

CSE 123

Introduction to Computing

Lecture 4

Linear Regression/Curve Fitting and Statistics
Functions/Iteration, Analysis Toolpak, Goal Seek, Pivot
Tables, External Data Sources

SPRING 2012

Assist. Prof. A. Evren Tugtas



CSE 123

Introduction to Computing

Linear Regression/ Curve Fitting and Analysis Toolpak

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Linear Regression

- “Linear” term in linear regression means that the equation used to fit the data points must be linear in the coefficients.
- “Regression” part involves fitting the coefficients that produce the “best fit” of the regression model
- Linear regression attempts to model the relationship between two variables by fitting a linear equation to observed data.

Linear Regression

- Built-in regression functions
- Adding trendlines to graphs
- Using regression analysis package

Excel's Built-in Regression Functions

- SLOPE () → calculates the slope
- INTERCEPT () → finds the intercept of the best fit straight line
- RSQ() → Calculates the coefficient of determination or R^2

Regression

- Give names to cell ranges

time		fx		0
	A	B	C	D
1	Time (min)	Temp (K)		
2	0	298		Slope
3	1	299		Intercept
4	2	301		R ²
5	3	304		
6	4	306		
7	5	309		
8				

Regression

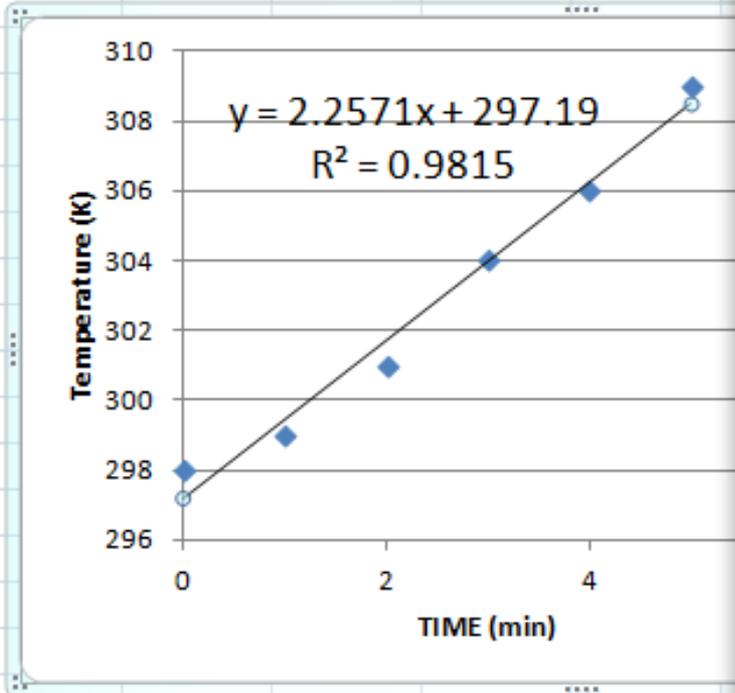
Clipboard		Font				
E3		fx =INTERCEPT(temp, time)				
	A	B	C	D	E	F
1	Time (min)	Temp (K)				
2	0	298		Slope	2.257143	
3	1	299		Intercept	297.1905	
4	2	301		R ²	0.981547	
5	3	304				
6	4	306				
7	5	309				

$$=SLOPE(y, x)$$

$$=INTERCEPT(y, x)$$

$$=R^2(y, x)$$

	A	B	C	D	E
1	Time (min)	Temp (K)			
2	0	298		Slope	2.257143
3	1	299		Intercept	297.1905
4	2	301		R ²	0.981547
5	3	304			
6	4	306			
7	5	309			



Format Trendline

Trendline Options

- Line Color
- Line Style
- Shadow

Trendline Options

Trend/Regression Type

- Exponential
- Linear
- Logarithmic
- Polynomial Order: 2
- Power
- Moving Average Period: 2

Trendline Name

- Automatic: Linear (Series1)
- Custom: []

Forecast

Forward: 0.0 periods

Backward: 0.0 periods

Set Intercept = 0.0

Display Equation on chart

Display R-squared value on chart

Close

Linear Regression Using Excel's Regression Analysis Package

There are two reasons to use Excel's Regression Package

1. If the regression model is not available as a trendline
2. If you want to know the details of the regression process

Linear Regression Using Excel's Regression Analysis Package

- Excel's Regression Analysis Package is part of the Excel's Analysis Toolpak Add-In
- Office/Excel Option/Add-Ins

Popular

Formulas

Proofing

Save

Advanced

Customize

Add-Ins

Trust Center

Resources



View and manage Microsoft Office add-ins.

Add-ins

Name	Location	Type
Active Application Add-ins		
<i>No Active Application Add-ins</i>		
Inactive Application Add-ins		
Analysis ToolPak	analys32.xll	Excel Add-in
Analysis ToolPak - VBA	atpvbaen.xlam	Excel Add-in
Conditional Sum Wizard	sumif.xlam	Excel Add-in
Custom XML Data	C:\...6)\Microsoft Office\Office12\OFFRHD.DLL	Document Inspector
Date (Smart tag lists)	C:\...es\microsoft shared\Smart Tag\MOFL.DLL	Smart Tag
EndNote (Cwyw Citation Recognizer)	C:\...esearchSoft\Cwyw\13\EndNote Cwyw.dll	Smart Tag
Euro Currency Tools	eurotool.xlam	Excel Add-in
Financial Symbol (Smart tag lists)	C:\...es\microsoft shared\Smart Tag\MOFL.DLL	Smart Tag
Headers and Footers	C:\...6)\Microsoft Office\Office12\OFFRHD.DLL	Document Inspector
Hidden Rows and Columns	C:\...6)\Microsoft Office\Office12\OFFRHD.DLL	Document Inspector
Hidden Worksheets	C:\...6)\Microsoft Office\Office12\OFFRHD.DLL	Document Inspector
Internet Assistant VBA	C:\...rosoft Office\Office12\Library\HTML.XLAM	Excel Add-in
Invisible Content	C:\...6)\Microsoft Office\Office12\OFFRHD.DLL	Document Inspector
Lookup Wizard	lookup.xlam	Excel Add-in
Person Name (Outlook e-mail recipients)	C:\...s\microsoft shared\Smart Tag\FNAME.DLL	Smart Tag
Send to Bluetooth		COM Add-in
Solver Add-in	solver.xlam	Excel Add-in
Document Related Add-ins		

Add-in: Analysis ToolPak

Publisher:

Location: analys32.xll

Description: Provides data analysis tools for statistical and engineering analysis

Manage: Excel Add-ins

Go...

