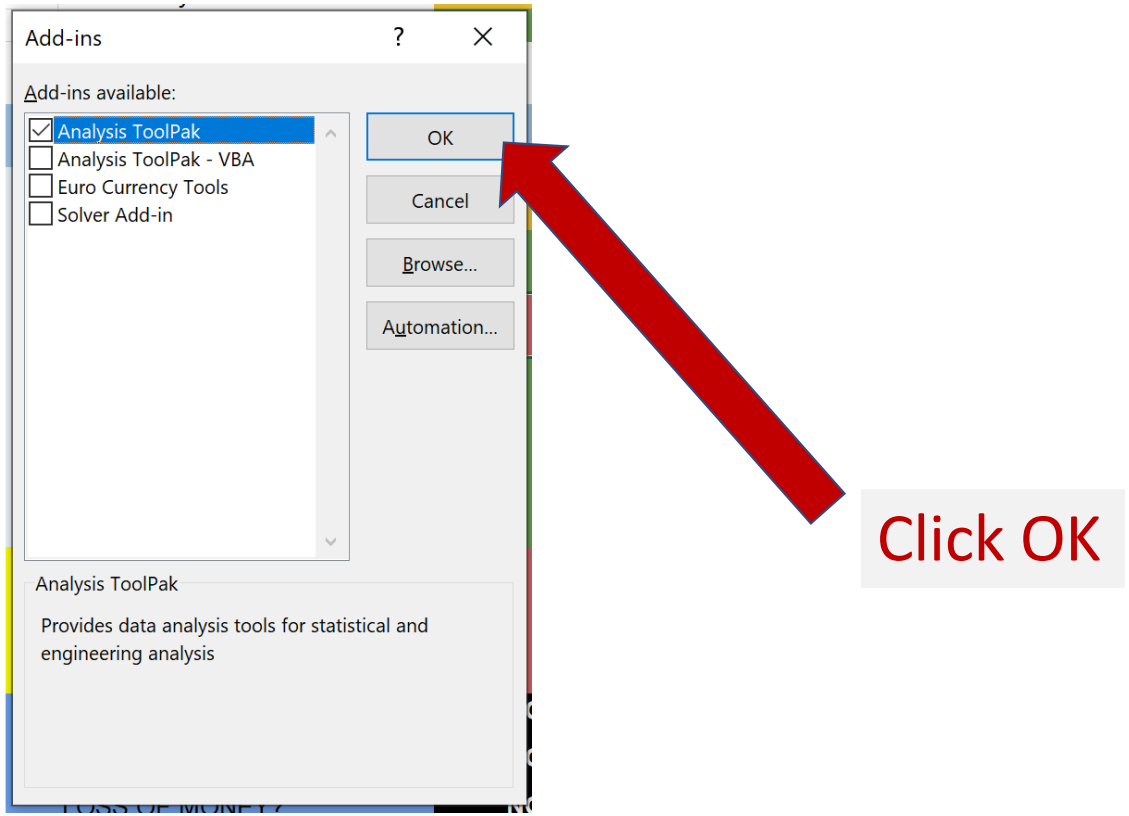


Adding the data analysis toolpak



Select Analysis ToolPak

Adding the data analysis toolpak



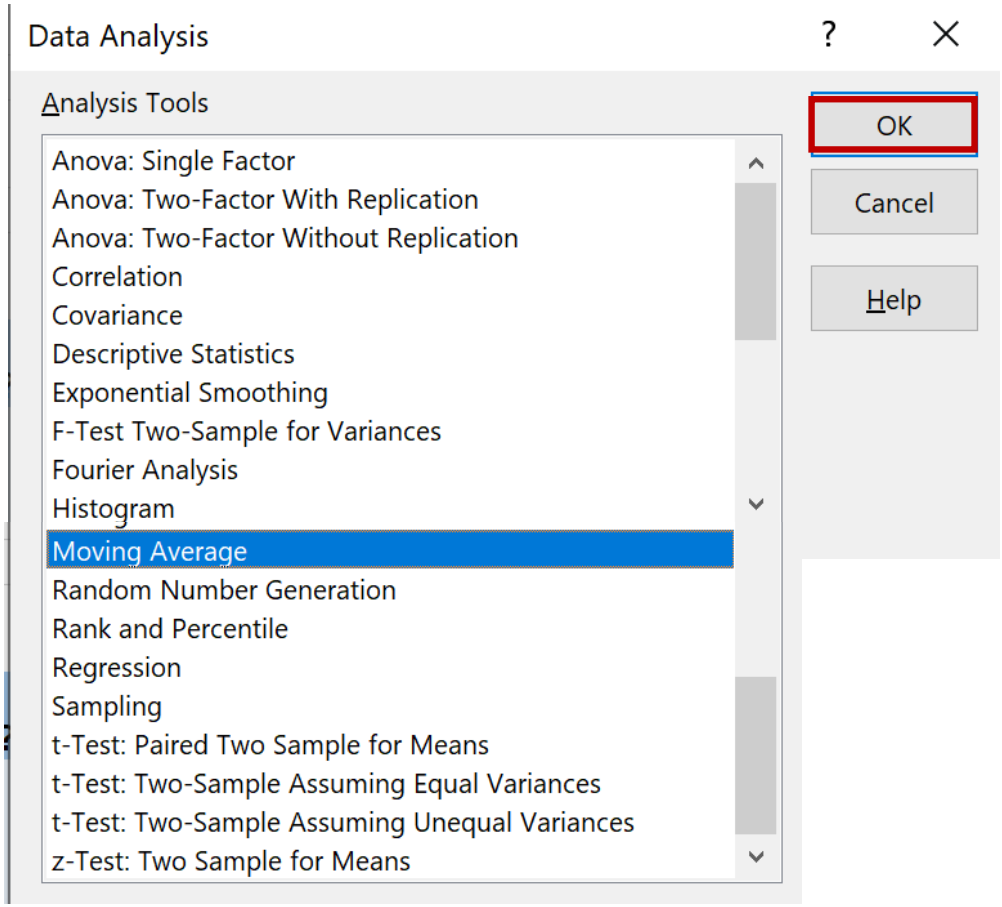
Mac Users: Adding the data analysis toolpak

The File tab does not exist in Excel for Mac.

To add the Analysis TookPak in Excel for Mac:

1. Click on the Data tab.
2. Click on the Analysis Tools gear icon (which can be found on the far right side of the Data tab).
3. This opens the Add-ins dialog box. Select Analysis ToolPak, and click OK.

Using the data analysis toolpak



Data Analysis Toolpak: All Tools

- Anova
- Correlation
- Covariance
- Descriptive Statistics
- Exponential Smoothing
- F-Test Two-Sample for Variances
- Fourier Analysis
- Histogram
- Moving Average
- Random Number Generation
- Rank and Percentile
- Regression
- Sampling
- t-Test
- z-Test

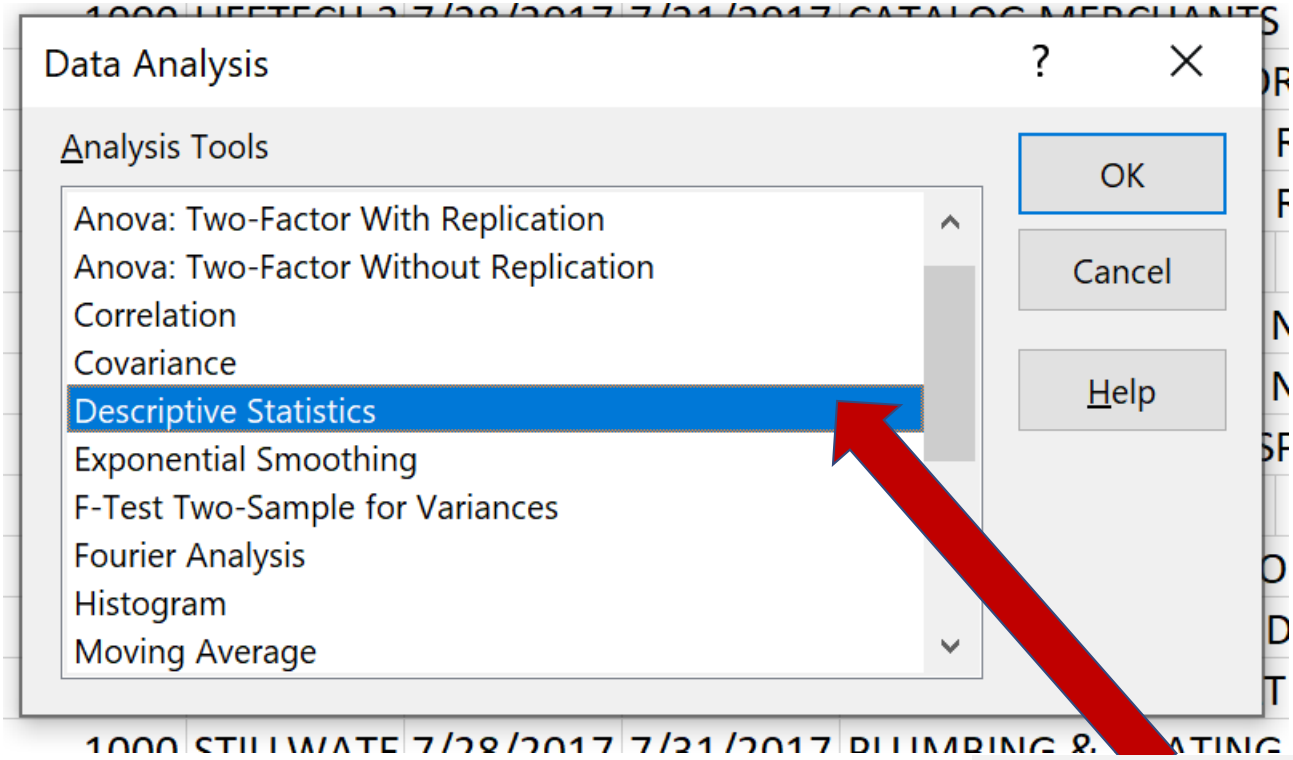
Data Analysis Toolpak:
Covering Today

- Descriptive Statistics
- Histogram
- Sampling (random and periodic)
- Correlation / Regression

Worksheet 01

Descriptive statistics

Descriptive statistics



Select Descriptive Statistics

Descriptive statistics

Worksheet 02 shows these results.

	A	B
1	*Amount*	
2		
3	Mean	1017.488
4	Standard Error	44.08275
5	Median	450
6	Mode	77
7	Standard Deviation	1288.242
8	Sample Variance	1659568
9	Kurtosis	2.925843
10	Skewness	1.860849
11	Range	5949.05
12	Minimum	4.5
13	Maximum	5953.55
14	Sum	868934.3
15	Count	854
16		

Worksheet 02

Descriptive statistics:
Measures of central tendency

Descriptive statistics: Measures of central tendency

	A	B
1	*Amount*	
2		
3	Mean	1017.488
4	Standard Error	44.08275
5	Median	450
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14	Sum	868934.3
15	Count	854
16		

Measures of central tendency – how a set of numbers is centered around a particular point on a line scale

Where the numbers "bunch" together

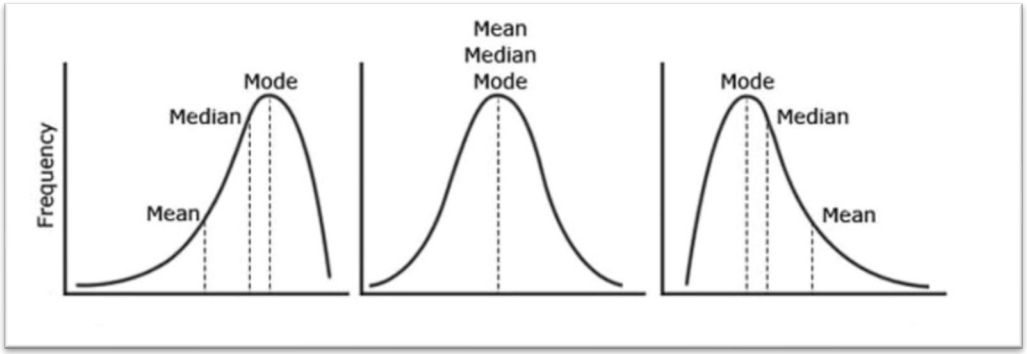

Image source: Einstein Education

Descriptive statistics: Measures of central tendency

	A	B
1	*Amount*	
2		
3	Mean	1017.488
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5	Median	450
6	Mode	77
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16		

Mean – average of a set of numbers
"Central" value of a set of numbers

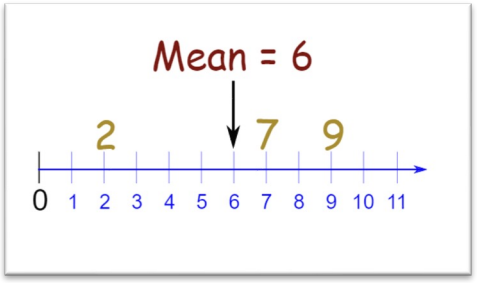

Image source: Math is Fun

$$\frac{(2+7+9)}{3} = 6$$

Descriptive statistics: Measures of central tendency

	A	B
1	*Amount*	
2		
3	Mean	1017.488
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7	Standard Deviation	1288.242
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16		

Median – "middle" of a sorted list of numbers

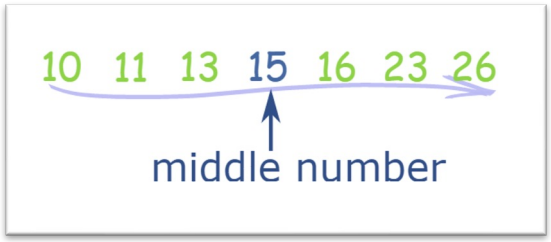

Image source: Math is Fun

Median may often be a better measure of central tendency when data is skewed.

Descriptive statistics: Measures of central tendency

	A	B
1	*Amount*	
2		
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16		

Mode – most frequently occurring number in a set of numbers

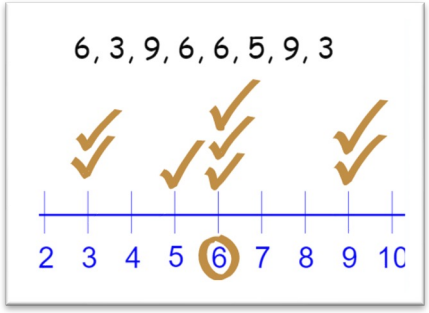

Image source: Math is Fun

Frequently occurring numbers may be something to investigate further.

Descriptive statistics: Sum and Count

	A	B
1	*Amount*	
2		
3	Mean	1017.488
4	Standard Error	44.08275
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7	Standard Deviation	1288.242
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10	Skewness	1.860849
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13	Maximum	5953.55
14	Sum	868934.3
15	Count	854
16		

Sum – sum of all values
Count – number of observations (transactions)

Does the sum tie to financial statements or ledger?

Is your data complete?

Worksheet 03

Descriptive statistics: Measures of variation

Descriptive statistics: Measures of variation

	A	B
1	*Amount*	
2		
3	Mean	1017.488
4	Standard Error	44.08275
5	Median	450
6	Mode	77
7	Standard Deviation	1288.242
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11	Range	5949.05
12	Minimum	4.5
13	Maximum	5953.55
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15	Count	854
16		

Measures of variation – how far the numbers are scattered about the center value of a set of numbers

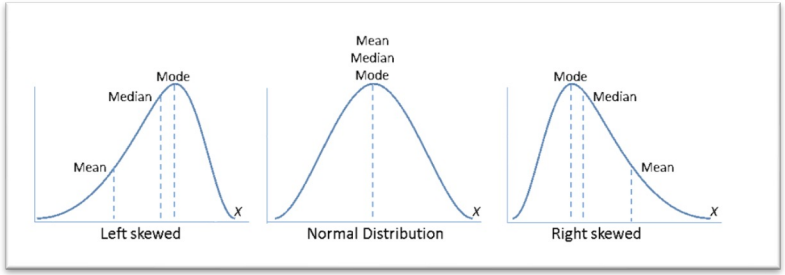

Image source: minitab.com

Descriptive statistics: Measures of variation

	A	B
1	*Amount*	
2		
3	Mean	1017.488
4	Standard Error	44.08275
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11	Range	5949.05
12	Minimum	4.5
13	Maximum	5953.55
14	Sum	868934.3
15	Count	854
16		

Range – difference between the lowest score and highest score in a set of numbers

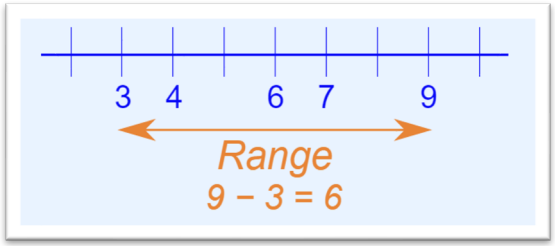

Image source: Math is Fun

Looking at minimum and maximum numbers can lead to transactions to explore further.

