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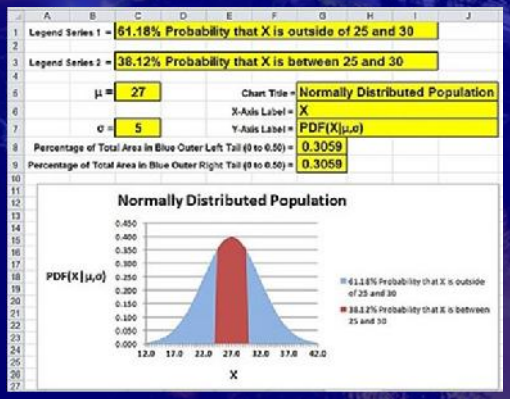
LECTURE 11: EXCEL STATISCTICS



1. INTRODUCTION

1. Definition

- "Statistics is the fun of finding patterns in data; the pleasure of making discoveries; the import of deep philosophical questions; the power to shed light on important decisions, and the ability to guide decisions..... in business, science, government, medicine, industry..." Professor David Hand [Hand, 2009].
- This definition indicates that the discipline of statistics has moved from being grounded firmly in the world of measurement and scientific analysis into the world of exploration, comprehension and decision-making.

2. USAGE

- The usage od statistics has grown enormously, expanding from a relatively small set of specific application areas (such as design of experiments and computation of life insurance premiums) to almost every walk of life.
  - A particular feature of this change is the massive expansion in information (and misinformation) available to all sectors and age-groups in society.
- Understanding this information, and making well-informed decisions on the basis of such understanding, is the primary function of modern statistical methods.
- Statistics are applied every day – in research, industry and government – to become more scientific about decisions that need to be made. For example:

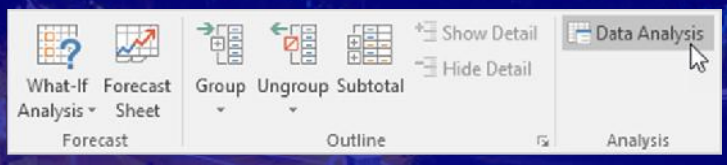
- Manufacturers use statistics to weave quality into beautiful fabrics, to bring lift to the airline industry and to help guitarists make beautiful music.
- Researchers keep children healthy by using statistics to analyze data from the production of viral vaccines, which ensures consistency and safety.
- Communication companies use statistics to optimize network resources, improve service and reduce customer churn by gaining greater insight into subscriber requirements.
- Government agencies around the world rely on statistics for a clear understanding of their countries, their businesses and their people.

2. DESCRIPTIVE STATISTICS

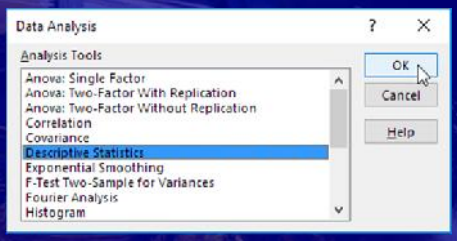
- You can use the Analysis Toolpak add-in to generate **descriptive statistics**. For example, you may have the scores of 15 participants for a test.

Scores				
82	69	88	100	78
93	96	58	93	98
91	61	59	71	65

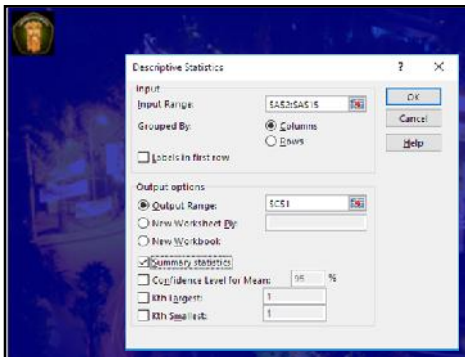
1. On the Data tab, in the Analysis group, click **Data Analysis**.



2. Select Descriptive Statistics and click OK.



3. Select the range A2:A15 as the Input Range.
4. Select cell C1 as the Output Range.
5. Make sure Summary statistics is checked.



2. Click OK

Results:

	A	B	C	D	E
1	Scores		Column1		
2	82				
3	93		Mean	81.21428571	
4	91		Standard Error	4.045318243	
5	69		Median	85	
6	96		Mode	93	
7	61		Standard Deviation	15.13619489	
8	88		Sample Variance	229.1043956	
9	58		Kurtosis	-1.426053506	
10	59		Skewness	-0.402108004	
11	100		Range	42	
12	93		Minimum	58	
13	71		Maximum	100	
14	78		Sum	1137	
15	98		Count	14	
16					