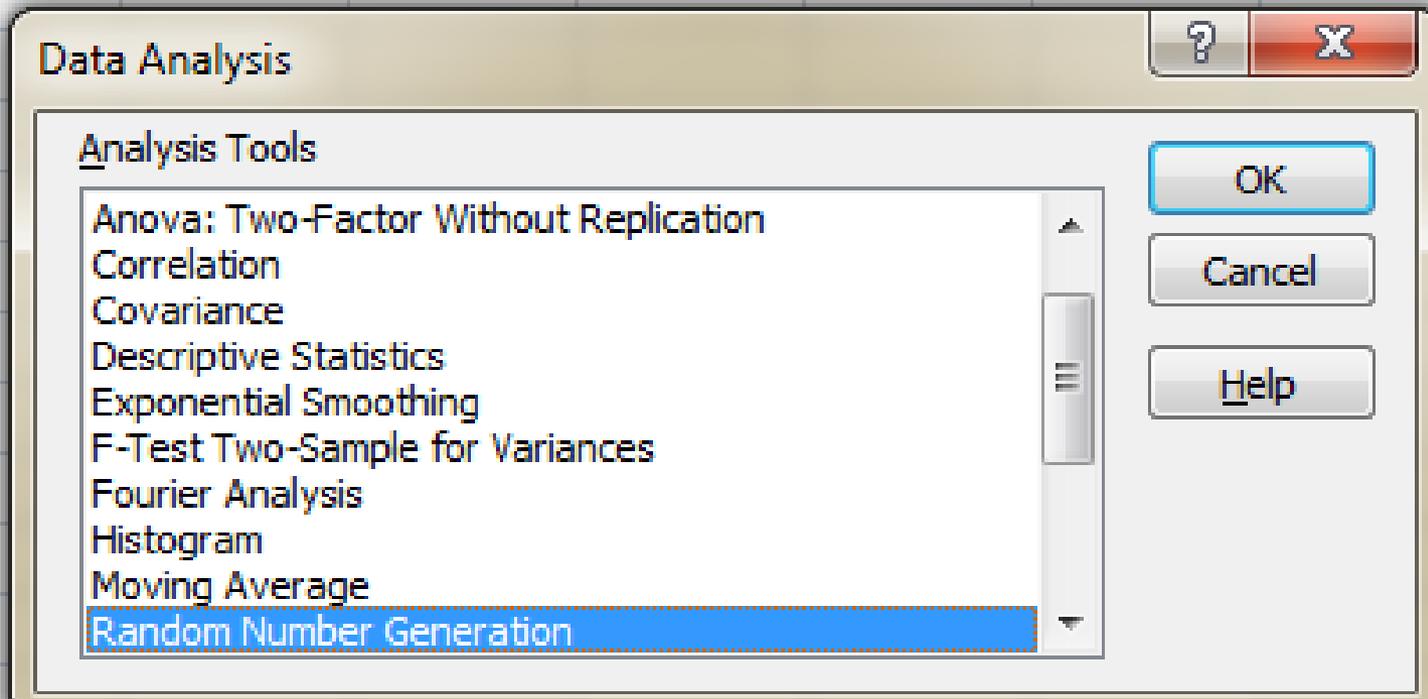
OK

Cancel

Linear Regression Using Excel's Regression Analysis Package

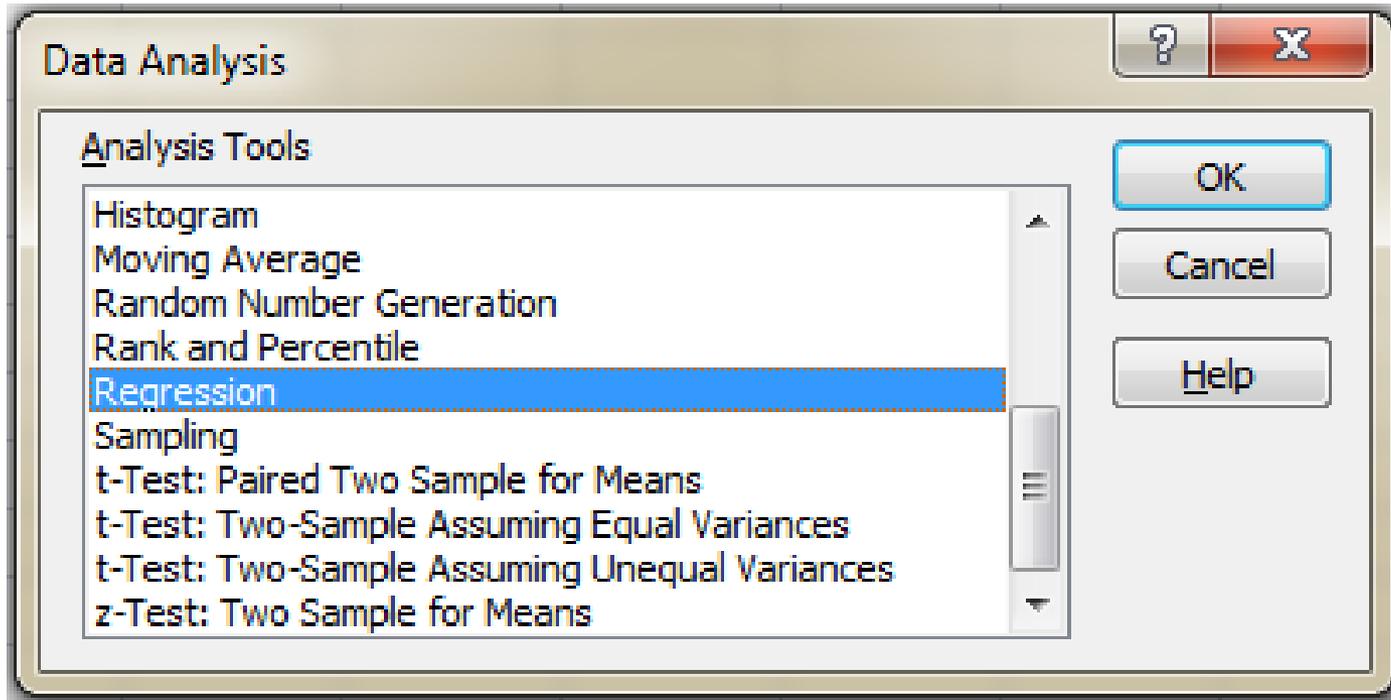
- The Add-Ins panel lists
 - Active application Add-Ins
 - Inactive application Add-Ins
- If the Analysis toolpak is in the Inactive list then,
 - Click on the Analysis toolpak
 - Click the Go button
 - Check the box labeled Analysis toolpak
 - Click the OK button
 - Data Analysis button will appear in the ribbon