Descriptive statistics: Measures of variation

	A	B
1	*Amount*	
2		
3	Mean	1017.488
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11	Range	5949.05
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15	Count	854
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Measures of variation – how far the numbers are scattered about the center value of a set of numbers

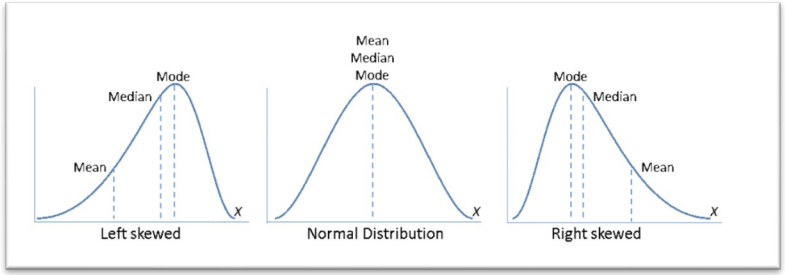

Image source: minitab.com

Descriptive statistics: Measures of variation

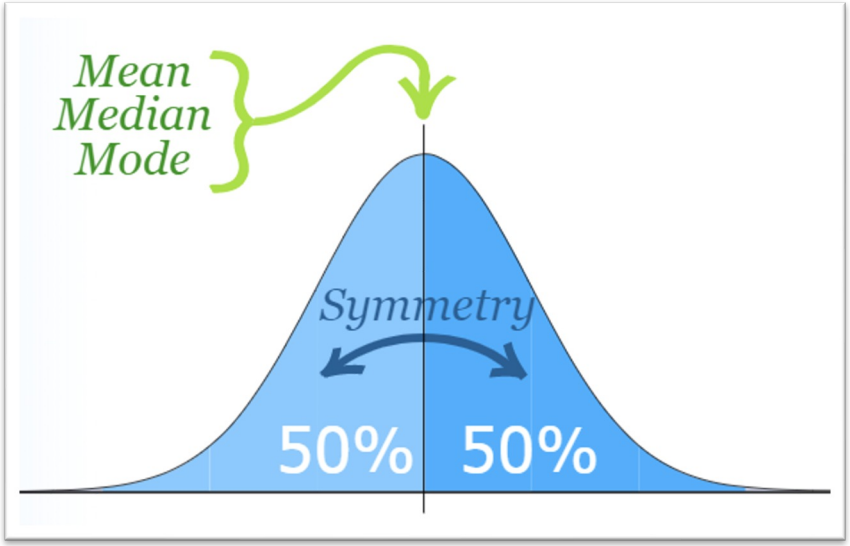

Image source: mathisfun.com

Normal distribution – data is normally distributed around a central value

OR

No skew

Mean = median = mode

Descriptive statistics: Measures of variation

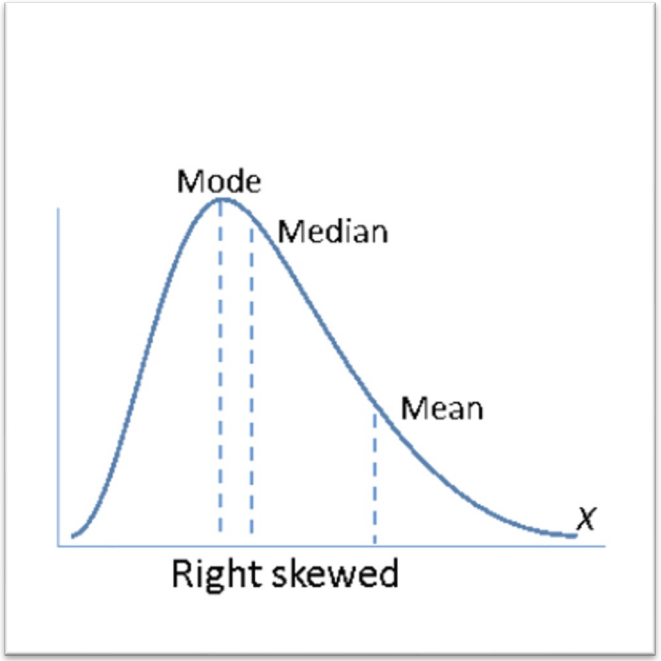

Image source: minitab.com

Positive skew – skewed to the right
OR
Right skewed

Mean > median > mode

Descriptive statistics: Measures of variation

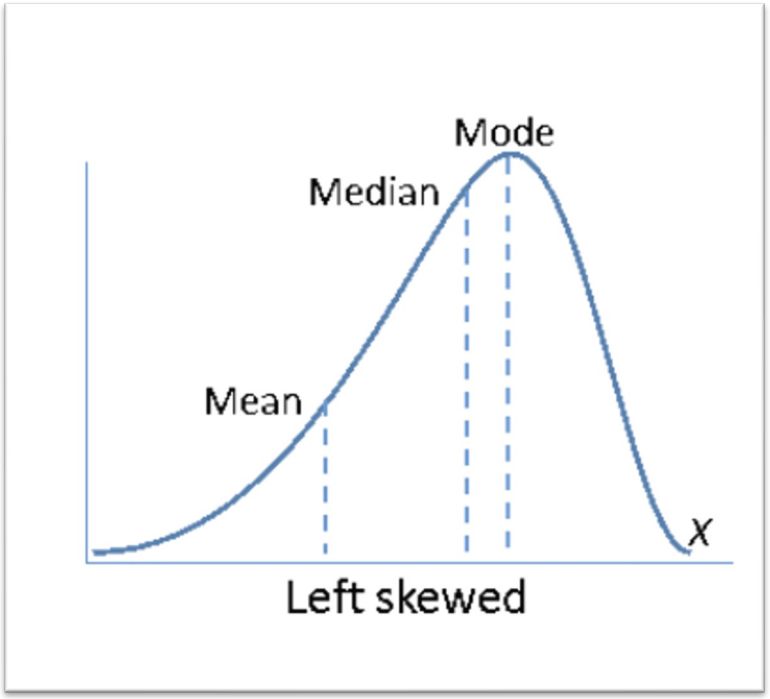

Image source: minitab.com

Negative skew – skewed to the left
OR
Left skewed

Mean < median < mode

Descriptive statistics: Measures of variation

Positive number shows positive skew (right skewed).

	A	B
3	Mean	1017.488
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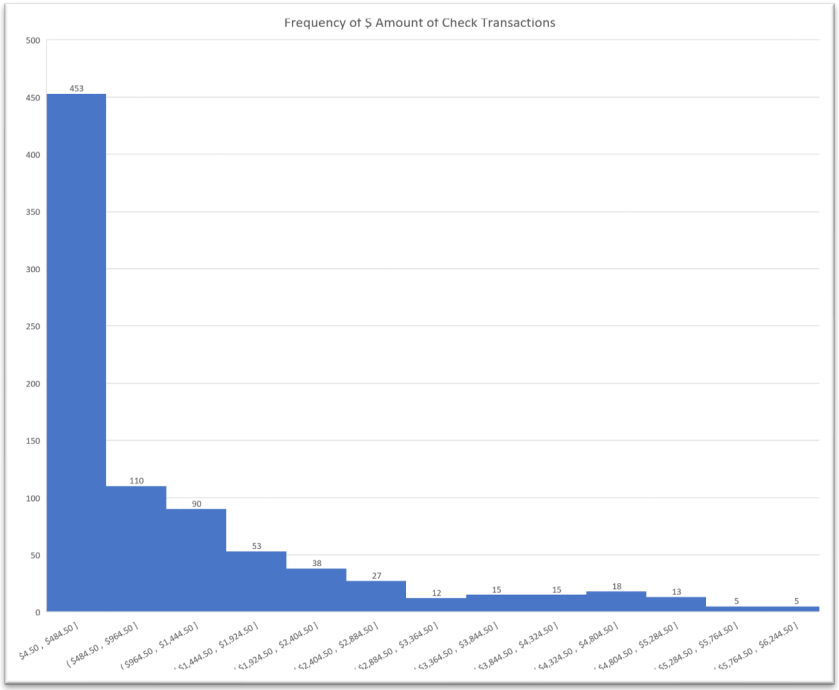

Most financial data will be positively skewed. If it is not, should investigate.

Descriptive statistics: Measures of variation

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16		

Standard deviation – how spread-out the numbers are

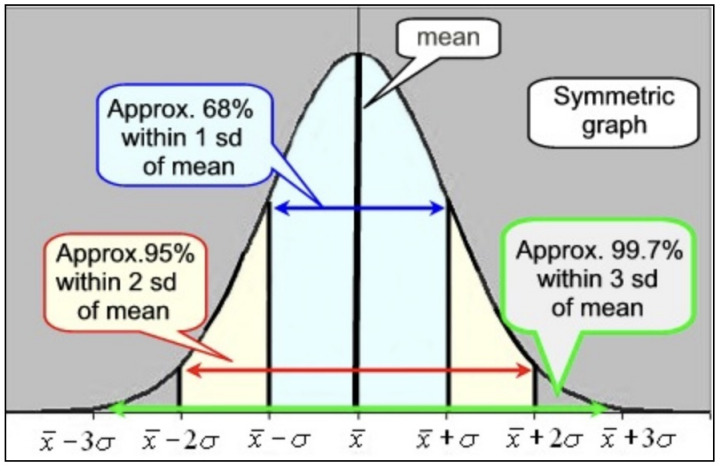


Image source: MathBitsNotebook.com

Descriptive statistics: Measures of variation

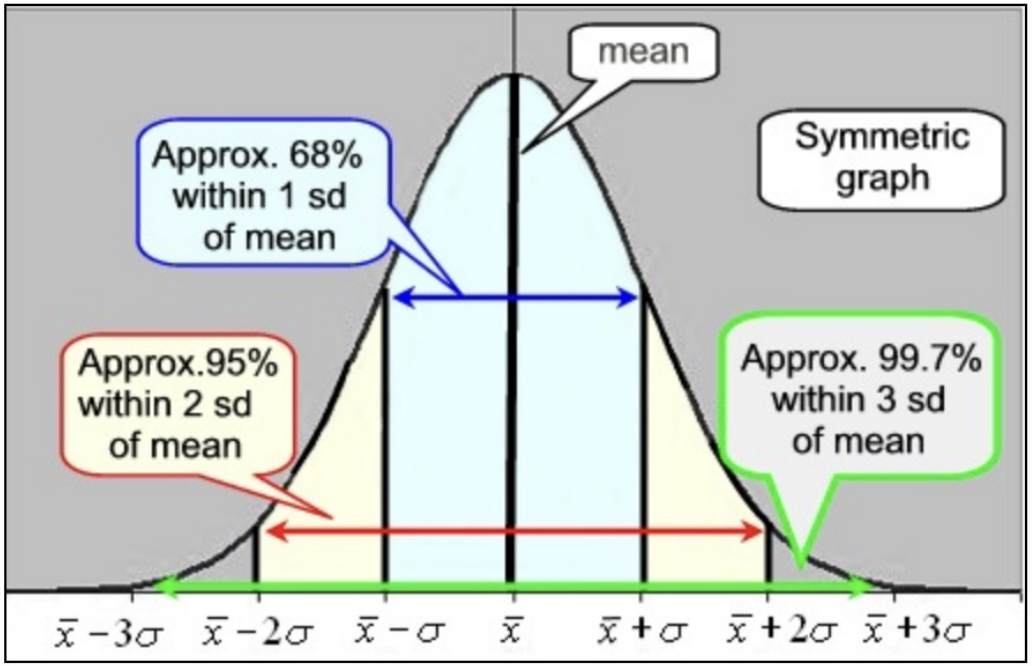


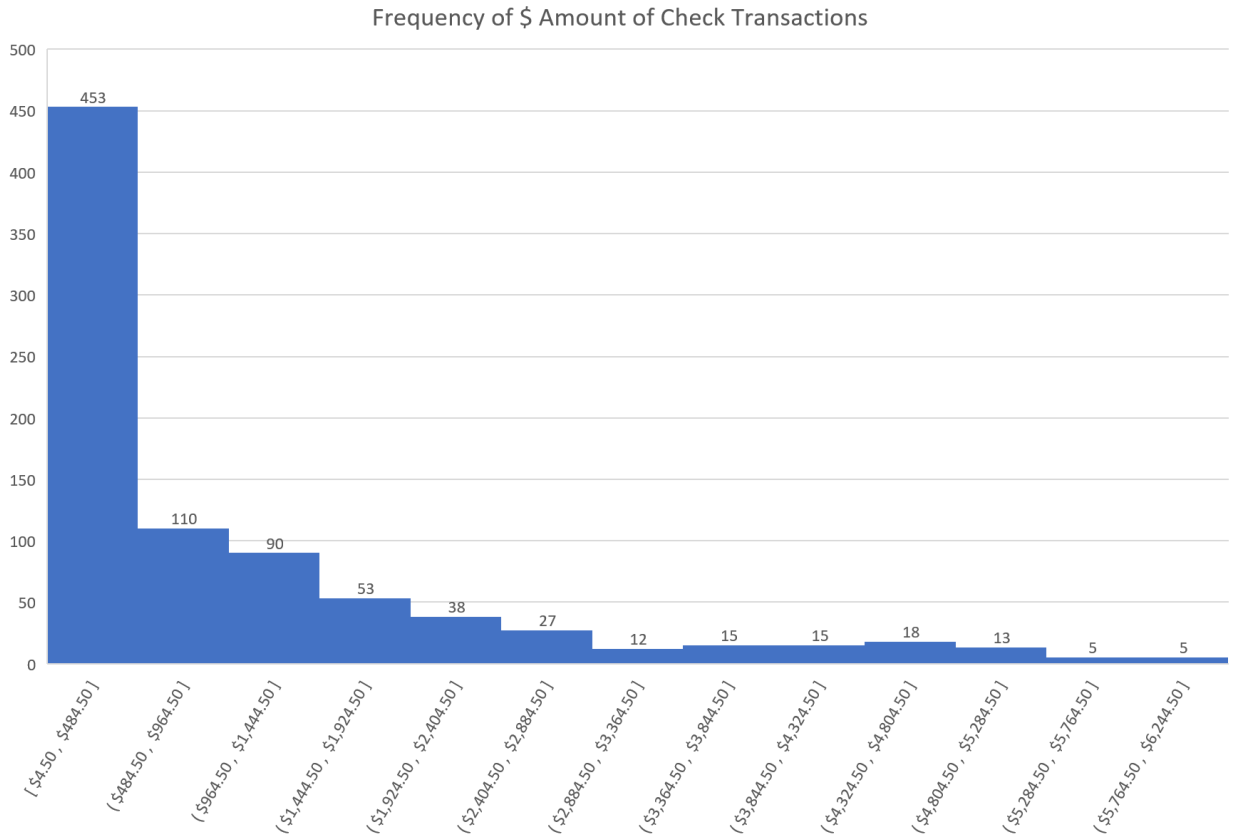
Image source: MathBitsNotebook.com

CAUTION: Standard deviation is only useful to evaluate in data that is symmetric.