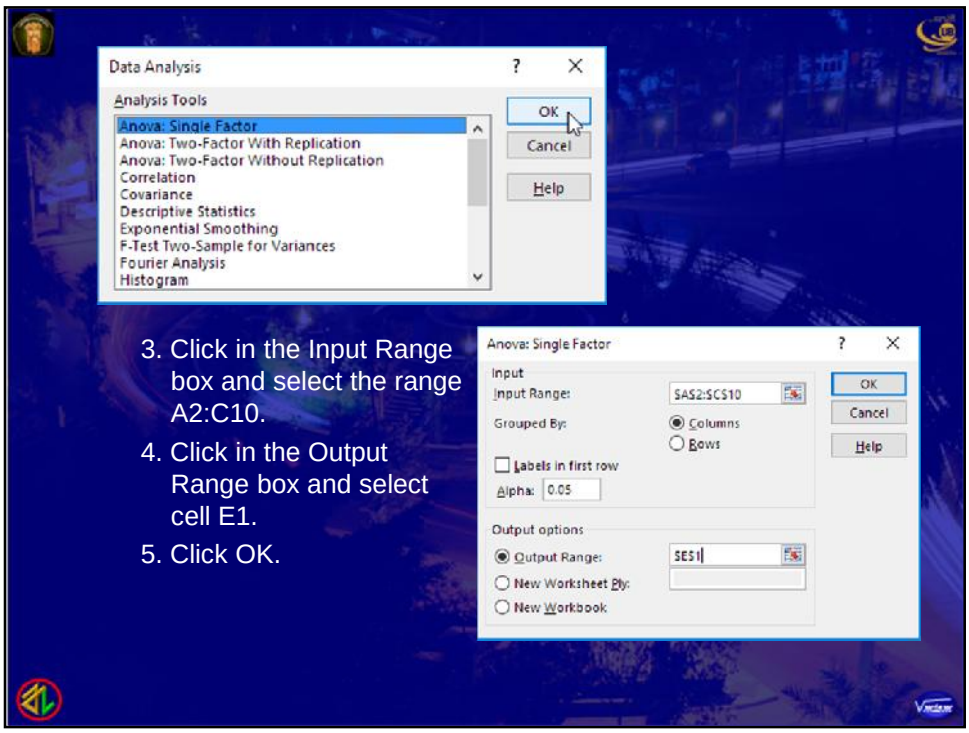
3. ANOVA

1. A single factor

- If there are only two samples, the worksheet function **T.TEST** can be used. With more than two samples, there is no convenient generalization of **T.TEST**, and the Single Factor Anova model can be called upon instead.
- A single factor or one-way ANOVA is used to test the null hypothesis that the means of several populations are all equal.
- Below you can find the salaries of people who have a degree in economics, medicine or history.
- H_0: $\mu_1 = \mu_2 = \mu_3$
  H_1: at least one of the means is different.

Economics	Medicine	History
42	69	35
53	54	40
49	58	53
53	64	42
43	64	50
44	55	39
45	56	55
52		39
54		40

- To perform a single factor **ANOVA**, execute the following steps.
  1. On the Data tab, in the Analysis group, click Data Analysis.
  2. Select Anova: Single Factor and click OK.



3. Click in the Input Range box and select the range A2:C10.
4. Click in the Output Range box and select cell E1.
5. Click OK.

E	F	G	H	I	J	K
Anova: Single Factor						
SUMMARY						
Groups	*Count*	*Sum*	*Average*	*Variance*		
Column 1	9	435	48.33333	23.5		
Column 2	7	420	60	32.33333		
Column 3	9	393	43.66667	50.5		
ANOVA						
Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	1085.84	2	542.92	15.19623	7.16E-05	3.443357
Within Groups	786	22	35.72727			
Total	1871.84	24				

Conclusion: if F > F crit, we reject the null hypothesis. This is the case, 15.196 > 3.443. Therefore, we reject the null hypothesis. The means of the three populations are not all equal. At least one of the means is different. However, the **ANOVA** does not tell you where the difference lies. You need a t-Test to test each pair of means.

3. TWO WAY ANOVA

2. Two Way ANOVA

- A two way ANOVA with replication is performed when you have two groups and individuals within that group are doing more than one thing (i.e. taking two tests). If you only have one group, use a two way ANOVA in Excel without replication.
- The following procedure is steps used in A two way ANOVA with replication.
  1. Click the “Data” tab and then click “Data Analysis.
  2. Click “ANOVA two factor with replication” and then click “OK.” The two way ANOVA window will open.
  3. Type an Input Range into the Input Range box, for example “A1:A25” into the Input Range box. Make sure you include *all* of your data, including headers and group names.

4. Type a number in the “Rows per sample” box.
   - Rows per sample is actually a bit misleading. What this is asking you is how many individuals are in each group. For example, if you have 12 individuals in a group taking two tests (as in the picture below) you would type “12” into the Rows per Sample box.

5. Select an Output Range. For example, click the “new worksheet” radio button to display the data in a new worksheet.
6. Select an alpha level. In most cases, an alpha level of 0.05 (5 percent) works for most tests.
7. Click “OK” to run the two way ANOVA. The data will be returned where you specified in Step 5.
8. Read the results. To figure out if you are going to

No.	Group			
	School A		School B	
	Math	English	Math	English
1.	90	87	81	99
2.	87	89	78	77
3.	78	84	54	71
4.	77	86	55	77
5.	89	99	49	81
6.	98	91	56	96
7.	88	92	79	68
8.	81	99	88	77
9.	84	86	87	90
10.	92	77	89	89
11.	84	71	77	91
12.	89	89	61	69

8. Read the results. To figure out if you are going to reject the null hypothesis or not, you’ll basically be looking at two factors:
   - If the F-value (*f*)is larger than the f critical value (*f crit*)
   - If the *p*-value is smaller than your chosen alpha level

That’s it!

Tip: You don’t *only* have to have two variables to run a two-way ANOVA in Excel 2013. You can also use the same function for three variables, four, five…etc

http://leavingbio.net/TheStructureandFunctionsofFlowers%5B1%5D.htm