- Click on the data analysis button
- Choose regression from the list



Simple Regression Using Analysis Toolpak

- Select “Regression” from Analysis toolpak



Simple Regression Using Analysis Toolpak

Regression

Input

Input Y Range: 

Input X Range: 

Labels Constant is Zero

Confidence Level: %

Output options

Output Range: 

New Worksheet Ply:

New Workbook

Residuals

Residuals Residual Plots

Standardized Residuals Line Fit Plots

Normal Probability

Normal Probability Plots

OK

Cancel

Help

Steps of Simple Regression Using Analysis Toolpak

- 1) Tell excel to find the y values
- 2) Tell Excel to find the x values
- 3) Choose location for the results
- 4) Indicate you want your results to be graphed
- 5) Perform the regression

Regression

y, x values

Input

Input Y Range:

Input X Range:

Labels

Constant is Zero

Confidence Level: %

OK
Cancel
Help

Output options

Output Range:

New Worksheet Ply:

New Workbook

Location for the results

Residuals

Residuals

Standardized Residuals

Residual Plots

Line Fit Plots

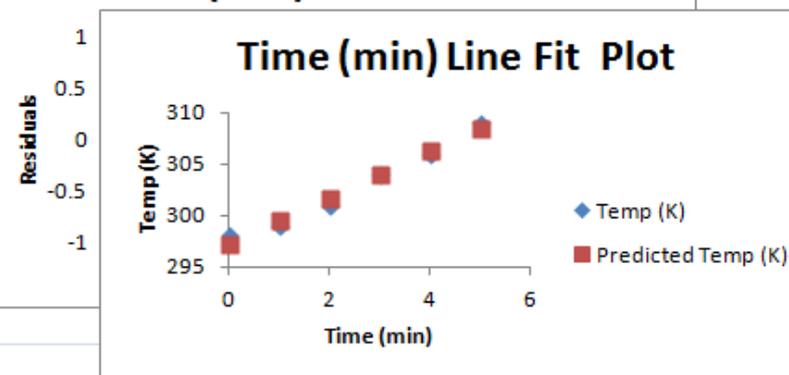
Normal Probability

Normal Probability Plots

Graph

1	SUMMARY OUTPUT								
2									
3	<i>Regression Statistics</i>								
4	Multiple R	0.99073							
5	R Square	0.981547							
6	Adjusted R Square	0.976933							
7	Standard Error	0.647339							
8	Observations	6							
9									
10	ANOVA								
11		<i>df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>Significance F</i>			
12	Regression	1	89.15714	89.15714	212.7614	0.000128			
13	Residual	4	1.67619	0.419048					
14	Total	5	90.83333						
15									
16		<i>Coefficients</i>	<i>Standard Error</i>	<i>t Stat</i>	<i>P-value</i>	<i>Lower 95%</i>	<i>Upper 95%</i>	<i>Lower 95.0%</i>	<i>Upper 95.0%</i>
17	Intercept	297.1905	0.468509	634.3318	3.71E-11	295.8897	298.4913	295.8897	298.4913
18	Time (min)	2.257143	0.154744	14.58634	0.000128	1.827506	2.68678	1.827506	2.68678
19									
20									
21									
22	RESIDUAL OUTPUT								
23									
24	<i>Observation</i>	<i>Actual Temp</i>	<i>Residuals</i>						
25	1	297.1905	0.809524						
26	2	299.4476	-0.44762						
27	3	301.7048	-0.70476						
28	4	303.9619	0.038095						
29	5	306.219	-0.21905						
30	6	308.4762	0.52381						
31									

Time (min) Residual Plot



CSE 123

Introduction to Computing

Statistics Functions/Iteration, Goal Seek, Solver

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Statistics Functions

- `=AVERAGE()`
- Variance and standard deviation provide information about the spread of the values.
- Small variance/Standard Deviation: data are closely clustered around the mean
- Large variance/Standard Deviation: wide range of values in the data set
- Standard deviation = $\text{SQRT}(\text{variance})$

Statistics Functions

- Standard deviation: =STDEV()
- Variance: =VAR()
- Analysis toolpak can be used to perform other statistical analysis such as t-test and ANOVA

Iteration

- Several methods have been used to find iterative solutions;
 - Excel's Goal Seek Feature
 - Excel's Solver

Excel's Goal Seek

- Goal seek feature allows you to solve problems backwards.
- Examples:
- Velocity in the pipe should not exceed 3 m/s; what pipe diameter is required to keep this velocity?
- To use Goal Seek, you need to know the answer you want.