Worksheet 04

Inserting a histogram chart

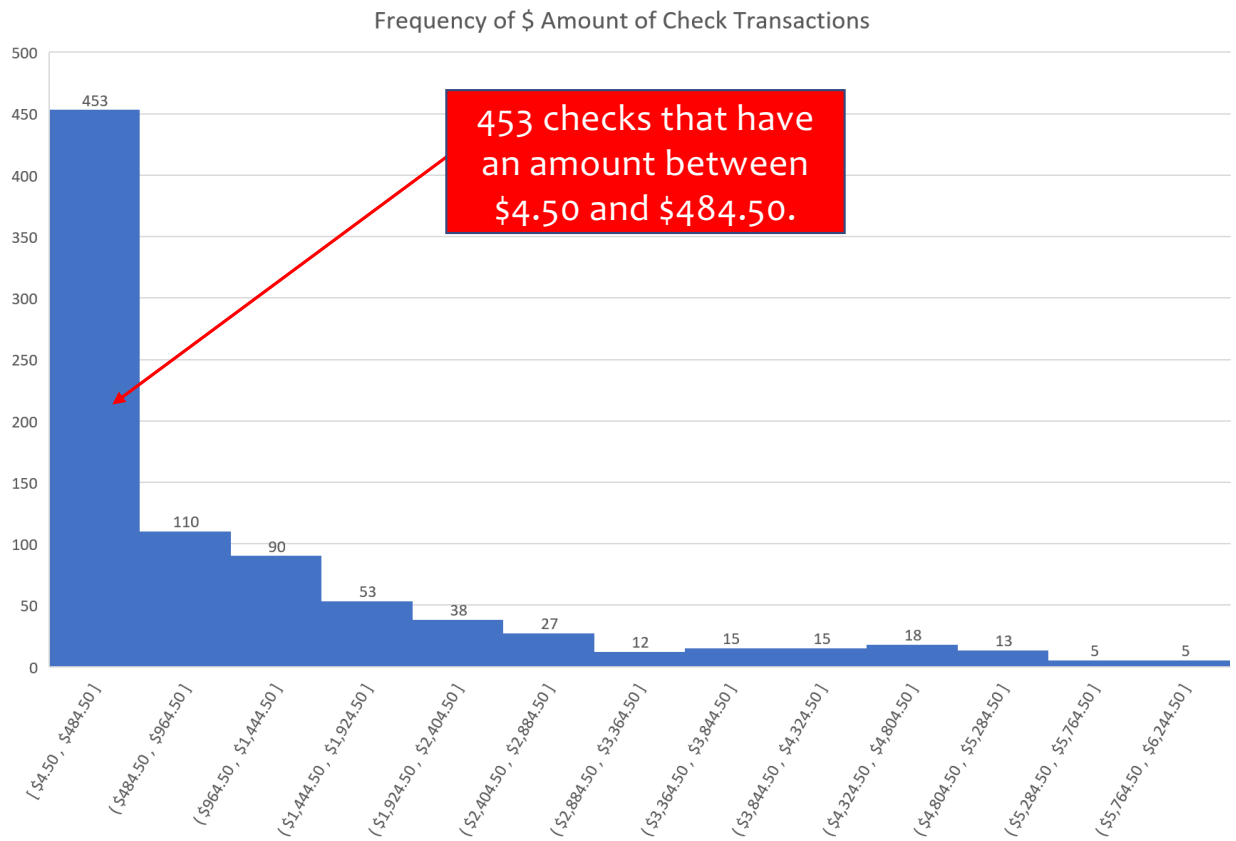
Inserting a histogram chart



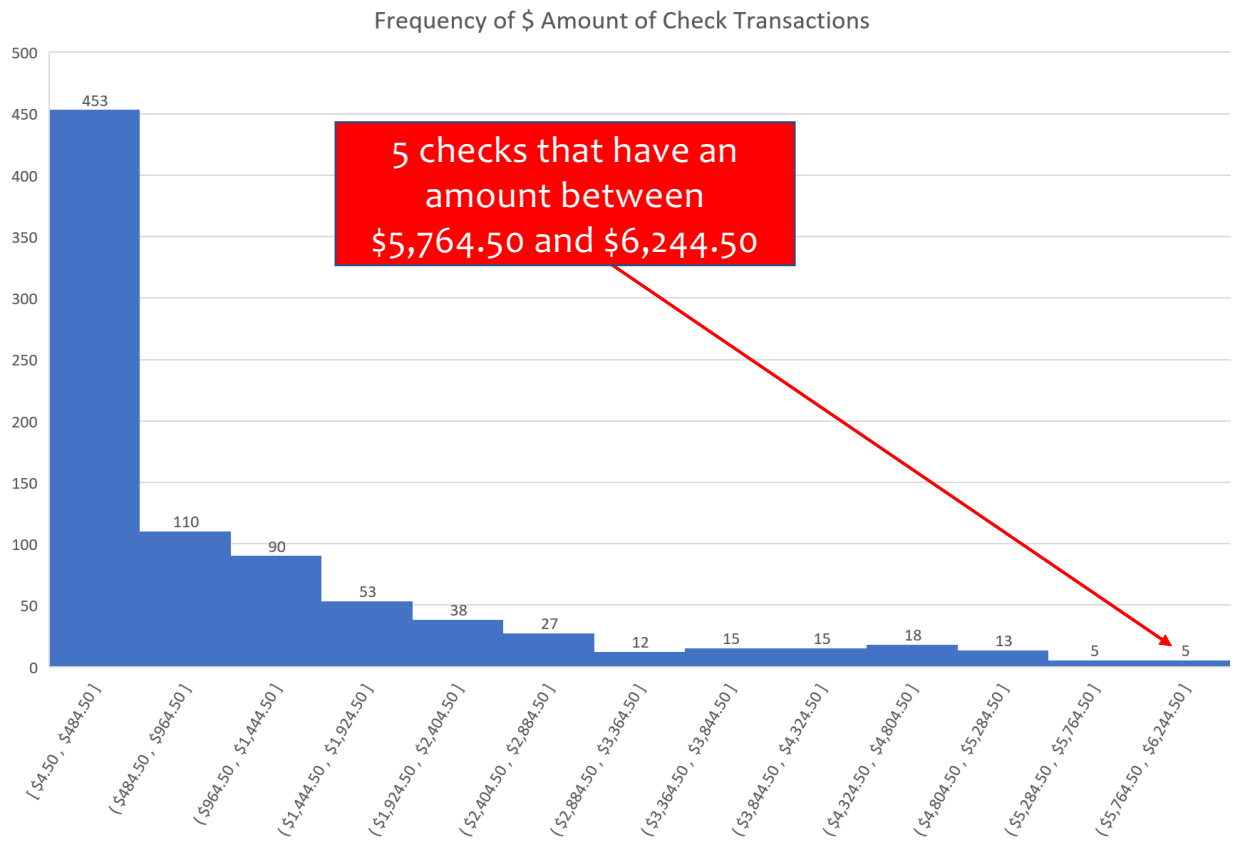
Histogram chart – count of data in each discrete bin
OR
Frequency of data

Excel 2016 or later

Inserting a histogram chart



Inserting a histogram chart



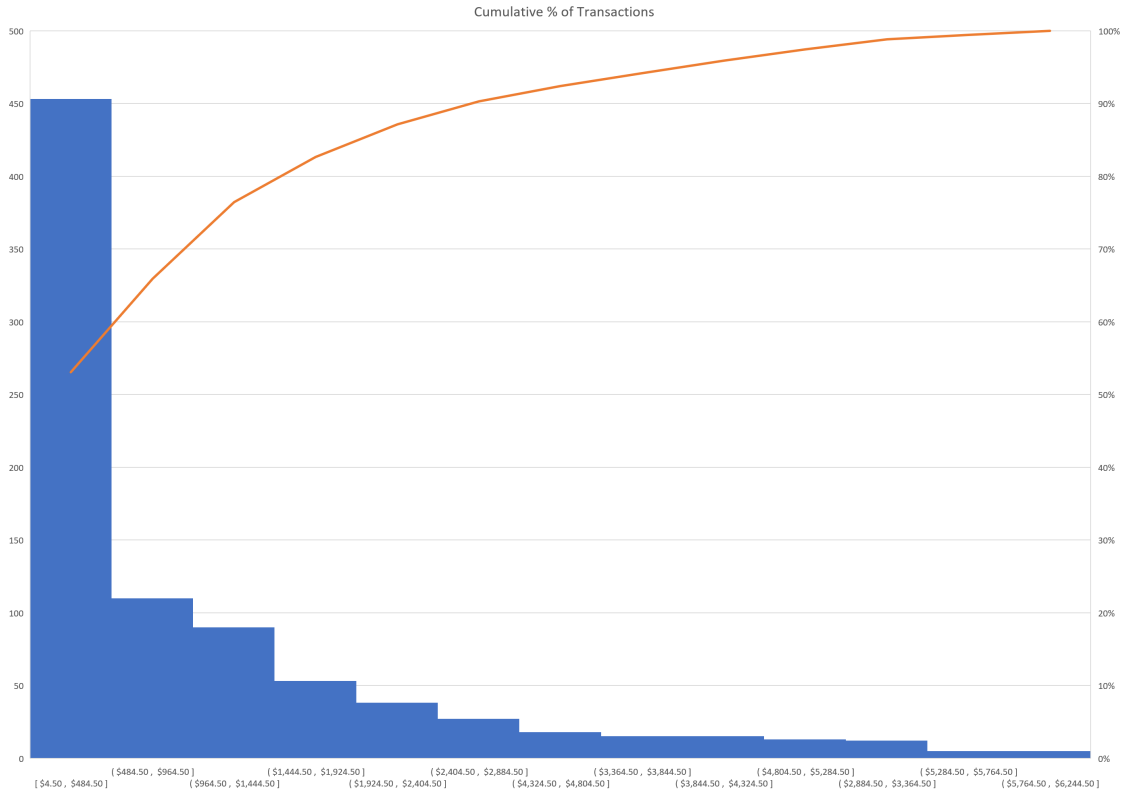
Mac Users: Inserting a histogram chart

The "See All Charts" option does not exist in Excel for Mac. To insert a histogram chart, click on the Insert Tab. Then, click on the "statistical" icon in the chart types and find "Histogram" in the drop-down menu.

Worksheet 05

Inserting a pareto chart

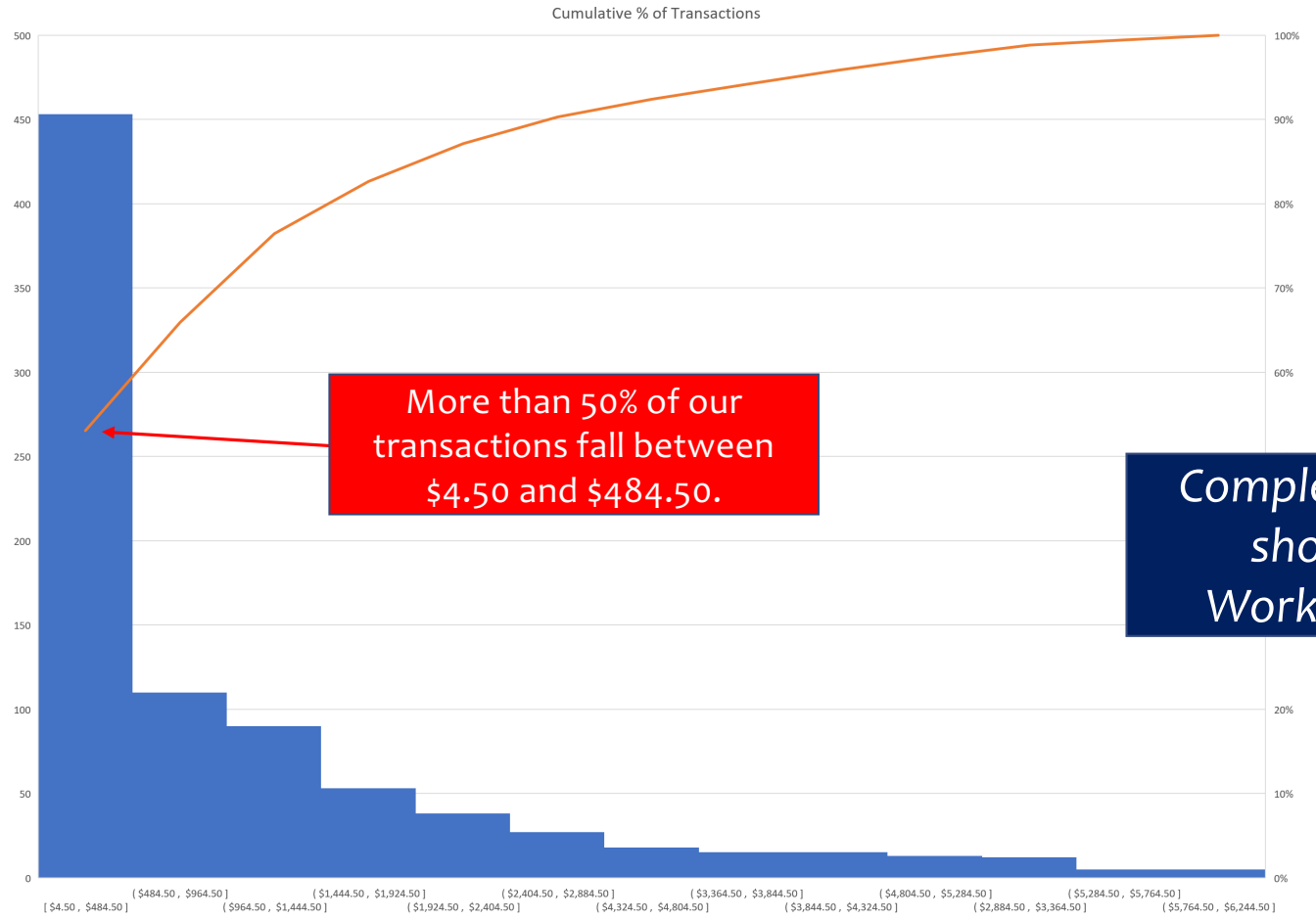
Inserting a pareto chart



Pareto chart – count of data in each discrete bin along with cumulative percentage
OR
Frequency of data

Excel 2016 or later

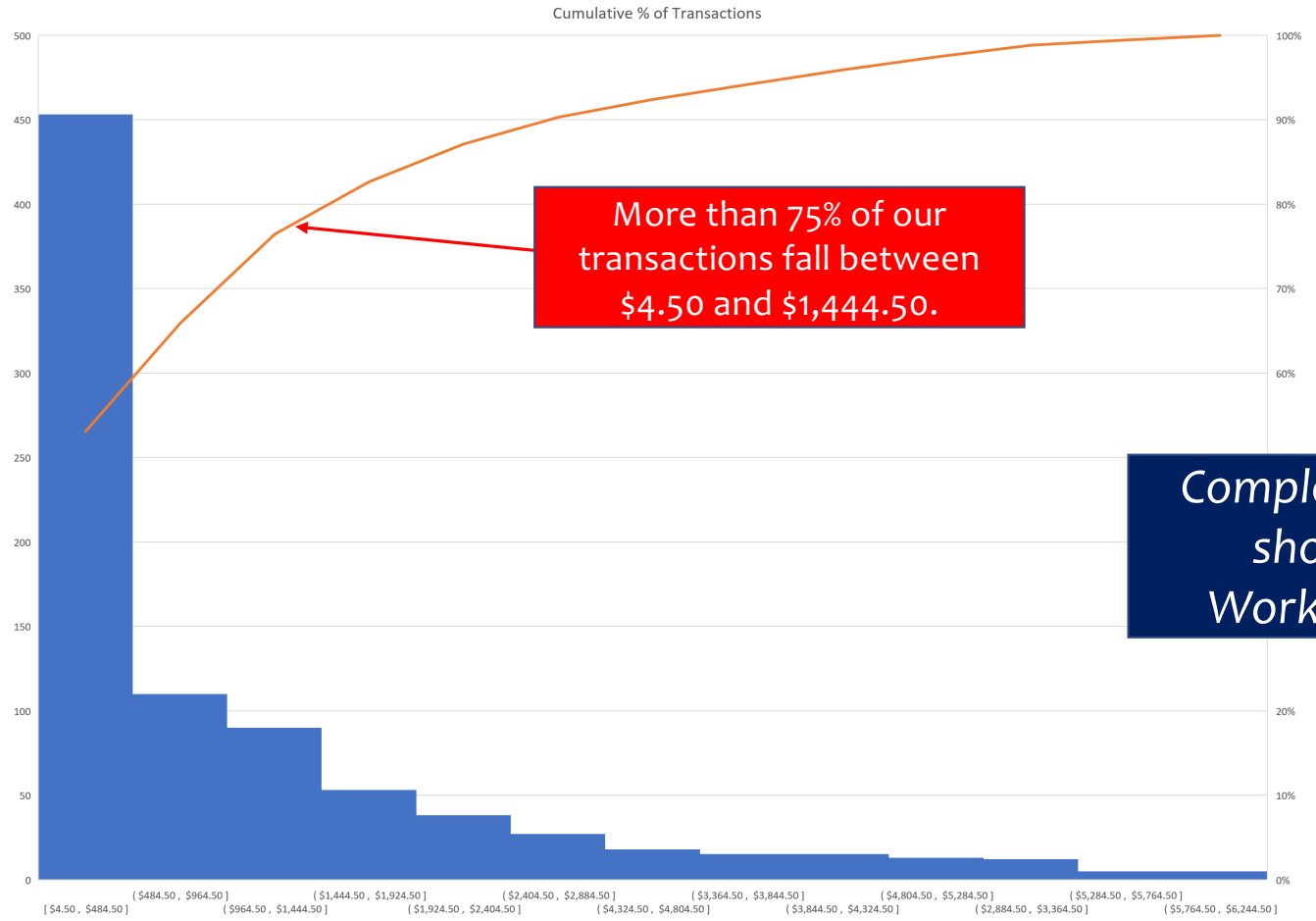
Inserting a pareto chart



More than 50% of our transactions fall between $4.50 and $484.50.

Completed chart shown on Worksheet 08

Inserting a pareto chart



Completed chart shown on Worksheet 08

Mac Users: Inserting a pareto chart

The "See All Charts" option does not exist in Excel for Mac. To insert a pareto chart, click on the Insert Tab. Then, click on the "statistical" icon in the chart types and find "Pareto" in the drop-down menu.

Worksheet 06

Random sampling using data analysis toolpak

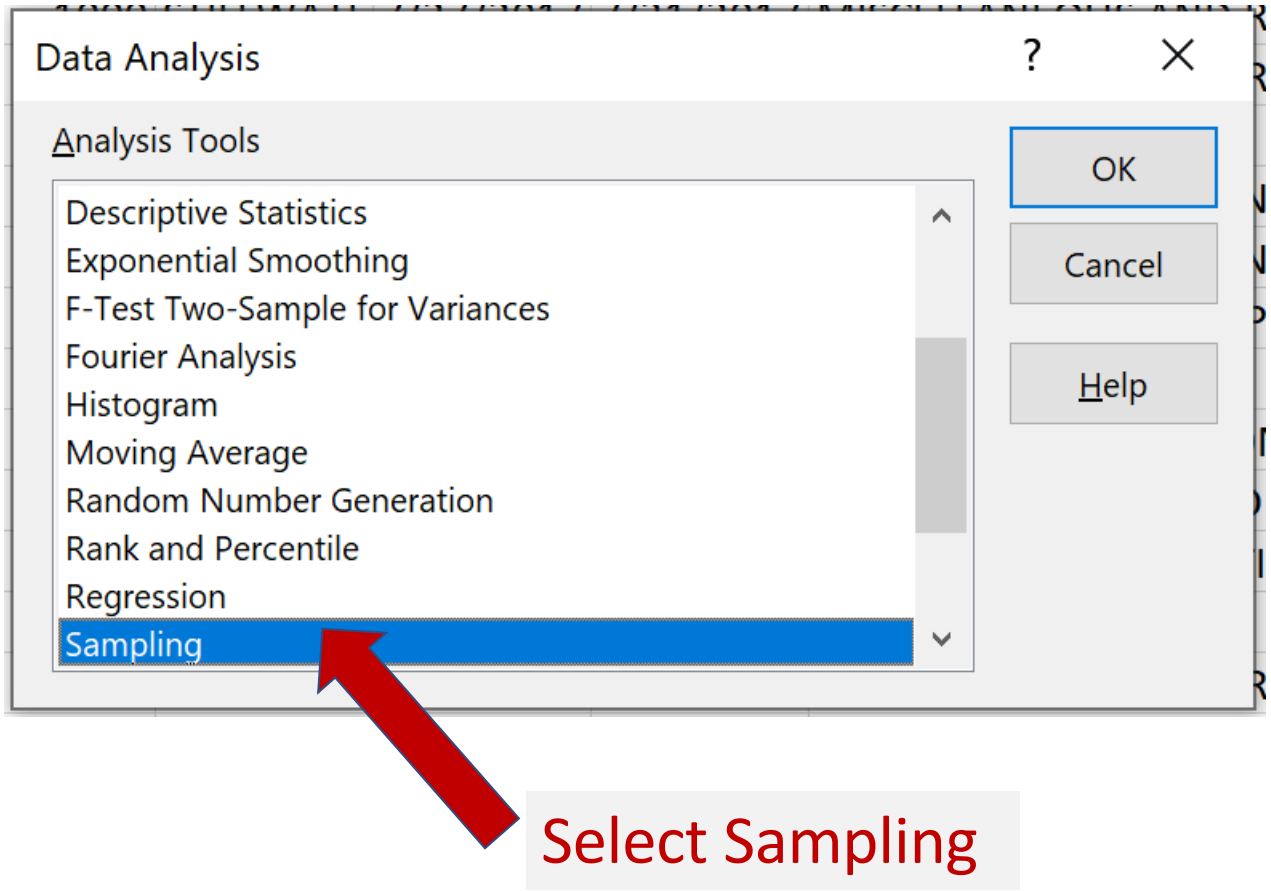
Random sampling using data analysis toolpak

	A
1	556214
2	556362
3	556072
4	555742
5	556410
6	556108
7	555957
8	555776
9	555881
10	556514
11	556118
12	556268
13	556122
14	556441
15	556013
16	556110
17	555988
18	556371
19	556429
20	556680
21	556360
22	556367
23	556090
24	555983
25	556118

Random sampling – every value has an equal probability of being chosen

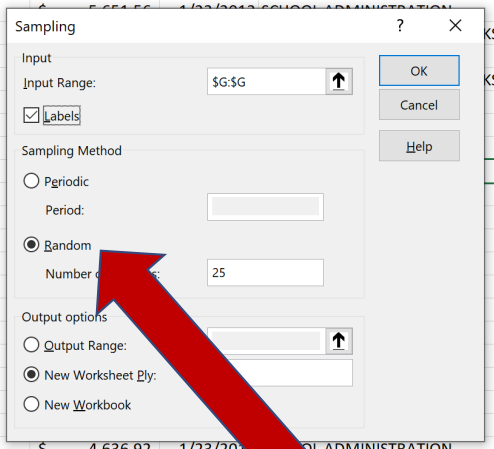
Random sample of 25 checks

Random sampling using data analysis toolpak



Random sampling using data analysis toolpak

	A	B	C	D	E	F	G	
1	Item Number	Category of Gov	Vendor Name	Amount	Check Date	Department	Check #	Org Descriptic
2	7129-2013	General Government	DUNCAN PARKING TECH	$ 5,953.55	1/30/2013	TRAFFIC AND PARKING	556665	TRAFFIC & PAF
3	15978-2013	Education	MILESTONES INC	$ 5,938.20	1/16/2013	SCHOOL ADMINISTRATION	556326	SPED-TUITNPS
4	12143-2013	Education	JAMES F.FARR ACADEMY	$ 5,904.15	1/30/2013	SCHOOL ADMINISTRATION	556713	SPED-TUITNPS
5	5993-2013	Education	COTTING SCHOOL INC	$ 5,890.20	1/2/2013	SCHOOL ADMINISTRATION	555753	SPED-TUITNPS
6	11142-2013	Education	HOME FOR LITTLE WANDERERS	$ 5,832.00	1/2/2013	SCHOOL ADMINISTRATION	555778	SPED-TUITNPS
7	2039-2013	Education	APPLE INC	$ 5,763.00	1/9/2013	SCHOOL ADMINISTRATION	555912	SCH. COMPUT
8	24797-2013	Education	THURSTON FOODS	$ 5,742.14	1/30/2013	SCHOOL ADMINISTRATION	556841	SCHOOL LUNC
9	7565-2013	Education	EDCO INC				556462	SPED-TUITNCC
10	7994-2013	Public Works	FAY SPOFFORD AND THORNDIKE LLC				556471	CH90 ENGN PA
11	8241-2013	Education	FRANCISCAN CHILDREN'S HOSPITAL				556473	SPED-TUITNPS
12	3187-2013	Public Works	BOSTON SAND AND GRAVEL CO				556233	DPW HIGHWA
13	613-2013	Education	A RUSSO AND SONS INC				556210	SCHOOL LUNC
14	22860-2013	Education	SCHOOLS FOR CHILDREN/DEARBORN ACADEMY				556369	SPED-TUITNPS
15	14332-2013	Education	LIGHTHOUSE SCHOOL INC				556736	SPED-TUITNPS
16	24504-2013	Education	TEACHING AND LEARNING ALLIANCE INC				556838	RTTT13 CONT
17	11334-2013	General Government	IMPERIEL MUNICIPAL PARTNERS INC				556000	POLICE ORDIN
18	25096-2013	Education	TRIUMPH CENTER				555885	SPED-PSYCH-D
19	6343-2013	General Government	DEACON TRANSPORTATION				556080	EXEC-ARTS CN
20	9186-2013	General Government	HARPERS DATA SERVICES INC				555992	TREAS/COLL O
21	11143-2013	Education	HOME FOR LITTLE WANDERERS				556706	SPED-TUITNPS
22	25097-2013	Education	TRIUMPH CENTER				556392	SPED-PSYCH-D
23	10486-2013	Education	HILL FOR LITERACY INC.				555996	TTI13 CONT SV
24	12441-2013	Education	JOHNSON STRING INSTRUMENT INC				556020	MUSIC-OIM-ES
25	25887-2013	Education	WALKER INC				555891	SPED-TUITNPS
26	26201-2013	Education	WORK INC				556404	SPED-OIS-DW-
27	7389-2013	Education	EASTER SEALS-MA				556668	SPED-MEDICAI
28	4396-2013	Education	CENTRAL PAPER PRODUCTS CO	$ 4,636.92	1/23/201	OL ADMINISTRATION	556437	SCHOOL LUNC
29	25008-2013	Public Works	TOTAL SERVICE SOLUTIONS LLC	$ 4,600.00	1/30/2013	MENT OF PUBLIC WORKS	556843	DPW-BLGD&G
30	3275-2013	Education	BOSTON VERTICAL LLC	$ 4,590.00	1/9/2013	SCH MINISTRATION	555928	COMMSCH SA
31	14227-2013	Education	LEARNING PREP SCHOOL	$ 4,586.40	1/16/2013	SCHOO NISTRATION	556310	SPED-TUITNPS
32	14502-2013	Education	LIONEL S. LYON	$ 4,547.50	1/16/2013	SCHOOL TRATION	556316	SPED-PSYCH-D
33	6433-2013	General Government	DELL MARKETING L P	$ 4,543.73	1/9/2013	IT DEPARTM TY HALL	555964	INFO TECH OP
34	5630-2013	Education	COMMUNICATIVE HEALTH CARE ASSOCIATES, INC.	$ 4,537.50	1/2/2013	SCHOOL ADMI IO		
35	13162-2013	Education	LANDMARK SCHOOL	$ 4,505.76	1/2/2013	SCHOOL ADMINIS O		
36	2632-2013	Education	BAY COVE HUMAN SERVICES	$ 4,494.45	1/30/2013	SCHOOL ADMINISTRATIO		
37	7784-2013	Public Works	ENVIRONMENTAL COMPLIANCE SERVICES,INC.	$ 4,435.00	1/30/2013	DEPARTMENT OF PUBLIC		
38	22906-2013	Education	SEAN AUGUSTUS	$ 4,422.00	1/9/2013	SCHOOL ADMINISTRATION	556124	COMMSCH SA
39	12447-2013	Education	JOHNSON'S FOOD PRODUCTS CORP	$ 4,379.45	1/16/2013	SCHOOL ADMINISTRATION	556298	CA-HS-OTHINS
40	41334	General Government	4IMPRINT	$ 4,363.26	1/9/2013	BOARD OF HEALTH	555894	HLTHY KIDS,HL
41	8840-2013	Education	GOV CONNECTION INC	$ 4,348.96	1/30/2013	SCHOOL ADMINISTRATION	556691	SCH. COMPUT
42	15617-2013	Public Works	METROPOLITAN PIPE AND SUPPLY CO	$ 4,343.16	1/16/2013	DEPARTMENT OF PUBLIC WORKS	556324	DPW-BLGD&G
43	26041-2013	Education	WHELAN HORICH LLC	$ 4,323.00	1/9/2013	SCHOOL ADMINISTRATION	556164	COMMSCH SA



Select Random

Random sampling using data analysis toolpak

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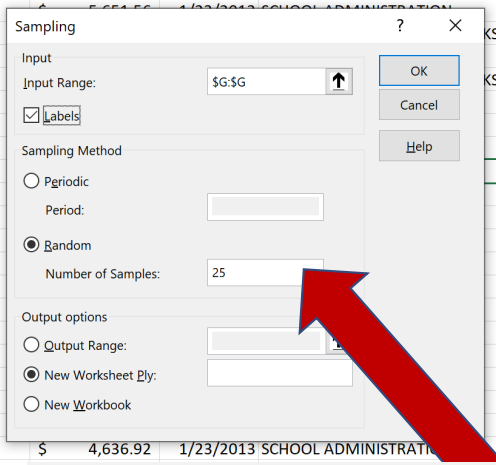
4	12143-2013	Education	JAMES F.FARR ACADEMY	$ 5,904.15	1/30/2013	SCHOOL ADMINISTRATION	556713	SPED-TUITNPS
5	5993-2013	Education	COTTING SCHOOL INC	$ 5,890.20	1/2/2013	SCHOOL ADMINISTRATION	555753	SPED-TUITNPS
6	11142-2013	Education	HOME FOR LITTLE WANDERERS	$ 5,832.00	1/2/2013	SCHOOL ADMINISTRATION	555778	SPED-TUITNPS
7	2039-2013	Education	APPLE INC	$ 5,763.00	1/9/2013	SCHOOL ADMINISTRATION	555912	SCH. COMPUT
8	24797-2013	Education	THURSTON FOODS	$ 5,742.14	1/30/2013	SCHOOL ADMINISTRATION	556841	SCHOOL LUNC
9	7565-2013	Education	EDCO INC				556462	SPED-TUITNCC
10	7994-2013	Public Works	FAY SPOFFORD AND THORNDIKE LLC			KS	556471	CH90 ENGN PA
11	8241-2013	Education	FRANCISCAN CHILDREN'S HOSPITAL				556473	SPED-TUITNPS
12	3187-2013	Public Works	BOSTON SAND AND GRAVEL CO			KS	556233	DPW HIGHWA
13	613-2013	Education	A RUSSO AND SONS INC				556210	SCHOOL LUNC
14	22860-2013	Education	SCHOOLS FOR CHILDREN/DEARBORN ACADEMY				556369	SPED-TUITNPS
15	14332-2013	Education	LIGHTHOUSE SCHOOL INC				556736	SPED-TUITNPS
16	24504-2013	Education	TEACHING AND LEARNING ALLIANCE INC				556838	RTTT13 CONT
17	11334-2013	General Government	IMPERIEL MUNICIPAL PARTNERS INC				556000	POLICE ORDIN
18	25096-2013	Education	TRIUMPH CENTER				555885	SPED-PSYCH-D
19	6343-2013	General Government	DEACON TRANSPORTATION				556080	EXEC-ARTS CN
20	9186-2013	General Government	HARPERS DATA SERVICES INC				555992	TREAS/COLL O
21	11143-2013	Education	HOME FOR LITTLE WANDERERS				556706	SPED-TUITNPS
22	25097-2013	Education	TRIUMPH CENTER				556392	SPED-PSYCH-D
23	10486-2013	Education	HILL FOR LITERACY INC.				555996	TTI13 CONT SV
24	12441-2013	Education	JOHNSON STRING INSTRUMENT INC				556020	MUSIC-OIM-ES
25	25887-2013	Education	WALKER INC				555891	SPED-TUITNPS
26	26201-2013	Education	WORK INC				556404	SPED-OIS-DW-
27	7389-2013	Education	EASTER SEALS-MA				556668	SPED-MEDICAI
28	4396-2013	Education	CENTRAL PAPER PRODUCTS CO	$ 4,636.92	1/23/2013	SCHOOL ADMINISTRATI	556437	SCHOOL LUNC
29	25008-2013	Public Works	TOTAL SERVICE SOLUTIONS LLC					
30	3275-2013	Education	BOSTON VERTICAL LLC					
31	14227-2013	Education	LEARNING PREP SCHOOL					
32	14502-2013	Education	LIONEL S. LYON					
33	6433-2013	General Government	DELL MARKETING L P	$ 4,543.73	1/9/2013	IT DEPARTMENT CITY HALL	555964	INFO TECH OR
34	5630-2013	Education	COMMUNICATIVE HEALTH CARE ASSOCIATES, INC.	$ 4,537.50	1/2/2013	SCHOOL ADMINISTRATION	555752	SPED-MEDICAI
35	13162-2013	Education	LANDMARK SCHOOL	$ 4,505.76	1/2/2013	SCHOOL ADMINISTRATION	555790	SPED-TUITNPS
36	2632-2013	Education	BAY COVE HUMAN SERVICES	$ 4,494.45	1/30/2013	SCHOOL ADMINISTRATION	556615	SPED-TUITNPS
37	7784-2013	Public Works	ENVIRONMENTAL COMPLIANCE SERVICES,INC.	$ 4,435.00	1/30/2013	DEPARTMENT OF PUBLIC WORKS	556674	DPW-ADMIN C
38	22906-2013	Education	SEAN AUGUSTUS	$ 4,422.00	1/9/2013	SCHOOL ADMINISTRATION	556124	COMMSCH SA
39	12447-2013	Education	JOHNSON'S FOOD PRODUCTS CORP	$ 4,379.45	1/16/2013	SCHOOL ADMINISTRATION	556298	CA-HS-OTHINS
40	41334	General Government	4IMPRINT	$ 4,363.26	1/9/2013	BOARD OF HEALTH	555894	HLTHY KIDS,HL
41	8840-2013	Education	GOV CONNECTION INC	$ 4,348.96	1/30/2013	SCHOOL ADMINISTRATION	556691	SCH. COMPUT
42	15617-2013	Public Works	METROPOLITAN PIPE AND SUPPLY CO	$ 4,343.16	1/16/2013	DEPARTMENT OF PUBLIC WORKS	556324	DPW-BLGD&G
43	26041-2013	Education	WHELAN HORICH LLC	$ 4,323.00	1/9/2013	SCHOOL ADMINISTRATION	556164	COMMSCH SA