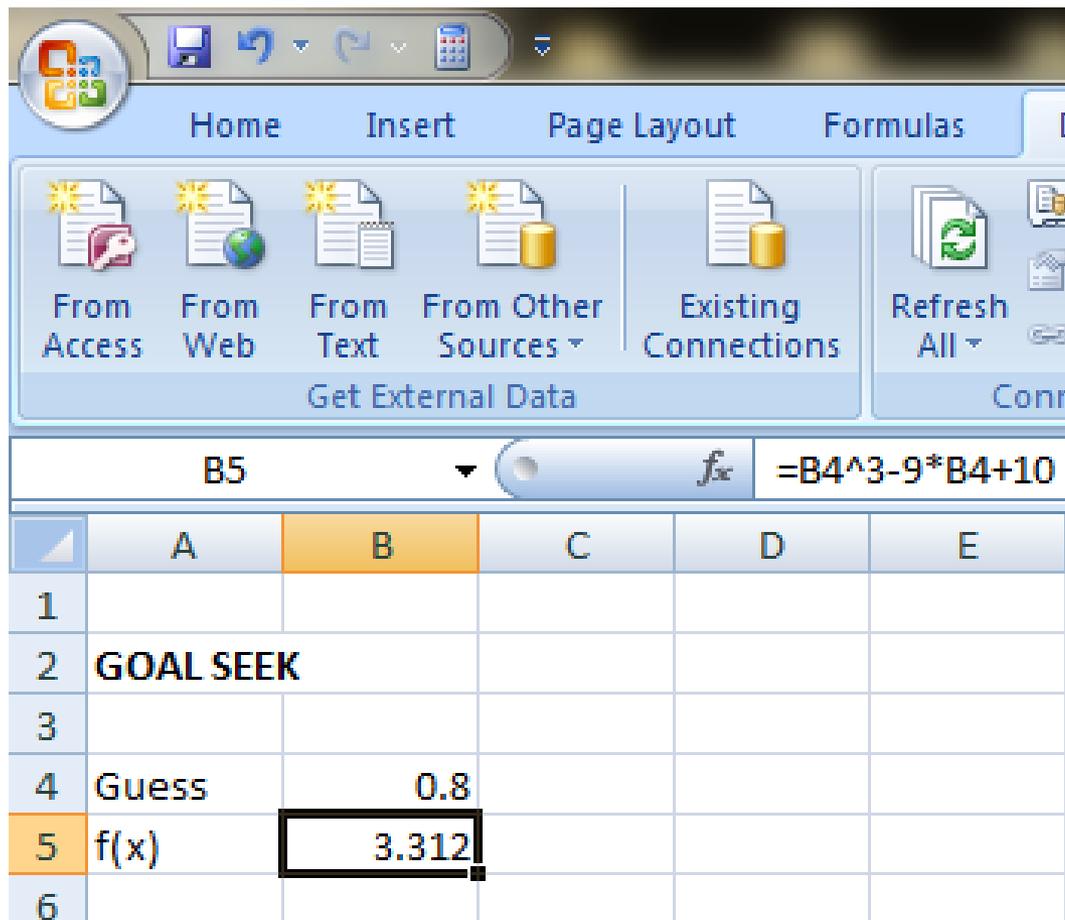
Excel's Goal Seek

- To use Goal Seek, you need a cell to hold guess value and another cell to contain a formula that computes the results
- To open Goal Seek;

Data/Data Tools/What-If Analysis/Goal Seek

Excel's Goal Seek - Example

$$f(x) = x^3 - 9x + 10$$



The screenshot shows the Excel interface with the 'Formulas' ribbon selected. The 'Data Table' group is active, and the 'Goal Seek' tool is being used. The formula bar displays the function $f(x) = B4^3 - 9*B4 + 10$. The spreadsheet shows a table with the following data:

	A	B	C	D	E
1					
2		GOAL SEEK			
3					
4	Guess	0.8			
5	f(x)	3.312			
6					

Excel's Goal Seek - Example

The screenshot shows the Microsoft Excel interface with the 'Data' tab selected. The ribbon includes 'Get External Data' and 'Connections' groups. The spreadsheet area shows columns A through G and rows 1 through 9. Cell B4 is highlighted with a dashed border and contains the value '0.8'. Cell B5 contains the value '3.312'. The 'Goal Seek' dialog box is open, displaying the following settings:

Field	Value
Set cell:	\$B\$5
To value:	0
By changing cell:	\$B\$4

Buttons for 'OK' and 'Cancel' are visible at the bottom of the dialog box.

Excel's Goal Seek - Example

The screenshot displays the Microsoft Excel interface with the 'Data' tab selected. The formula bar shows the formula for cell B5: $=B4^3-9*B4+10$. The spreadsheet contains the following data:

	A	B	C	D	E	F	G
1							
2		GOAL SEEK					
3							
4	Guess	1.449129					
5	f(x)	0.000973					
6							
7							
8							
9							

The 'Goal Seek Status' dialog box is open, displaying the following information:

- Goal Seeking with Cell B5 found a solution.
- Target value: 0
- Current value: 0.000972691

Buttons: Step, Pause, OK, Cancel.