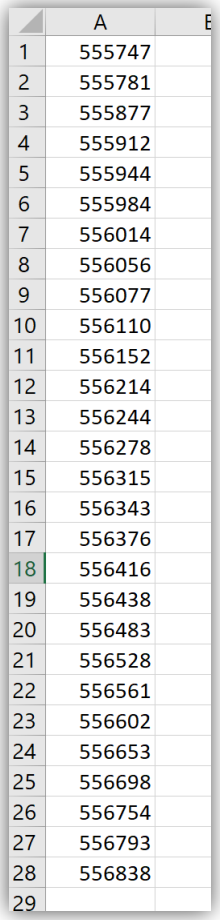


Input number of samples

Worksheet 07

Periodic sampling using data analysis toolpak

Periodic sampling using data analysis toolpak



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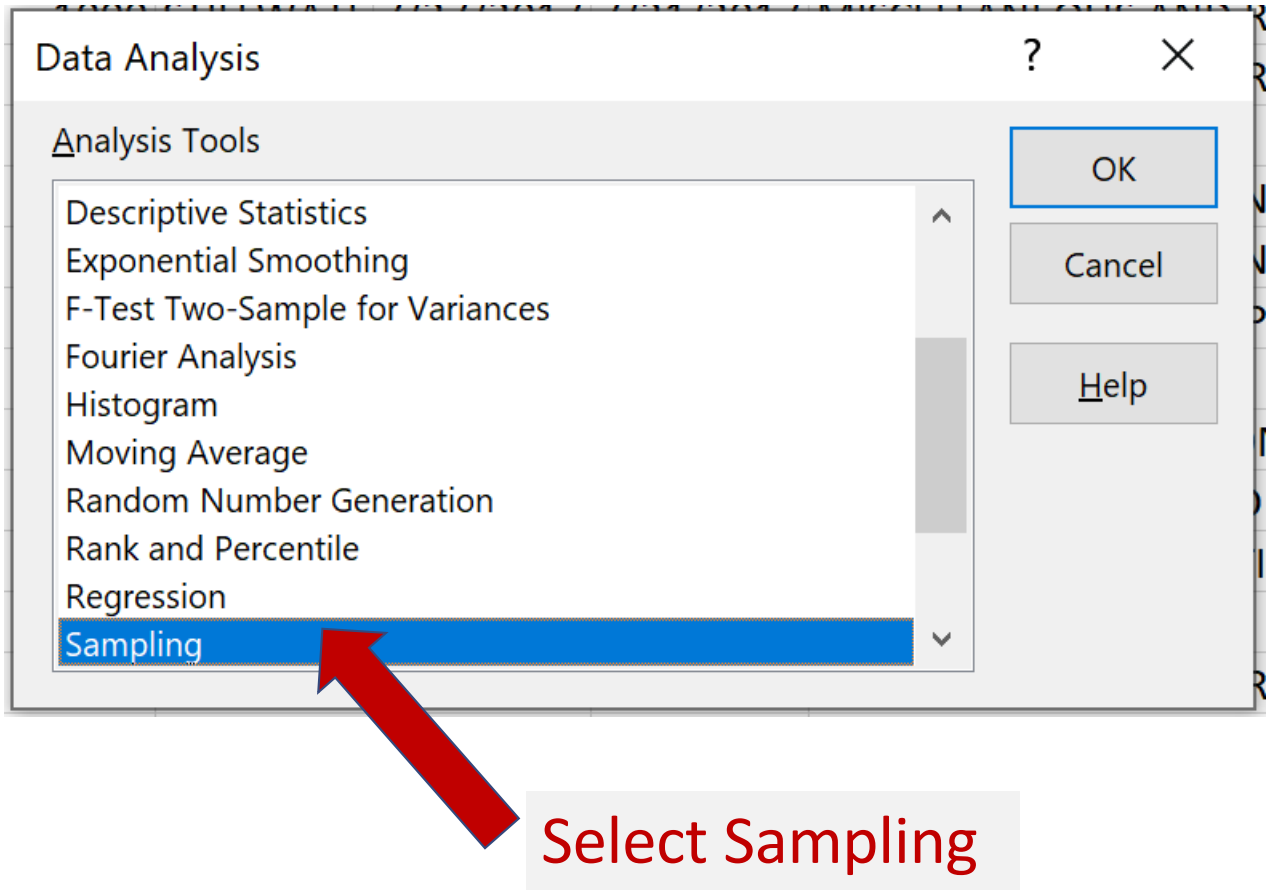
Periodic sampling – Excel selects every nth value from the Input range

Periodic sample of every 30 checks

Periodic sampling using data analysis toolpak



Periodic sampling using data analysis toolpak

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4	12143-2013	Education	JAMES F.FARR ACADEMY	$ 5,904.15	1/30/2013	SCHOOL ADMINISTRATION	556713	SPED-TUITNPSCH-DW-SPED
5	5993-2013	Education	COTTING SCHOOL INC	$ 5,890.20	1/2/2013	SCHOOL ADMINISTRATION	555753	SPED-TUITNPSCH-DW-SPED
6	11142-2013	Education	HOME FOR LITTLE WANDERERS	$ 5,832.00	1/2/2013	SCHOOL ADMINISTRATION	555778	SPED-TUITNPSCH-DW-SPED
7	2039-2013	Education	APPLE INC	$ 5,763.00	1/9/2013	SCHOOL ADMINISTRATION	555912	SCH. COMPUTER EQUIP DONATION
8	24797-2013	Education	THURSTON FOODS	$ 5,742.14	1/30/2013	SCHOOL ADMINISTRATION	556841	SCHOOL LUNCH EXPENSES
9	7565-2013	Education	EDCO INC				556462	SPED-TUITNCOLAB-DW-SPED
10	7994-2013	Public Works	FAY SPOFFORD AND THORNDIKE LLC			KS	556471	CH90 ENGN PAVEMNT MGT SYS FY1
11	8241-2013	Education	FRANCISCAN CHILDREN'S HOSPITAL				556473	SPED-TUITNPSCH-DW-SPED
12	3187-2013	Public Works	BOSTON SAND AND GRAVEL CO			KS	556233	DPW HIGHWAY ORDINARY MAINT
13	613-2013	Education	A RUSSO AND SONS INC				556210	SCHOOL LUNCH EXPENSES
14	22860-2013	Education	SCHOOLS FOR CHILDREN/DEARBORN ACADEMY				556369	SPED-TUITNPSCH-DW-SPED
15	14332-2013	Education	LIGHTHOUSE SCHOOL INC				556736	SPED-TUITNPSCH-DW-SPED
16	24504-2013	Education	TEACHING AND LEARNING ALLIANCE INC				556838	RTTT13 CONT SVC-DW-PD STIPENDS
17	11334-2013	General Government	IMPERIEL MUNICIPAL PARTNERS INC				556000	POLICE ORDINARY MAINTENANCE
18	25096-2013	Education	TRIUMPH CENTER				555885	SPED-PSYCH-DW-SPED
19	6343-2013	General Government	DEACON TRANSPORTATION				556080	EXEC-ARTS CNCL ORDINARY MAINT
20	9186-2013	General Government	HARPERS DATA SERVICES INC				555992	TREAS/COLL ORDINARY MAINT
21	11143-2013	Education	HOME FOR LITTLE WANDERERS				556706	SPED-TUITNPSCH-DW-SPED
22	25097-2013	Education	TRIUMPH CENTER				556392	SPED-PSYCH-DW-SPED
23	10486-2013	Education	HILL FOR LITERACY INC.				555996	TTI13 CONT SVC-DW-PD STIPENDS
24	12441-2013	Education	JOHNSON STRING INSTRUMENT INC				556020	MUSIC-OIM-ESCS-REG
25	25887-2013	Education	WALKER INC				555891	SPED-TUITNPSCH-DW-SPED
26	26201-2013	Education	WORK INC				556404	SPED-OIS-DW-SPED
27	7389-2013						556668	SPED-MEDICAL-DW-SPED
28	4396-2013			$ 4,636.92	1/23/2013	SCHOOL ADMINISTRATION	556437	SCHOOL LUNCH EXPENSES
29	25008-2013			$ 4,600.00	1/30/2013	DEPARTMENT OF PUBLIC WORKS	556843	DPW-BLGD&GRNDS ORDINARY MAI
30	3275-2013			$ 4,590.00	1/9/2013	SCHOOL ADMINISTRATION	555928	COMMSCH SACC-DW-CIVIC
31	14227-2013			$ 4,586.40	1/16/2013	SCHOOL ADMINISTRATION	556310	SPED-TUITNPSCH-DW-SPED
32	14502-2013	Education	LIONEL S. LYON	$ 4,547.50	1/16/2013	SCHOOL ADMINISTRATION	556316	SPED-PSYCH-DW-SPED
33	6433-2013	General Government	DELL MARKETING L P	$ 4,543.73	1/9/2013	IT DEPARTMENT CITY HALL	555964	INFO TECH ORDINARY MAINTENANC
34	5630-2013	Education	COMMUNICATIVE HEALTH CARE ASSOCIATES, INC.	$ 4,537.50	1/2/2013	SCHOOL ADMINISTRATION	555752	SPED-MEDICAL-DW-SPED
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36	2632-2013	Education	BAY COVE HUMAN SERVICES	$ 4,494.45	1/30/2013	SCHOOL ADMINISTRATION	556615	SPED-TUITNPSCH-DW-SPED
37	7784-2013	Public Works	ENVIRONMENTAL COMPLIANCE SERVICES,INC.	$ 4,435.00	1/30/2013	DEPARTMENT OF PUBLIC WORKS	556674	DPW-ADMIN ORDINARY MAINT
38	22906-2013	Education	SEAN AUGUSTUS	$ 4,422.00	1/9/2013	SCHOOL ADMINISTRATION	556124	COMMSCH SACC-DW-CIVIC
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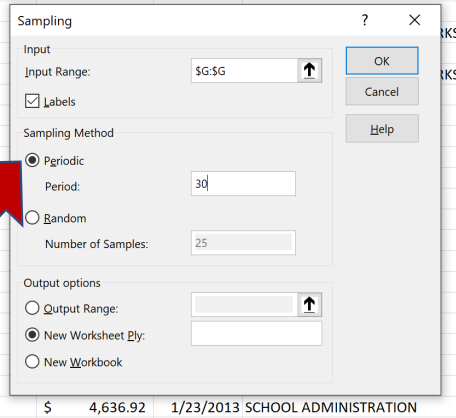
40	41334	General Government	4IMPRINT	$ 4,363.26	1/9/2013	BOARD OF HEALTH	555894	HLTHY KIDS,HLTHY COMM RWJ '12
41	8840-2013	Education	GOV CONNECTION INC	$ 4,348.96	1/30/2013	SCHOOL ADMINISTRATION	556691	SCH. COMPUTER EQUIP DONATION
42	15617-2013	Public Works	METROPOLITAN PIPE AND SUPPLY CO	$ 4,343.16	1/16/2013	DEPARTMENT OF PUBLIC WORKS	556324	DPW-BLGD&GRNDS ORDINARY MAI
43	26041-2013	Education	WHELAN HORICH LLC	$ 4,323.00	1/9/2013	SCHOOL ADMINISTRATION	556164	COMMSCH SACC-DW-CIVIC
44	3999-2013	Education	CATHOLIC CHARITIES	$ 4,297.50	1/30/2013	SCHOOL ADMINISTRATION	556632	SPED-CDS-DW-SPED
45	21080-2013	Education	PHUNK PHENOMENON DANCE COMPLEX	$ 4,290.00	1/30/2013	SCHOOL ADMINISTRATION	556796	COMMSCH SACC-DW-CIVIC
46	25860-2013	General Government	W R BRADLEY CO LLC	$ 4,213.00	1/16/2013	RECREATION AND YOUTH	556397	OUTDOOR ICE SKATE RINK EXP
47	21596-2013	Education	RESEARCH FOR BETTER TEACHING INC	$ 4,200.00	1/9/2013	SCHOOL ADMINISTRATION	556104	CURR-PDSTPD-DW-REG



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Periodic sampling using data analysis toolpak

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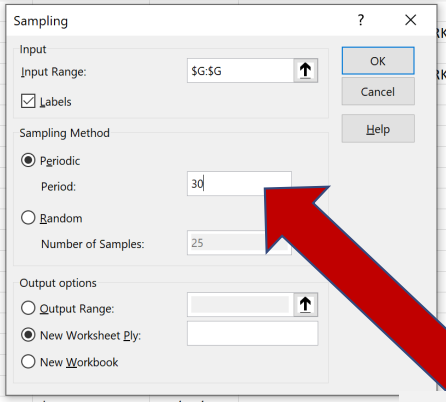
27	7389-2013	Education	EASTER SEALS-MA				556668	SPED-MEDICAL-DW-SPED
28	4396-2013	Education	CENTRAL PAPER PRODUCTS CO	$ 4,636.92	1/23/2013	SCHOOL ADMINISTRATIC		
29	25008-2013	Public Works	TOTAL SERVICE SOLUTIONS LLC	$ 4,600.00	1/30/2013	DEPARTMENT OF PUBLIC		
30	3275-2013	Education	BOSTON VERTICAL LLC	$ 4,590.00	1/9/2013	SCHOOL ADMINISTRATIC		
31	14227-2013	Education	LEARNING PREP SCHOOL	$ 4,586.40	1/16/2013	SCHOOL ADMINISTRATIC		
32	14502-2013	Education	LIONEL S. LYON	$ 4,547.50	1/16/2013	SCHOOL ADMINISTRATIO		
33	6433-2013	General Government	DELL MARKETING L P	$ 4,543.73	1/9/2013	IT DEPARTMENT CITY HALL	555964	INFO TECH ORDINARY MAINTENANC
34	5630-2013	Education	COMMUNICATIVE HEALTH CARE ASSOCIATES, INC.	$ 4,537.50	1/2/2013	SCHOOL ADMINISTRATION	555752	SPED-MEDICAL-DW-SPED
35	13162-2013	Education	LANDMARK SCHOOL	$ 4,505.76	1/2/2013	SCHOOL ADMINISTRATION	555790	SPED-TUITNPSCH-DW-SPED
36	2632-2013	Education	BAY COVE HUMAN SERVICES	$ 4,494.45	1/30/2013	SCHOOL ADMINISTRATION	556615	SPED-TUITNPSCH-DW-SPED
37	7784-2013	Public Works	ENVIRONMENTAL COMPLIANCE SERVICES,INC.	$ 4,435.00	1/30/2013	DEPARTMENT OF PUBLIC WORKS	556674	DPW-ADMIN ORDINARY MAINT
38	22906-2013	Education	SEAN AUGUSTUS	$ 4,422.00	1/9/2013	SCHOOL ADMINISTRATION	556124	COMMSCH SACC-DW-CIVIC
39	12447-2013	Education	JOHNSON'S FOOD PRODUCTS CORP	$ 4,379.45	1/16/2013	SCHOOL ADMINISTRATION	556298	CA-HS-OTHINSTMAT
40	41334	General Government	4IMPRINT	$ 4,363.26	1/9/2013	BOARD OF HEALTH	555894	HLTHY KIDS,HLTHY COMM RWJ '12
41	8840-2013	Education	GOV CONNECTION INC	$ 4,348.96	1/30/2013	SCHOOL ADMINISTRATION	556691	SCH. COMPUTER EQUIP DONATION
42	15617-2013	Public Works	METROPOLITAN PIPE AND SUPPLY CO	$ 4,343.16	1/16/2013	DEPARTMENT OF PUBLIC WORKS	556324	DPW-BLGD&GRNDS ORDINARY MAI
43	26041-2013	Education	WHELAN HORICH LLC	$ 4,323.00	1/9/2013	SCHOOL ADMINISTRATION	556164	COMMSCH SACC-DW-CIVIC
44	3999-2013	Education	CATHOLIC CHARITIES	$ 4,297.50	1/30/2013	SCHOOL ADMINISTRATION	556632	SPED-CDS-DW-SPED
45	21080-2013	Education	PHUNK PHENOMENON DANCE COMPLEX	$ 4,290.00	1/30/2013	SCHOOL ADMINISTRATION	556796	COMMSCH SACC-DW-CIVIC
46	25860-2013	General Government	W R BRADLEY CO LLC	$ 4,213.00	1/16/2013	RECREATION AND YOUTH	556397	OUTDOOR ICE SKATE RINK EXP
47	21596-2013	Education	RESEARCH FOR BETTER TEACHING INC	$ 4,200.00	1/9/2013	SCHOOL ADMINISTRATION	556104	CURR-PDSTPD-DW-REG



Input period

Worksheet 08

Regression

Regression

Q. Do purchases in Arkansas have a significantly higher transaction balances than all other states?

Q. Are online purchase amounts statistically greater than or less than non-online purchase amounts?

Correlation – a statistical method that determines the degree of relationship between two variables

Strong relationship - one variable will help predict another variable

Regression

Correlation DOES NOT imply causation.

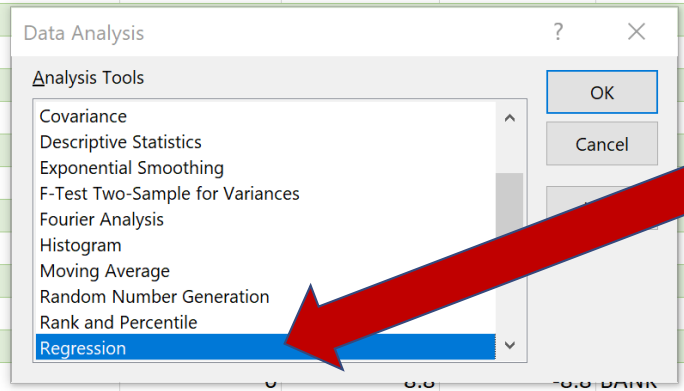
Regression

	E	F	G	H	I	J	K	L	M	N	O	P
1	TRAN_NUM	TRAN_TIME	CUST_ID	TRAN_LINE_NUM	MIC	TRAN_TYPE	ORIG_PRICE	SALE_PRICE	TRAN_AMT	TENDER_TYPE	SKU	STATE
2	12	1514	208589650	1	466	P	69	24.15	24.15	DAMX	3966879	TX
3	3910	1404	204521570	1	000	P	0	4.25	4.25	BANK	9999999950	AZ
4	19	1442	207142002	1	374	P	55	19.25	19.25	BANK	3640361	TX
5	12	1514	208589650	2	143	P	39	13.65	13.65	DAMX	1223794	TX
6	15	1401	135024117	1	335	P	54	32.4	32.4	DLRD	6514248	TX
7	27	1942	117728542	1	855	P	59	20.65	20.65	DLRD	3877868	TX
8	3	1143	136421421	1	000	P	0	27.22	27.22	BANK	9999999950	AZ
9	9	1921	117674642	2	773	P	14.99	14.99	14.99	BANK	4451939	TX
10	6	1354	186839862	1	487	P	22	11	11	DAMX	7251659	TX
11	7	1223	116379514	1	000	P	0	1.95	1.95	DAMX	9999999950	MO
12												
13												
14												
15												
16												
17												
18												
19	24	1516	134539712	1	000	P	0	6.44	6.44	BANK	9999999950	TX
20	57	1850	211734231	1	000	P	0	7.84	7.84	BANK	9999999950	AZ
21	9	1150	171901702	2	366	P	38	13.3	13.3	BANK	3654197	TX
22	9	1402	203442549	1	213	P	59.5	20.82	20.82	DLRD	4349813	TX
23	23	1823	219357759	2	000	R	0	8.8	-8.8	BANK	9999999950	TX
24	23	1251	135276841	9	673	P	14.99	8.99	8.99	DLRD	4255193	TX
25	3	1057	193586027	1	000	P	0	6.89	6.89	BANK	9999999950	AZ
26	2	1112	118680846	1	000	P	0	20.25	20.25	DAMX	9999999950	AZ
27	34	2024	189971449	1	000	P	0	1.23	1.23	BANK	9999999950	NE
28	9	1300	219396669	1	000	R	0	9.9	-9.9	BANK	9999999950	TX
29	27	1535	219506660	1	300	P	9.99	9.99	9.99	DLRD	6817416	TX
30	6	1146	182708390	1	332	R	74	25.9	25.9	DAMX	4779490	AZ

Q. Do purchase transactions in Arkansas have a significantly higher transaction balance than all other states?

Regression

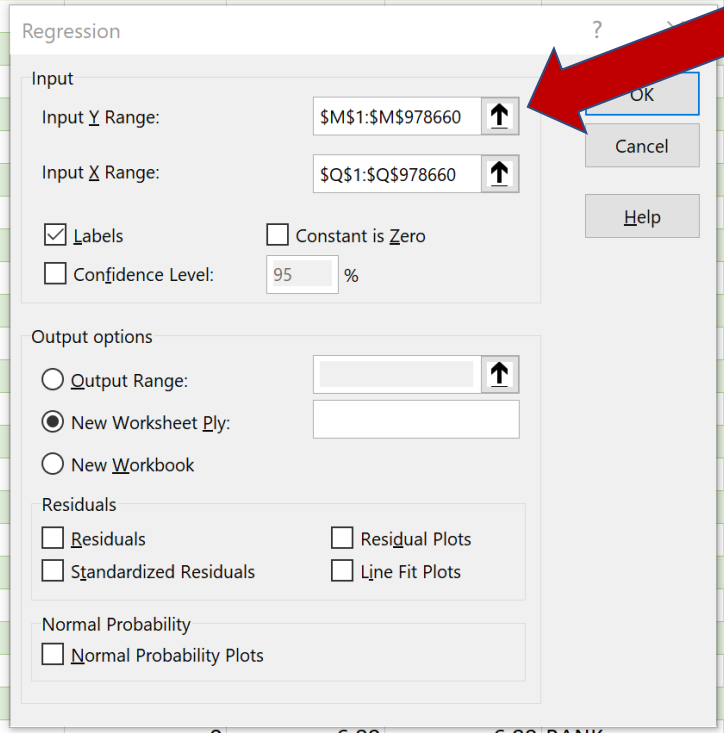
	G	H	I	J	K	L	M	N	O	P	Q	R	S
1	CUST_ID	TRAN_LINE_NUM	MIC	TRAN_TYPE	ORIG_PRICE	SALE_PRICE	TRAN_AMT	TENDER_TYPE	SKU	STATE	ARKANS		
2	208589650	1	466	P	69	24.15	24.15	DAMX	3966879	TX	0		
3	204521570	1	000	P	0	4.25	4.25	BANK	9999999950	AZ	0		
4	207142002	1	374	P	55	19.25	19.25	BANK	3640361	TX	0		
5	208589650	2	143	P	39	13.65	13.65	DAMX	1223794	TX	0		
6	135024117	1	335	P	54	32.4	32.4	DLRD	6514248	TX	0		
7	117728542	1	855	P	59	20.65	20.65	DLRD	3877868	TX	0		
8	136421421	1	000	P	0	27.22	27.22	BANK	9999999950	AZ	0		
9	117674642	2	773	P	14.99	14.99	14.99	BANK	4451939	TX	0		
10	186839862	1	487	P	22	11	11	DAMX	7251659	TX	0		
11	116379514	1	000	P	0	1.95	1.95	DAMX	9999999950	MO	0		
12	117693440	2	250	P					2765519	TX	0		
13	198440937	1	878	P					3633910	TX	0		
14	129563165	2	000	P									
15	219456182	1	777	P									
16	219363261	1	107	R									
17	217091073	1	731	R					4544093	TX	0		
18	116359470	2	276	P					6401550	MO	0		
19	134539712	1	000	P					9999999950	TX	0		
20	211734231	1	000	P					9999999950	AZ	0		
21	171901702	2	366	P					3654197	TX	0		
22	203442549	1	213	P					4349813	TX	0		
23	219357759	2	000	R					9999999950	TX	0		
24	135276841	9	673	P	14.99	8.99	8.99	DLRD	4255193	TX	0		
25	193586027	1	000	P	0	6.89	6.89	BANK	9999999950	AZ	0		
26	118680846	1	000	P	0	20.25	20.25	DAMX	9999999950	AZ	0		
27	189971449	1	000	P	0	1.23	1.23	BANK	9999999950	NE	0		
28	219396669	1	000	R	0	9.9	-9.9	BANK	9999999950	TX	0		
29	219506660	1	300	P	9.99	9.99	9.99	DLRD	6817416	TX	0		



Click Regression

Regression

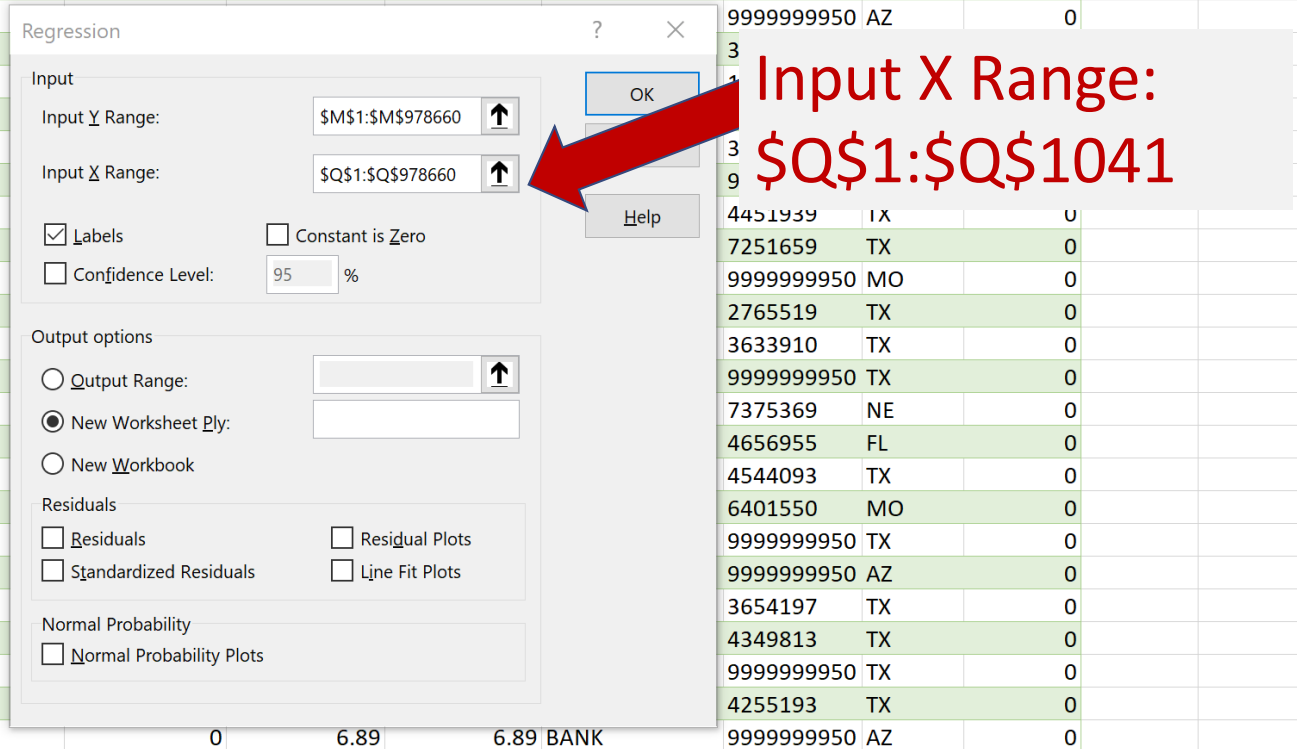
	G	H	I	J	K	L	M	N	O	P	Q	R	S
1	CUST_ID	TRAN_LINE_NUM	MIC	TRAN_TYPE	ORIG_PRICE	SALE_PRICE	TRAN_AMT	TENDER_TYPE	SKU	STATE	ARKANS		
2	208589650	1	466	P	69	24.15	24.15	DAMX	3				
3	204521570	1	000	P									
4	207142002	1	374	P									
5	208589650	2	143	P					1				
6	135024117	1	335	P					6				
7	117728542	1	855	P					3877868	TX	0		
8	136421421	1	000	P					9999999950	AZ	0		
9	117674642	2	773	P					4451939	TX	0		
10	186839862	1	487	P					7251659	TX	0		
11	116379514	1	000	P					9999999950	MO	0		
12	117693440	2	250	P					2765519	TX	0		
13	198440937	1	878	P					3633910	TX	0		
14	129563165	2	000	P					9999999950	TX	0		
15	219456182	1	777	P					7375369	NE	0		
16	219363261	1	107	R					4656955	FL	0		
17	217091073	1	731	R					4544093	TX	0		
18	116359470	2	276	P					6401550	MO	0		
19	134539712	1	000	P					9999999950	TX	0		
20	211734231	1	000	P					9999999950	AZ	0		
21	171901702	2	366	P					3654197	TX	0		
22	203442549	1	213	P					4349813	TX	0		
23	219357759	2	000	R					9999999950	TX	0		
24	135276841	9	673	P					4255193	TX	0		
25	193586027	1	000	P	0	6.89	6.89	BANK	9999999950	AZ	0		
26	118680846	1	000	P	0	20.25	20.25	DAMX	9999999950	AZ	0		
27	189971449	1	000	P	0	1.23	1.23	BANK	9999999950	NE	0		
28	219396669	1	000	R	0	9.9	-9.9	BANK	9999999950	TX	0		
29	219506660	1	300	P	9.99	9.99	9.99	DLRD	6817416	TX	0		



Input Y Range:
$M$1:$M$1041

Regression

	G	H	I	J	K	L	M	N	O	P	Q	R	S
1	CUST_ID	TRAN_LINE_NUM	MIC	TRAN_TYPE	ORIG_PRICE	SALE_PRICE	TRAN_AMT	TENDER_TYPE	SKU	STATE	ARKANS		
2	208589650	1	466	P	69	24.15	24.15	DAMX	3966879	TX	0		
3	204521570	1	000	P					9999999950	AZ	0		
4	207142002	1	374	P					3				
5	208589650	2	143	P									
6	135024117	1	335	P									
7	117728542	1	855	P					3				
8	136421421	1	000	P					9				
9	117674642	2	773	P					4451939	TX	0		
10	186839862	1	487	P					7251659	TX	0		
11	116379514	1	000	P					9999999950	MO	0		
12	117693440	2	250	P					2765519	TX	0		
13	198440937	1	878	P					3633910	TX	0		
14	129563165	2	000	P					9999999950	TX	0		
15	219456182	1	777	P					7375369	NE	0		
16	219363261	1	107	R					4656955	FL	0		
17	217091073	1	731	R					4544093	TX	0		
18	116359470	2	276	P					6401550	MO	0		
19	134539712	1	000	P					9999999950	TX	0		
20	211734231	1	000	P					9999999950	AZ	0		
21	171901702	2	366	P					3654197	TX	0		
22	203442549	1	213	P					4349813	TX	0		
23	219357759	2	000	R					9999999950	TX	0		
24	135276841	9	673	P					4255193	TX	0		
25	193586027	1	000	P	0	6.89	6.89	BANK	9999999950	AZ	0		
26	118680846	1	000	P	0	20.25	20.25	DAMX	9999999950	AZ	0		
27	189971449	1	000	P	0	1.23	1.23	BANK	9999999950	NE	0		
28	219396669	1	000	R	0	9.9	-9.9	BANK	9999999950	TX	0		
29	219506660	1	300	P	9.99	9.99	9.99	DLRD	6817416	TX	0		



Input X Range:
$Q$1:$Q$1041

Regression

	A	B	C	D	E	F	G	H	I	J
1	SUMMARY OUTPUT									
2										
3	*Regression Statistics*									
4	Multiple R	0.064903997								
5	R Square	0.004212529								
6	Adjusted R Square	0.004211511								
7	Standard Error	43.51697487								
8	Observations	978659								
9										
10	ANOVA									
11		*df*	*SS*	*MS*	*F*	*Significance F*				
12	Regression	1	7840145.659	7840145.659	4140.060968	0				
13	Residual	978657	1853309284	1893.727102						
14	Total	978658	1861149430							
15										
16		*Coefficients*	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*	
17	Intercept	18.2918975	0.046362863	394.5377004	0	18.20102784	18.38276715	18.20102784	18.38276715	
18	ARKANSAS	9.44360093	0.146768974	64.34330553	0	9.155938671	9.731263188	9.155938671	9.731263188	
19										
20										

t Stat greater than 2.0 suggests the transaction amount is statistically greater in Arkansas than in all other states.