Excel's Solver

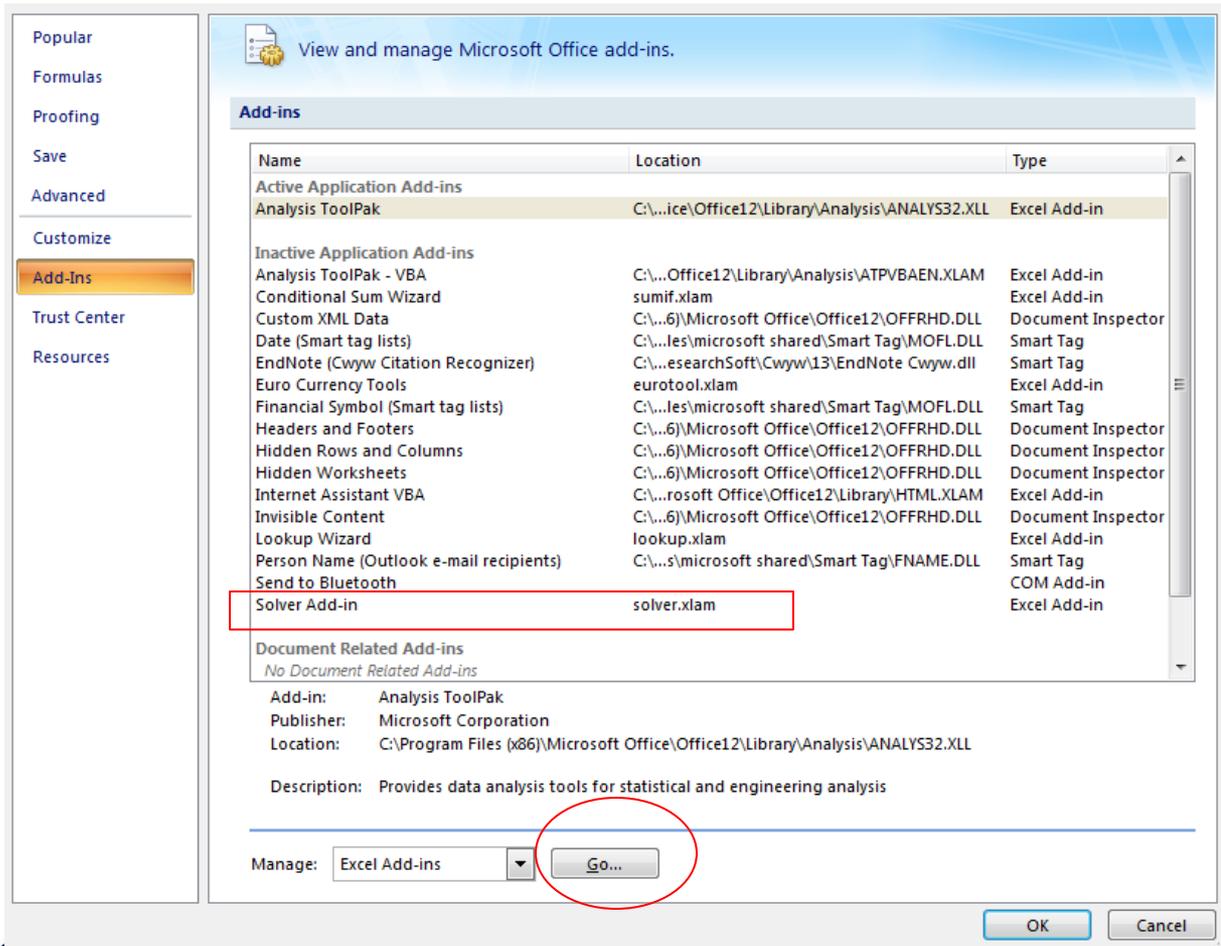
- Excel provides a very powerful iteration tool called Solver.
- Solver is an Add-In that installed but not activated by default when Excel is installed.
- If solver is already activated, you would see button labeled “Solver” at

Data/Data Analysis/Solver

Excel's Solver

If solver is not activated

Office/Excel Options/Add-Ins/Solver Add-In/Go



Excel's Solver

- Similar to Goal Seek, Excel requires the equation to be written.

The screenshot shows the Excel Solver Parameters dialog box overlaid on a spreadsheet. The spreadsheet has columns A through J and rows 1 through 14. The Solver Parameters dialog box is configured as follows:

- Set Target Cell:** \$B\$5
- Equal To:** Max Min Value of: 0
- By Changing Cells:** \$B\$4
- Subject to the Constraints:** (Empty list)

The spreadsheet data is as follows:

	A	B	C	D	E	F	G	H	I	J
1										
2	SOLVER									
3										
4	Guess	0.8								
5	f(x)	3.312								
6										
7										
8										
9										
10										
11										
12										
13										
14										

Excel's Solver

The screenshot displays the Microsoft Excel interface with the Solver Results dialog box open. The dialog box contains the following text and options:

Solver Results

Solver found a solution. All constraints and optimality conditions are satisfied.

Reports

- Answer
- Sensitivity
- Limits

Keep Solver Solution

Restore Original Values

Buttons: OK, Cancel, Save Scenario..., Help

The background spreadsheet shows the following data:

	A	B	C	D	E	F	G	H	I	J
1										
2	SOLVER									
3										
4	Guess	1.44949								
5	f(x)	-3.2E-07								
6										
7										
8										
9										
10										

Excel's Solver

Microsoft Excel 12.0 Answer Report

Worksheet: [InClass_Exercises.xlsx]Solver

Report Created: 12-Mar-12 6:00:27 PM

Target Cell (Value Of)

Cell	Name	Original Value	Final Value
\$B\$5	f(x)	3.312	-3.19595E-07

Adjustable Cells

Cell	Name	Original Value	Final Value
\$B\$4	Guess	0.8	1.449489861

Constraints

NONE

Microsoft Excel 12.0 Sensitivity Report

Worksheet: [InClass_Exercises.xlsx]Solver

Report Created: 12-Mar-12 6:00:27 PM

Adjustable Cells

Cell	Name	Final Value	Reduced Gradient
\$B\$4	Guess	1.449489861	0

Constraints

NONE

Microsoft Excel 12.0 Limits Report

Worksheet: [InClass_Exercises.xlsx]Limits Report 1

Report Created: 12-Mar-12 6:00:27 PM

Target		
Cell	Name	Value
\$B\$5	f(x)	-3.19595E-07

Adjustable		Lower Target	Upper Target
Cell	Name	Limit	Result
\$B\$4	Guess	#N/A	#N/A