Worksheet 09

Benford's Law Analysis:
Frequency Distribution

Benford's Law Analysis

Benford's Law

- An observation about the frequency of leading digits
- In many naturally occurring collections of numbers, the significant leading digit is likely to be small
- Help identify areas to investigate further

Benford's Law Analysis

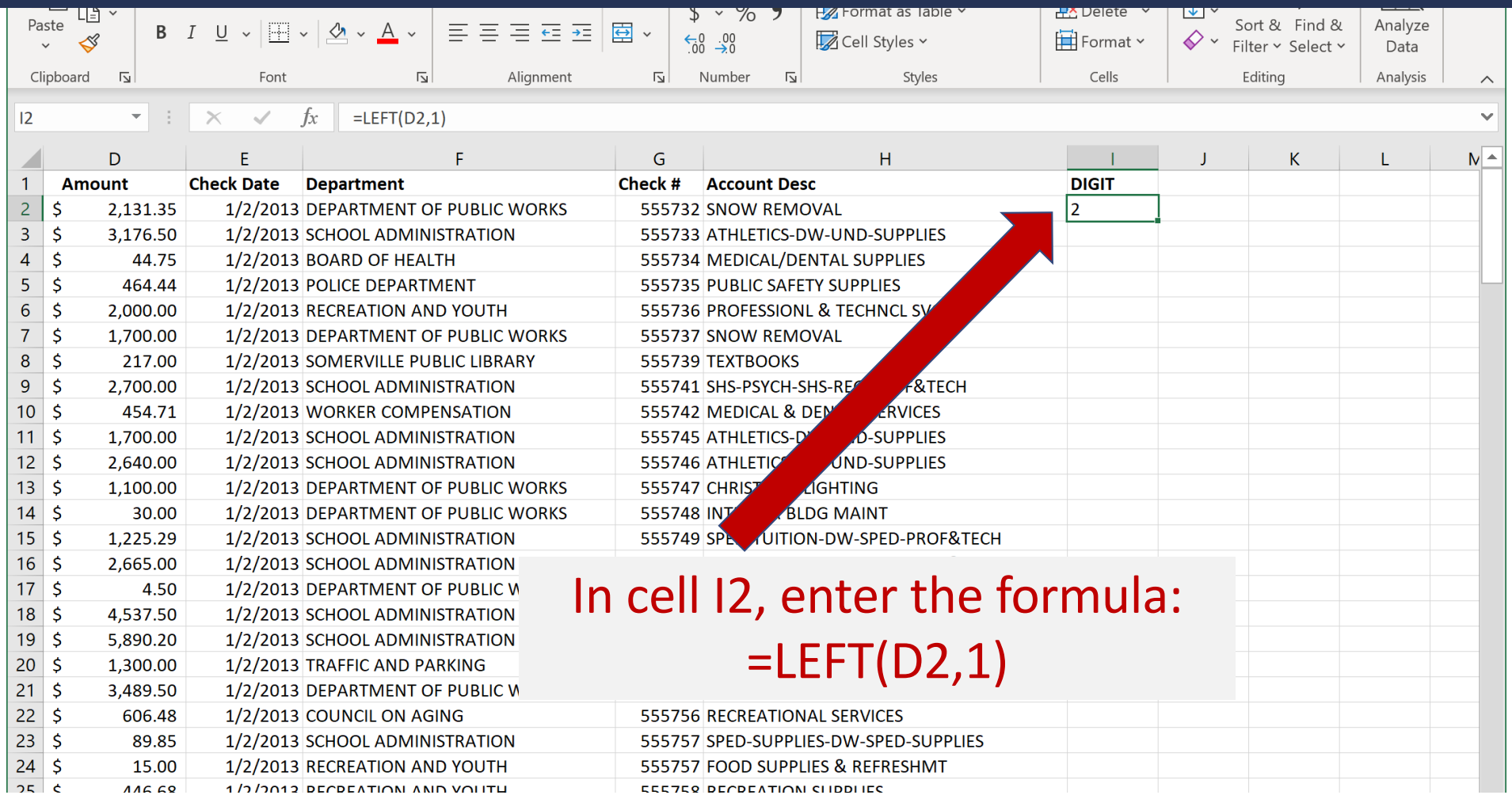
	A	B	C	D	E	F
1	**Item Number**	**Category of Gov**	**Vendor Name**	**Amount**	**Check Date**	**Department**
2	1180-2013	Public Works	ADAMSON INDUSTRIES CORP	$ 2,131.35	1/2/2013	DEPARTMENT OF PUBLIC WORI
3	1516-2013	Education	ALL AMERICAN SPORTS CORP	$ 3,176.50	1/2/2013	SCHOOL ADMINISTRATION
4	1602-2013	General Government	ALLEGRO ENTERPRISES INC	$ 44.75	1/2/2013	BOARD OF HEALTH
5	1943-2013	General Government	ANIMAL CARE EQUIPMENT & SERVICES LLC	$ 464.44	1/2/2013	POLICE DEPARTMENT
6	2168-2013	General Government	ASPIRING ARTIST	$ 2,000.00	1/2/2013	RECREATION AND YOUTH
7	2232-2013	Public Works	ATLANTIC BROOM SERVICE INC	$ 1,700.00	1/2/2013	DEPARTMENT OF PUBLIC WORI
8	2729-2013	General Government	BERNAN ASSOCIATES	$ 217.00	1/2/2013	SOMERVILLE PUBLIC LIBRARY
9	3605-2013	Education	CAMBRIDGE PUBLIC HEALTH COMMISSION	$ 2,700.00	1/2/2013	SCHOOL ADMINISTRATION
10	3664-2013	General Government	CAMBRIDGE PUBLIC HEALTH COMMISSION	$ 454.71	1/2/2013	WORKER COMPENSATION
11	4587-2013	Education	CHAMPIONS CHOICE INC	$ 1,700.00	1/2/2013	SCHOOL ADMINISTRATION
12	4588-2013	Education	CHAMPIONS CHOICE INC	$ 2,640.00	1/2/2013	SCHOOL ADMINISTRATION
13	4600-2013	Public Works	CHARLES MARINO	$ 1,100.00	1/2/2013	DEPARTMENT OF PUBLIC WORI
14	4710-2013	Public Works	CINTAS CORP NUMBER 2	$ 30.00	1/2/2013	DEPARTMENT OF PUBLIC WORI
15	4799-2013	Education	CITY OF HAVERHILL	$ 1,225.29	1/2/2013	SCHOOL ADMINISTRATION
16	4800-2013	Education	CITY OF HAVERHILL	$ 2,665.00	1/2/2013	SCHOOL ADMINISTRATION
17	5163-2013	Public Works	COMMONWEALTH LOCK CO	$ 4.50	1/2/2013	DEPARTMENT OF PUBLIC WORI
18	5630-2013	Education	COMMUNICATIVE HEALTH CARE ASSOCIATES, INC.	$ 4,537.50	1/2/2013	SCHOOL ADMINISTRATION
19	5993-2013	Education	COTTING SCHOOL INC	$ 5,890.20	1/2/2013	SCHOOL ADMINISTRATION
20	6021-2013	General Government	CREATIVE SIGNS INC	$ 1,300.00	1/2/2013	TRAFFIC AND PARKING
21	6267-2013	Public Works	DAVID MACEACHERN	$ 3,489.50	1/2/2013	DEPARTMENT OF PUBLIC WORI
22	6337-2013	General Government	DDH HOTEL SOMERVILLE LLC	$ 606.48	1/2/2013	COUNCIL ON AGING
23	6809-2013	Education	DEMOULAS SUPER MARKETS	$ 89.85	1/2/2013	SCHOOL ADMINISTRATION
24	6838-2013	General Government	DEMOULAS SUPER MARKETS	$ 15.00	1/2/2013	RECREATION AND YOUTH
25	6975-2013	General Government	DISCOUNT SCHOOL SUPPLY	$ 446.68	1/2/2013	RECREATION AND YOUTH
26	7601-2013	Education	EDUCATION INC	$ 948.29	1/2/2013	SCHOOL ADMINISTRATION
27	8073-2013	General Government	FIORE BUS ATLANITIC EXPRESS	$ 325.00	1/2/2013	COUNCIL ON AGING
28	8088-2013	General Government	FIORE BUS ATLANITIC EXPRESS	$ 250.00	1/2/2013	COUNCIL ON AGING
29	8115-2013	General Government	FIRST DATA CORPORATION	$ 410.41	1/2/2013	TRAFFIC AND PARKING
30	8628-2013	Public Works	GENERAL GLASS AND MIRROR CORP	$ 75.00	1/2/2013	DEPARTMENT OF PUBLIC WORI

Benford's Law Analysis

	D	E	F	G	H	I	J	K	L	M
1	Amount	Check Date	Department	Check #	Account Desc	DIGIT				
2	$ 2,131.35	1/2/2013	DEPARTMENT OF PUBLIC WORKS	555732	SNOW REMOVAL					
3	$ 3,176.50	1/2/2013	SCHOOL ADMINISTRATION	555733	ATHLETICS-DW-UND-SUPPLIES					
4	$ 44.75	1/2/2013	BOARD OF HEALTH	555734	MEDICAL/DENTAL SUPPLIES					
5	$ 464.44	1/2/2013	POLICE DEPARTMENT	555735	PUBLIC SAFETY SUPPLIES					
6	$ 2,000.00	1/2/2013	RECREATION AND YOUTH	555736	PROFESSIONL & TECHNCL					
7	$ 1,700.00	1/2/2013	DEPARTMENT OF PUBLIC WORKS	555737	SNOW REMOVAL					
8	$ 217.00	1/2/2013	SOMERVILLE PUBLIC LIBRARY	555739	TEXTBOOKS					
9	$ 2,700.00	1/2/2013	SCHOOL ADMINISTRATION	555741	SHS-PSYCH-SHS ROF&TECH					
10	$ 454.71	1/2/2013	WORKER COMPENSATION	555742	MEDICAL & L SERVICES					
11	$ 1,700.00	1/2/2013	SCHOOL ADMINISTRATION	555745	ATHLETIC UND-SUPPLIES					
12	$ 2,640.00	1/2/2013	SCHOOL ADMINISTRATION	555746	ATHLE W-UND-SUPPLIES					
13	$ 1,100.00	1/2/2013	DEPARTMENT OF PUBLIC WORKS	555747	CH AS LIGHTING					
14	$ 30.00	1/2/2013	DEPARTMENT OF PUBLIC WORKS	555748	INTERIOR BLDG MAINT					
15	$ 1,225.29	1/2/2013	SCHOOL ADMINISTRATION							
16	$ 2,665.00	1/2/2013	SCHOOL ADMINISTRATION							
17	$ 4.50	1/2/2013	DEPARTMENT OF PUBLIC WC							
18	$ 4,537.50	1/2/2013	SCHOOL ADMINISTRATION							
19	$ 5,890.20	1/2/2013	SCHOOL ADMINISTRATION							
20	$ 1,300.00	1/2/2013	TRAFFIC AND PARKING	555754	SIGNS AND CONES					
21	$ 3,489.50	1/2/2013	DEPARTMENT OF PUBLIC WORKS	555755	INTERIOR BLDG MAINT					
22	$ 606.48	1/2/2013	COUNCIL ON AGING	555756	RECREATIONAL SERVICES					
23	$ 89.85	1/2/2013	SCHOOL ADMINISTRATION	555757	SPED-SUPPLIES-DW-SPED-SUPPLIES					
24	$ 15.00	1/2/2013	RECREATION AND YOUTH	555757	FOOD SUPPLIES & REFRESHMT					
25	$ 446.68	1/2/2013	RECREATION AND YOUTH	555758	RECREATION SUPPLIES					
26	$ 948.29	1/2/2013	SCHOOL ADMINISTRATION	555760	SS-OIS-DW-REG-PROF&TECH					
27	$ 325.00	1/2/2013	COUNCIL ON AGING	555762	RECREATION - TRANSPORTATION					
28	$ 250.00	1/2/2013	COUNCIL ON AGING	555762	RECREATION-TRANSPORTATN.					
29	$ 410.41	1/2/2013	TRAFFIC AND PARKING	555763	CREDIT CARD CONVENIENCE FEE					

In cell I1, add column header "Digit"

Benford's Law Analysis



	D	E	F	G	H	I	J	K	L
1	Amount	Check Date	Department	Check #	Account Desc	DIGIT			
2	$ 2,131.35	1/2/2013	DEPARTMENT OF PUBLIC WORKS	555732	SNOW REMOVAL	2			
3	$ 3,176.50	1/2/2013	SCHOOL ADMINISTRATION	555733	ATHLETICS-DW-UND-SUPPLIES				
4	$ 44.75	1/2/2013	BOARD OF HEALTH	555734	MEDICAL/DENTAL SUPPLIES				
5	$ 464.44	1/2/2013	POLICE DEPARTMENT	555735	PUBLIC SAFETY SUPPLIES				
6	$ 2,000.00	1/2/2013	RECREATION AND YOUTH	555736	PROFESSIONL & TECHNCL SV				
7	$ 1,700.00	1/2/2013	DEPARTMENT OF PUBLIC WORKS	555737	SNOW REMOVAL				
8	$ 217.00	1/2/2013	SOMERVILLE PUBLIC LIBRARY	555739	TEXTBOOKS				
9	$ 2,700.00	1/2/2013	SCHOOL ADMINISTRATION	555741	SHS-PSYCH-SHS-RE F&TECH				
10	$ 454.71	1/2/2013	WORKER COMPENSATION	555742	MEDICAL & DEN ERVICES				
11	$ 1,700.00	1/2/2013	SCHOOL ADMINISTRATION	555745	ATHLETICS-D D-SUPPLIES				
12	$ 2,640.00	1/2/2013	SCHOOL ADMINISTRATION	555746	ATHLETIC UND-SUPPLIES				
13	$ 1,100.00	1/2/2013	DEPARTMENT OF PUBLIC WORKS	555747	CHRIST LIGHTING				
14	$ 30.00	1/2/2013	DEPARTMENT OF PUBLIC WORKS	555748	INT BLDG MAINT				
15	$ 1,225.29	1/2/2013	SCHOOL ADMINISTRATION	555749	SPE TUITION-DW-SPED-PROF&TECH				
16	$ 2,665.00	1/2/2013	SCHOOL ADMINISTRATION						
17	$ 4.50	1/2/2013	DEPARTMENT OF PUBLIC W						
18	$ 4,537.50	1/2/2013	SCHOOL ADMINISTRATION						
19	$ 5,890.20	1/2/2013	SCHOOL ADMINISTRATION						
20	$ 1,300.00	1/2/2013	TRAFFIC AND PARKING						
21	$ 3,489.50	1/2/2013	DEPARTMENT OF PUBLIC W						
22	$ 606.48	1/2/2013	COUNCIL ON AGING	555756	RECREATIONAL SERVICES				
23	$ 89.85	1/2/2013	SCHOOL ADMINISTRATION	555757	SPED-SUPPLIES-DW-SPED-SUPPLIES				
24	$ 15.00	1/2/2013	RECREATION AND YOUTH	555757	FOOD SUPPLIES & REFRESHMT				
25	$ 446.68	1/2/2013	RECREATION AND YOUTH	555758	RECREATION SUPPLIES				

In cell I2, enter the formula:
=LEFT(D2,1)

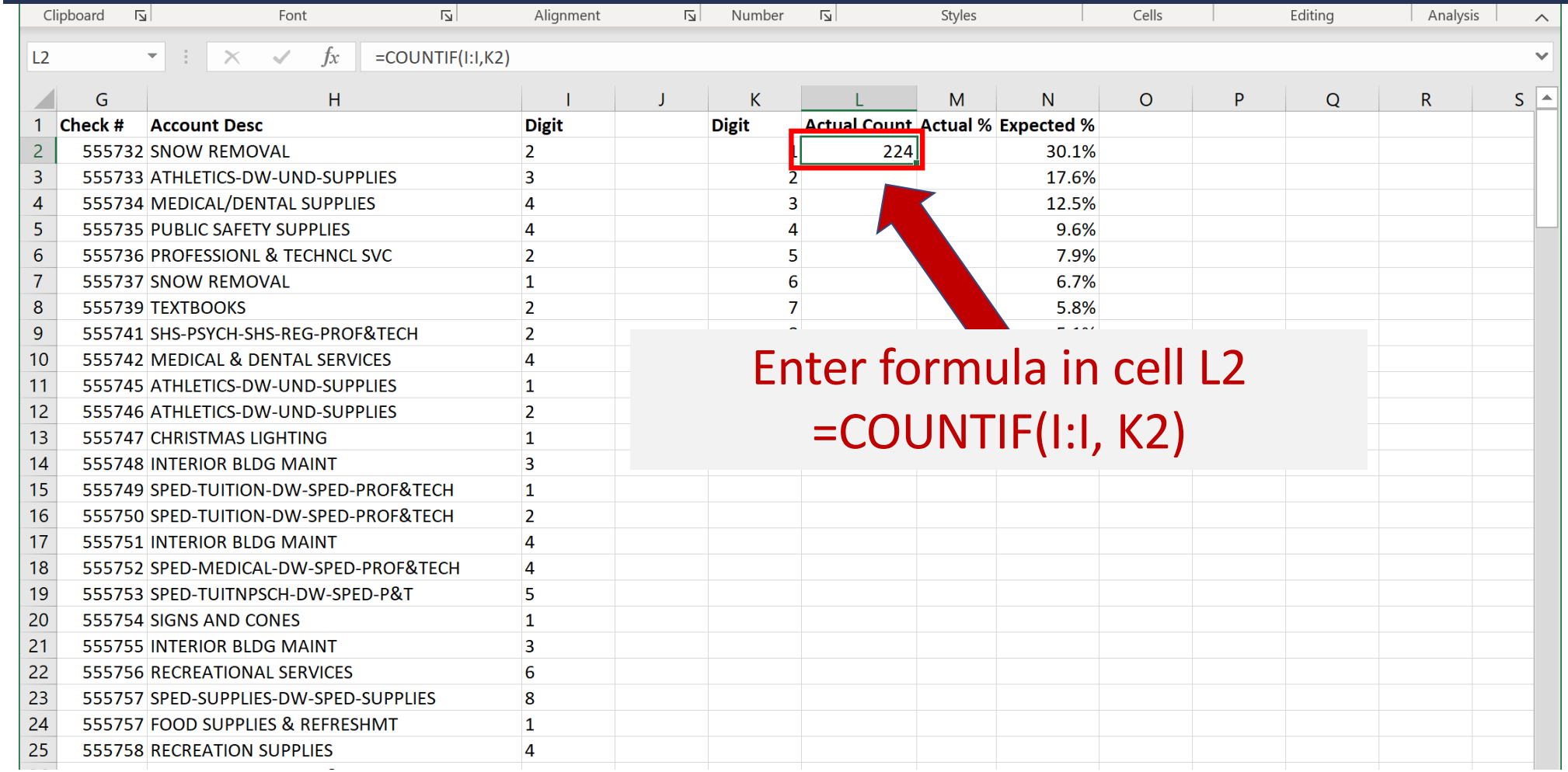
Benford's Law Analysis

Create a frequency distribution

Digit	Actual Count	Actual %	Expected %
1			30.1%
2			17.6%
3			12.5%
4			9.6%
5			7.9%
6			6.7%
7			5.8%
8			5.1%
9			4.6%

The digits and expected % are standard for all data.

Benford's Law Analysis

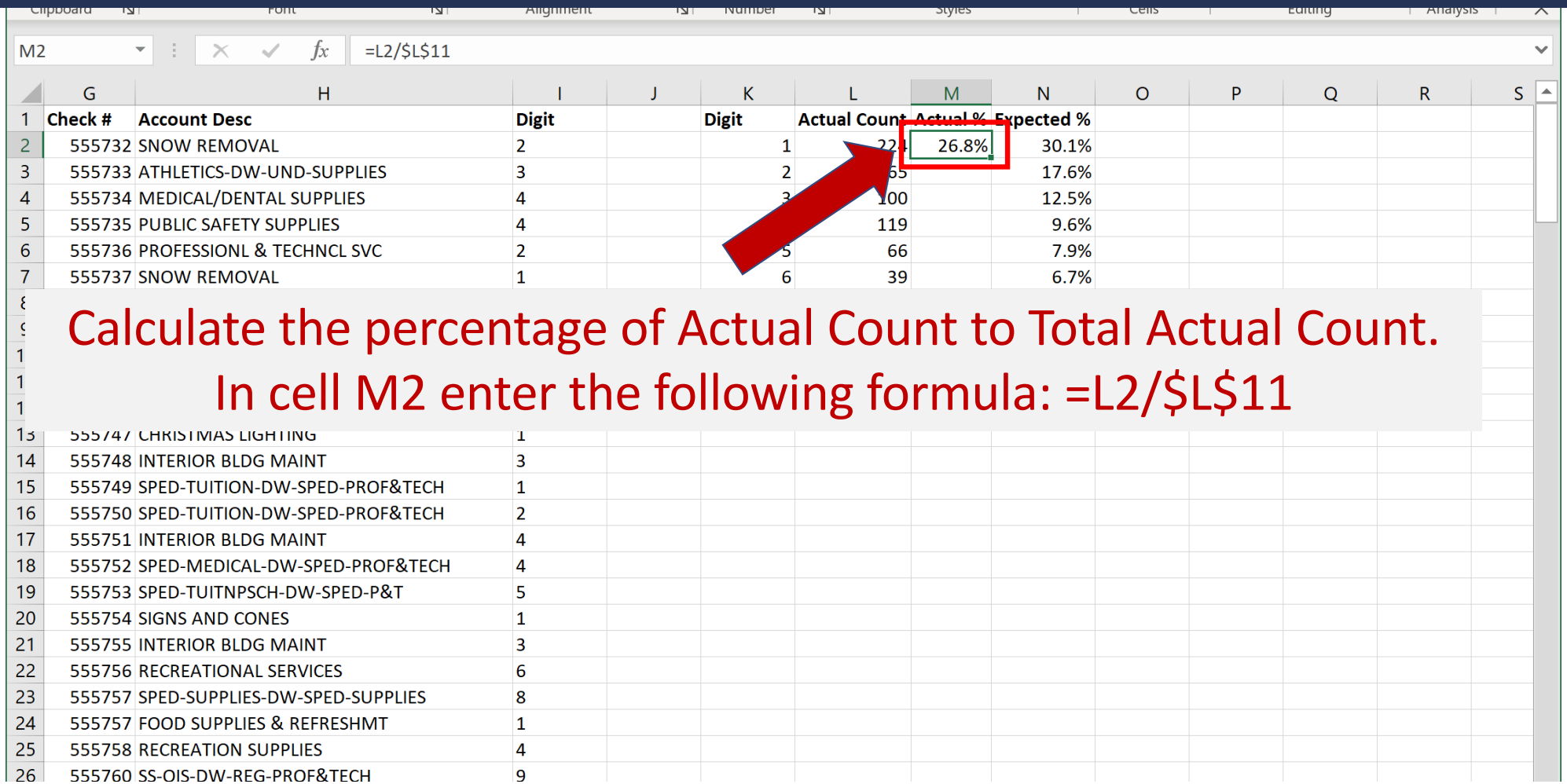


	G	H	I	J	K	L	M	N	O	P	Q	R	S
1	**Check #**	**Account Desc**	**Digit**		**Digit**	**Actual Count**	**Actual %**	**Expected %**					
2	555732	SNOW REMOVAL	2		1	224		30.1%					
3	555733	ATHLETICS-DW-UND-SUPPLIES	3		2			17.6%					
4	555734	MEDICAL/DENTAL SUPPLIES	4		3			12.5%					
5	555735	PUBLIC SAFETY SUPPLIES	4		4			9.6%					
6	555736	PROFESSIONL & TECHNCL SVC	2		5			7.9%					
7	555737	SNOW REMOVAL	1		6			6.7%					
8	555739	TEXTBOOKS	2		7			5.8%					
9	555741	SHS-PSYCH-SHS-REG-PROF&TECH	2										
10	555742	MEDICAL & DENTAL SERVICES	4										
11	555745	ATHLETICS-DW-UND-SUPPLIES	1										
12	555746	ATHLETICS-DW-UND-SUPPLIES	2										
13	555747	CHRISTMAS LIGHTING	1										
14	555748	INTERIOR BLDG MAINT	3										
15	555749	SPED-TUITION-DW-SPED-PROF&TECH	1										
16	555750	SPED-TUITION-DW-SPED-PROF&TECH	2										
17	555751	INTERIOR BLDG MAINT	4										
18	555752	SPED-MEDICAL-DW-SPED-PROF&TECH	4										
19	555753	SPED-TUITNPSCH-DW-SPED-P&T	5										
20	555754	SIGNS AND CONES	1										
21	555755	INTERIOR BLDG MAINT	3										
22	555756	RECREATIONAL SERVICES	6										
23	555757	SPED-SUPPLIES-DW-SPED-SUPPLIES	8										
24	555757	FOOD SUPPLIES & REFRESHMT	1										
25	555758	RECREATION SUPPLIES	4										

Enter formula in cell L2

=COUNTIF(I:I, K2)

Benford's Law Analysis



M2 =L2/$L$11

	G	H	I	J	K	L	M	N	O	P	Q	R	S
1	Check #	Account Desc	Digit		Digit	Actual Count	Actual %	Expected %					
2	555732	SNOW REMOVAL	2		1	224	26.8%	30.1%					
3	555733	ATHLETICS-DW-UND-SUPPLIES	3		2	65		17.6%					
4	555734	MEDICAL/DENTAL SUPPLIES	4		3	100		12.5%					
5	555735	PUBLIC SAFETY SUPPLIES	4			119		9.6%					
6	555736	PROFESSIONL & TECHNCL SVC	2		5	66		7.9%					
7	555737	SNOW REMOVAL	1		6	39		6.7%					
13	555747	CHRISTMAS LIGHTING	1										
14	555748	INTERIOR BLDG MAINT	3										
15	555749	SPED-TUITION-DW-SPED-PROF&TECH	1										
16	555750	SPED-TUITION-DW-SPED-PROF&TECH	2										
17	555751	INTERIOR BLDG MAINT	4										
18	555752	SPED-MEDICAL-DW-SPED-PROF&TECH	4										
19	555753	SPED-TUITNPSCH-DW-SPED-P&T	5										
20	555754	SIGNS AND CONES	1										
21	555755	INTERIOR BLDG MAINT	3										
22	555756	RECREATIONAL SERVICES	6										
23	555757	SPED-SUPPLIES-DW-SPED-SUPPLIES	8										
24	555757	FOOD SUPPLIES & REFRESHMT	1										
25	555758	RECREATION SUPPLIES	4										
26	555760	SS-OIS-DW-REG-PROF&TECH	9										

Calculate the percentage of Actual Count to Total Actual Count.

In cell M2 enter the following formula: =L2/$L$11

Benford's Law Analysis

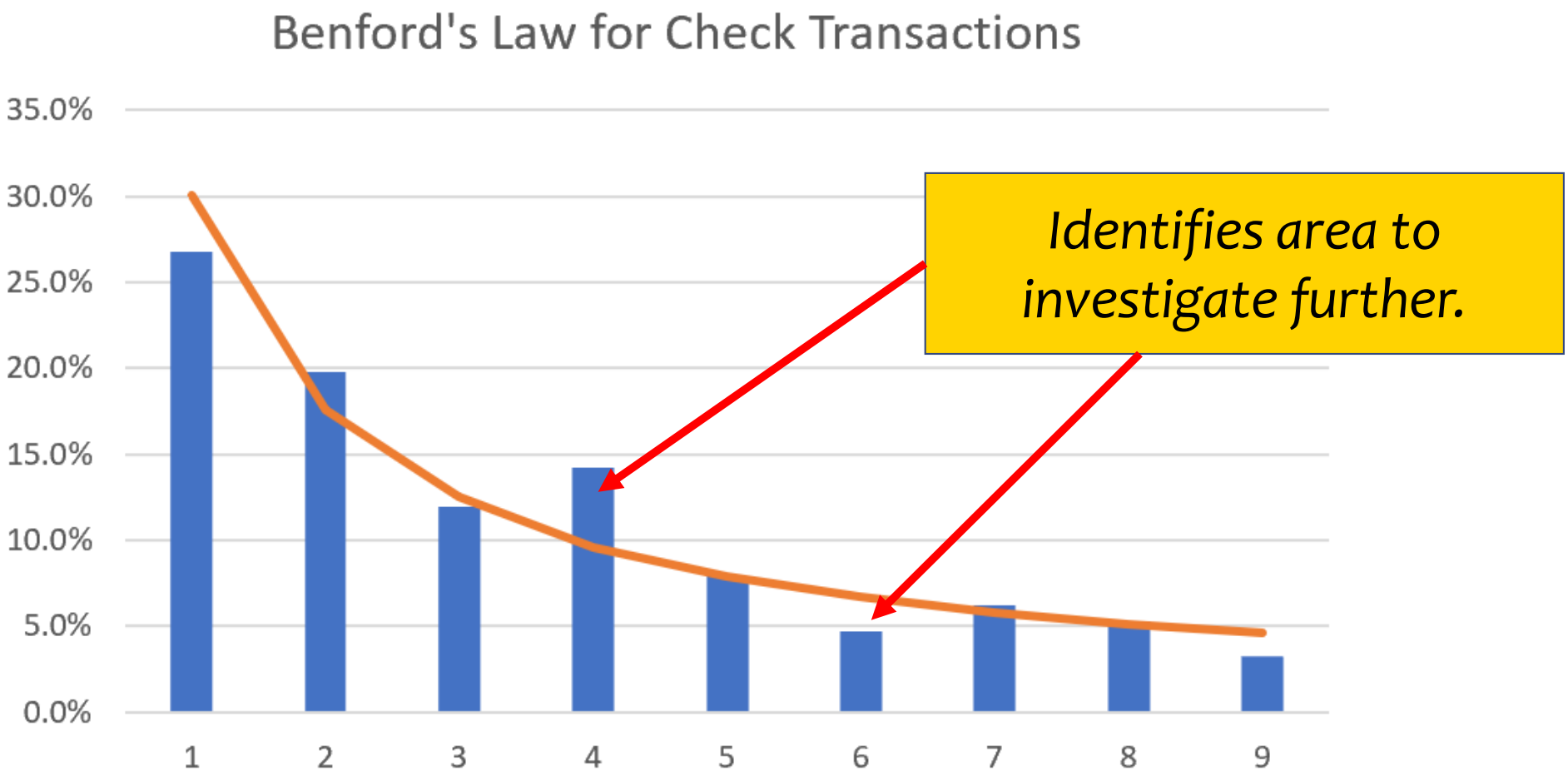
	G	H	I	J	K	L	M	N	O	P	Q	R	S
1	**Check #**	**Account Desc**	**Digit**		**Digit**	**Actual Count**	**Actual %**	**Expected %**					
2	555732	SNOW REMOVAL	2		1	224	26.8%	30.1%					
3	555733	ATHLETICS-DW-UND-SUPPLIES	3		2	165	19.7%	17.6%					
4	555734	MEDICAL/DENTAL SUPPLIES	4		3	100	12.0%	12.5%					
5	555735	PUBLIC SAFETY SUPPLIES	4		4	119	14.2%	9.6%					
6	555736	PROFESSIONL & TECHNCL SVC	2		5	66	7.9%	7.9%					
7	555737	SNOW REMOVAL	1		6	39	4.7%	6.7%					
8	555739	TEXTBOOKS	2		7	52	6.2%	5.8%					
9	555741	SHS-PSYCH-SHS-REG-PROF&TECH	2		8	44	5.3%	5.1%					
10	555742	MEDICAL & DENTAL SERVICES	4		9	27	3.2%	4.6%					
11	555745	ATHLETICS-DW-UND-SUPPLIES	1			836							
12	555746	ATHLETICS-DW-UND-SUPPLIES	2										
13	555747	CHRISTMAS LIGHTING	1										
14	555748	INTERIOR BLDG MAINT	3										
15	555749	SPED-TUITION-DW-SPED-PROF&TECH	1										
16	555750	SPED-TUITION-DW-SPED-PROF&TECH	2										
17	555751	INTERIOR BLDG MAINT	4										
18	555752	SPED-MEDICAL-DW-SPED-PROF&TECH	4										
19	555753	SPED-TUITNPSCH-DW-SPED-P&T	5										
20	555754	SIGNS AND CONES	1										
21	555755	INTERIOR BLDG MAINT	3										
22	555756	RECREATIONAL SERVICES	6										
23	555757	SPED-SUPPLIES-DW-SPED-SUPPLIES	8										
24	555757	FOOD SUPPLIES & REFRESHMT	1										
25	555758	RECREATION SUPPLIES	4										
26	555760	SS-OIS-DW-REG-PROF&TECH	9										
27	555762	RECREATION - TRANSPORTATION	3										
28	555762	RECREATION-TRANSPORTATN.	2										

Benford's Law Analysis

	G	H	I	J	K	L	M	N	O	P	Q	R	S
1	**Check #**	**Account Desc**	**Digit**		**Digit**	**Actual Count**	**Actual %**	**Expected %**					
2	555732	SNOW REMOVAL	2		1	224	26.8%	30.1%					
3	555733	ATHLETICS-DW-UND-SUPPLIES	3		2	165	19.7%	17.6%					
4	555734	MEDICAL/DENTAL SUPPLIES	4		3	100	12.0%	12.5%					
5	555735	PUBLIC SAFETY SUPPLIES	4		4	119	14.2%	9.6%					
6	555736	PROFESSIONL & TECHNCL SVC	2		5	66	7.9%	7.9%					
7	555737	SNOW REMOVAL	1		6	39	4.7%	6.7%					
8	555739	TEXTBOOKS	2		7	52	6.2%	5.8%					
9	555741	SHS-PSYCH-SHS-REG-PROF&TECH	2		8	44	5.3%	5.1%					
10	555742	MEDICAL & DENTAL SERVICES	4		9	27	3.2%	4.6%					
11	555745	ATHLETICS-DW-UND-SUPPLIES	1			836							
12	555746	ATHLETICS-DW-UND-SUPPLIES	2										
13	555747	CHRISTMAS LIGHTING	1										
14	555748	INTERIOR BLDG MAINT	3										
15	555749	SPED-TUITION-DW-SPED-PROF&TECH	1										
16	555750	SPED-TUITION-DW-SPED-PROF&TECH	2										
17	555751	INTERIOR BLDG MAINT	4										
18	555752	SPED-MEDICAL-DW-SPED-PROF&TECH	4										
19	555753	SPED-TUITNPSCH-DW-SPED-P&T	5										
20	555754	SIGNS AND CONES	1										
21	555755	INTERIOR BLDG MAINT	3										
22	555756	RECREATIONAL SERVICES	6										
23	555757	SPED-SUPPLIES-DW-SPED-SUPPLIES	8										
24	555757	FOOD SUPPLIES & REFRESHMT	1										
25	555758	RECREATION SUPPLIES	4										
26	555760	SS-OIS-DW-REG-PROF&TECH	9										
27	555762	RECREATION - TRANSPORTATION	3										
28	555762	RECREATION-TRANSPORTATN.	2										

Create a Combo Chart

Benford's Law Analysis

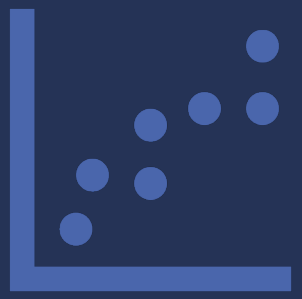


Mac Users: Benford's Law Analysis

The "See All Charts" option does not exist in Excel for Mac. To insert a Combo chart, click on the Insert Tab. Then, click on the "Combo" icon in the chart types and select "Clustered Combo - Line".

Analyzing Data with the Analysis Toolpak

Analytical capability



Statistical analysis

Questions?