Excel's Solver

- You can add constraints to the Solver

The screenshot shows the Excel Solver Parameters dialog box overlaid on a spreadsheet. The spreadsheet has columns A and B, and rows 1 through 12. Cell B5 contains the formula $=B4^3-9*B4+10$. The Solver Parameters dialog box is configured as follows:

- Set Target Cell: $\$B\5
- Equal To: Max Min Value of: 0
- By Changing Cells: $\$B\4
- Subject to the Constraints: $\$B\$4 \leq 3$

The dialog box includes buttons for Solve, Close, Options, Reset All, and Help. The spreadsheet shows the following data:

	A	B
1		
2	SOLVER	
3		
4	Guess	1.44949
5	f(x)	-3.2E-07
6		
7		
8		
9		
10		
11		
12		

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Introduction to Computing

Pivot Tables

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Pivot Tables

- It is a summary table for large data sets
- Pivot tables can be easily modified to get different views of a table
- You need to have a large data set with number of columns and rows

Pivot Tables

	A	B	C	D	E	F
1	Date	Time (Day)	Voltage (m.V)	Current (m.Amp)	External Resistance (ohm)	Power (m.Watt)
2	13-09-10 11:47	0.491	-11.05314268	-1.023439137	10.8	0.011312967
3	13-09-10 12:07	0.505	-10.86271805	-1.005807227	10.8	0.010927088
4	13-09-10 12:27	0.519	-10.67485328	-0.988412341	10.8	0.01055165
5	13-09-10 12:47	0.533	-10.6828125	-0.989149306	10.8	0.010568116
6	13-09-10 13:07	0.547	-10.54657378	-0.976534609	10.8	0.010299961
7	13-09-10 13:27	0.560	-10.53746612	-0.975691307	10.8	0.010282005
8	13-09-10 13:47	0.574	-9.970020286	-0.923150026	10.8	0.009653149
9	13-09-10 14:07	0.588	-0.365612061	-0.033852969	10.8	1.23802E-05
10	13-09-10 14:27	0.602	-0.365376	-0.033831111	10.8	1.23639E-05
11	13-09-10 14:47	0.616	-0.367713998	-0.034047592	10.8	1.25218E-05
12	13-09-10 15:07	0.630	-0.371080699	-0.034359324	10.8	1.2752E-05
13	13-09-10 15:27	0.644	-0.369211687	-0.034186267	10.8	1.26644E-05
14	13-09-10 15:47	0.658	-0.337944325	-0.031291141	10.8	1.05785E-05
15	13-09-10 16:07	0.672	-0.348478493	-0.032266527	10.8	1.12473E-05
16	13-09-10 16:27	0.685	-0.351403779	-0.032537387	10.8	1.14415E-05
17	13-09-10 16:47	0.699	-0.355738074	-0.032938711	10.8	1.17198E-05
18	13-09-10 17:07	0.713	-0.359724273	-0.033307803	10.8	1.19834E-05
19	13-09-10 17:27	0.727	-0.362097876	-0.033527581	10.8	1.21422E-05
20	13-09-10 17:47	0.741	-0.378379522	-0.035035141	10.8	1.32769E-05
21	13-09-10 18:07	0.755	-0.391726779	-0.036270998	10.8	1.42109E-05
22	13-09-10 18:27	0.769	-0.393030412	-0.036391705	10.8	1.43067E-05
23	13-09-10 18:47	0.783	-0.391551663	-0.036254784	10.8	1.4198E-05
24	13-09-10 19:07	0.797	-0.387779429	-0.035905503	10.8	1.39259E-05
25	13-09-10 19:27	0.810	-0.388928269	-0.036011877	10.8	1.4007E-05
26	13-09-10 10:47	0.824	0.396216771	0.025760912	10.8	1.39146E-05

Pivot Table

■ Insert/Pivot Table

	A	B	C	D	E	F
1	Date	Time (Day)	Voltage (m.V)	Current (m.Amp)	Resistance (ohm)	Power (m.Watt)
2	13-09-10 11:47	0.491	-11.05314268	-1.023439137	10.8	0.011312967
3	13-09-10 12:07	0.505	-10.86271805	-1.005807227	10.8	0.010927088
4	13-09-10 12:27	0.519	-10.67485328	-0.988412341	10.8	0.01055165
5	13-09-10 12:47	0.533				0.010568116
6	13-09-10 13:07	0.547				0.010299961
7	13-09-10 13:27	0.560				0.010282005
8	13-09-10 13:47	0.574				0.009653149
9	13-09-10 14:07	0.588				2.3802E-05
10	13-09-10 14:27	0.602				2.3639E-05
11	13-09-10 14:47	0.616				2.5218E-05
12	13-09-10 15:07	0.630				1.2752E-05
13	13-09-10 15:27	0.644				2.6644E-05
14	13-09-10 15:47	0.658				5.0578E-05
15	13-09-10 16:07	0.672				1.2473E-05
16	13-09-10 16:27	0.685				1.4415E-05
17	13-09-10 16:47	0.699				1.7198E-05
18	13-09-10 17:07	0.713				1.9834E-05
19	13-09-10 17:27	0.727				1.21422E-05
20	13-09-10 17:47	0.741				1.2776E-05

Create PivotTable

Choose the data that you want to analyze

Select a table or range

Table/Range: Sheet5!\$A\$1:\$F\$39

Use an external data source

Choose Connection...

Connection name:

Choose where you want the PivotTable report to be placed

New Worksheet

Existing Worksheet

Location:

OK Cancel

A screenshot of Microsoft Excel showing a PivotTable named "PivotTable1" and the "PivotTable Field List" task pane. The PivotTable is currently empty, with the instruction: "To build a report, choose fields from the PivotTable Field List".

The PivotTable Field List pane is open on the right side of the screen. It contains the following sections:

- Choose fields to add to report:** A list of fields with checkboxes: Date, Time (Day), Voltage (m.V), Current (m.Amp), External Resistance (ohm), and Power (m.Watt). All checkboxes are currently unchecked.
- Drag fields between areas below:** Four empty boxes for organizing fields:
 - Report Filter:** Represented by a funnel icon.
 - Column Labels:** Represented by a grid icon.
 - Row Labels:** Represented by a grid icon.
 - Values:** Represented by a summation symbol (Σ).
- Defer Layout Update:** A checkbox at the bottom left, which is currently unchecked.
- Update:** A button at the bottom right.

	A	B	J	K	L	M	N
2							
3	Row Labels	Sum of Current (m.Amp)					
4	13-09-10 11:47	-1.023439137					
5	13-09-10 12:07	-1.005807227					
6	13-09-10 12:27	-0.988412341					
7	13-09-10 12:47	-0.989149306					
8	13-09-10 13:07	-0.976534609					
9	13-09-10 13:27	-0.975691307					
10	13-09-10 13:47	-0.923150026					
11	13-09-10 14:07	-0.033852969					
12	13-09-10 14:27	-0.033831111					
13	13-09-10 14:47	-0.034047592					
14	13-09-10 15:07	-0.034359324					
15	13-09-10 15:27	-0.034186267					
16	13-09-10 15:47	-0.031291141					
17	13-09-10 16:07	-0.032266527					
18	13-09-10 16:27	-0.032537387					
19	13-09-10 16:47	-0.032938711					
20	13-09-10 17:07	-0.033307803					
21	13-09-10 17:27	-0.033527581					
22	13-09-10 17:47	-0.035035141					
23	13-09-10 18:07	-0.036270998					
24	13-09-10 18:27	-0.036391705					
25	13-09-10 18:47	-0.036254784					
26	13-09-10 19:07	-0.035905503					
27	13-09-10 19:27	-0.036011877					
28	13-09-10 19:47	-0.035760812					
29	13-09-10 20:07	-0.036216793					
30	13-09-10 20:27	-0.035574014					
31	13-09-10 20:47	-0.035514766					
32	13-09-10 21:07	-0.035347145					
33	13-09-10 21:27	-0.0356926					

PivotTable Field List

Choose fields to add to report:

- Date**
- Time (Day)
- Voltage (m.V)
- Current (m.Amp)**
- External Resistance (ohm)
- Power (m.Watt)

Drag fields between areas below:

Report Filter Column Labels

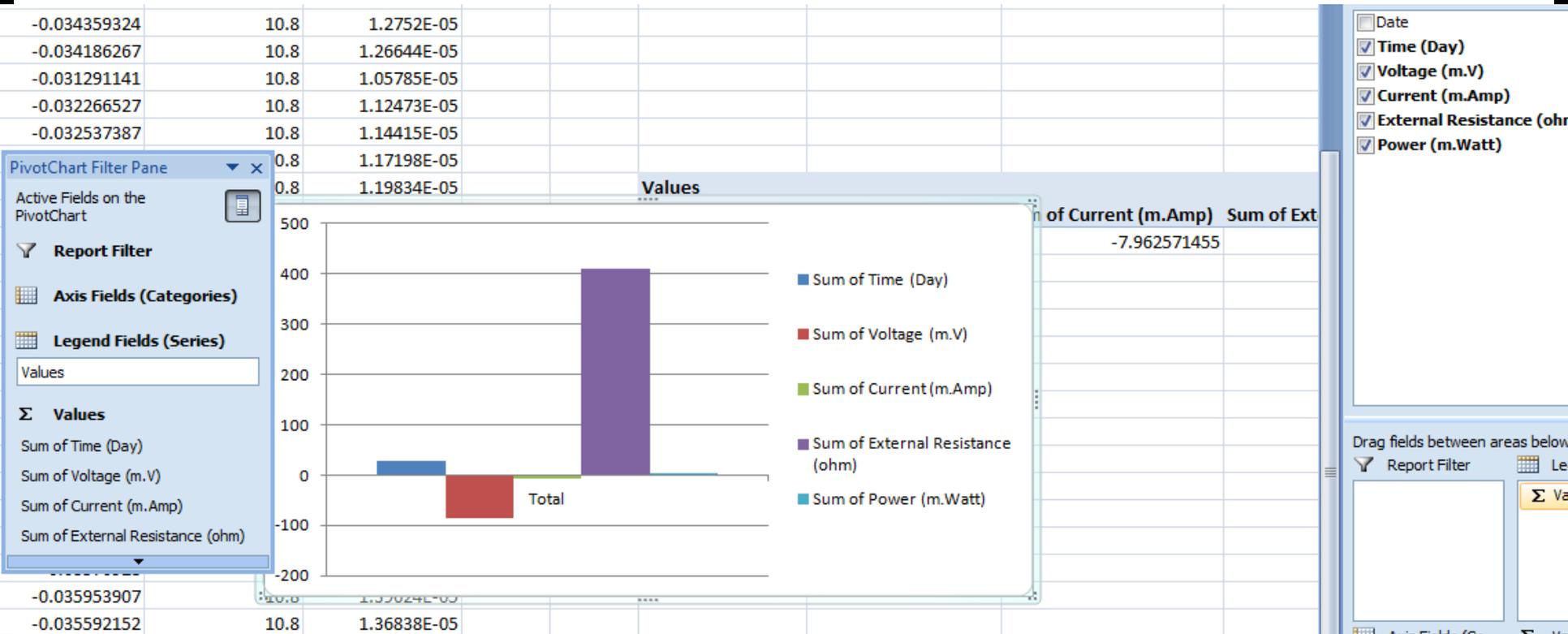
Row Labels Values

Date Sum of Curre...

Defer Layout Update Update



PIVOT CHARTS



CSE 123

Introduction to Computing

External Data Sources

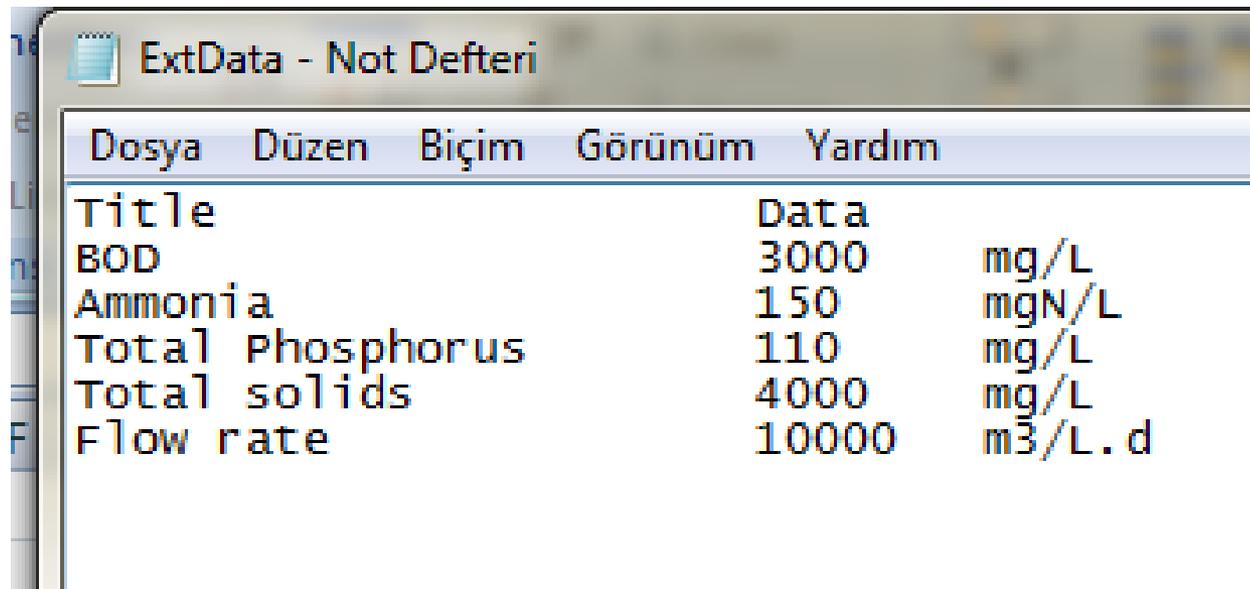
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External Data Sources

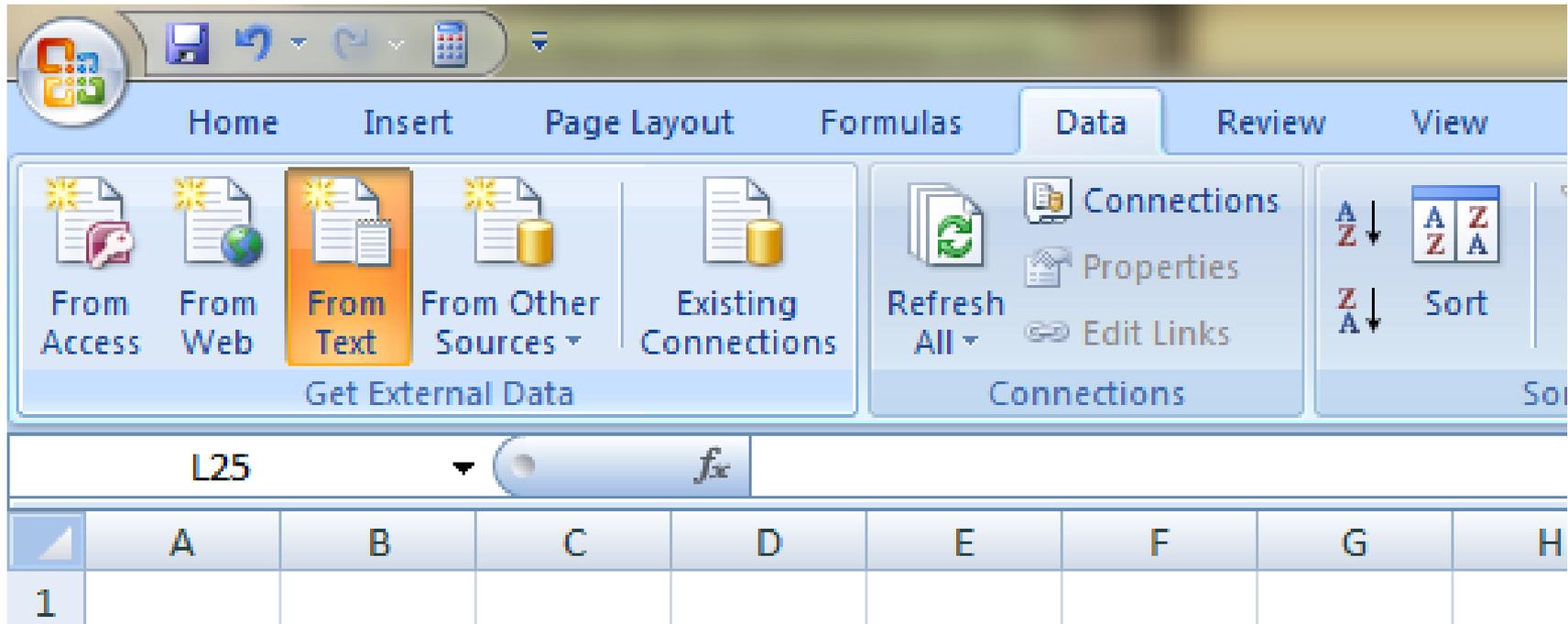
- Data file used as an input to an Excel Worksheet
- Excel is updated whenever the external data changes
- Create a text file (Use tab to limit data)



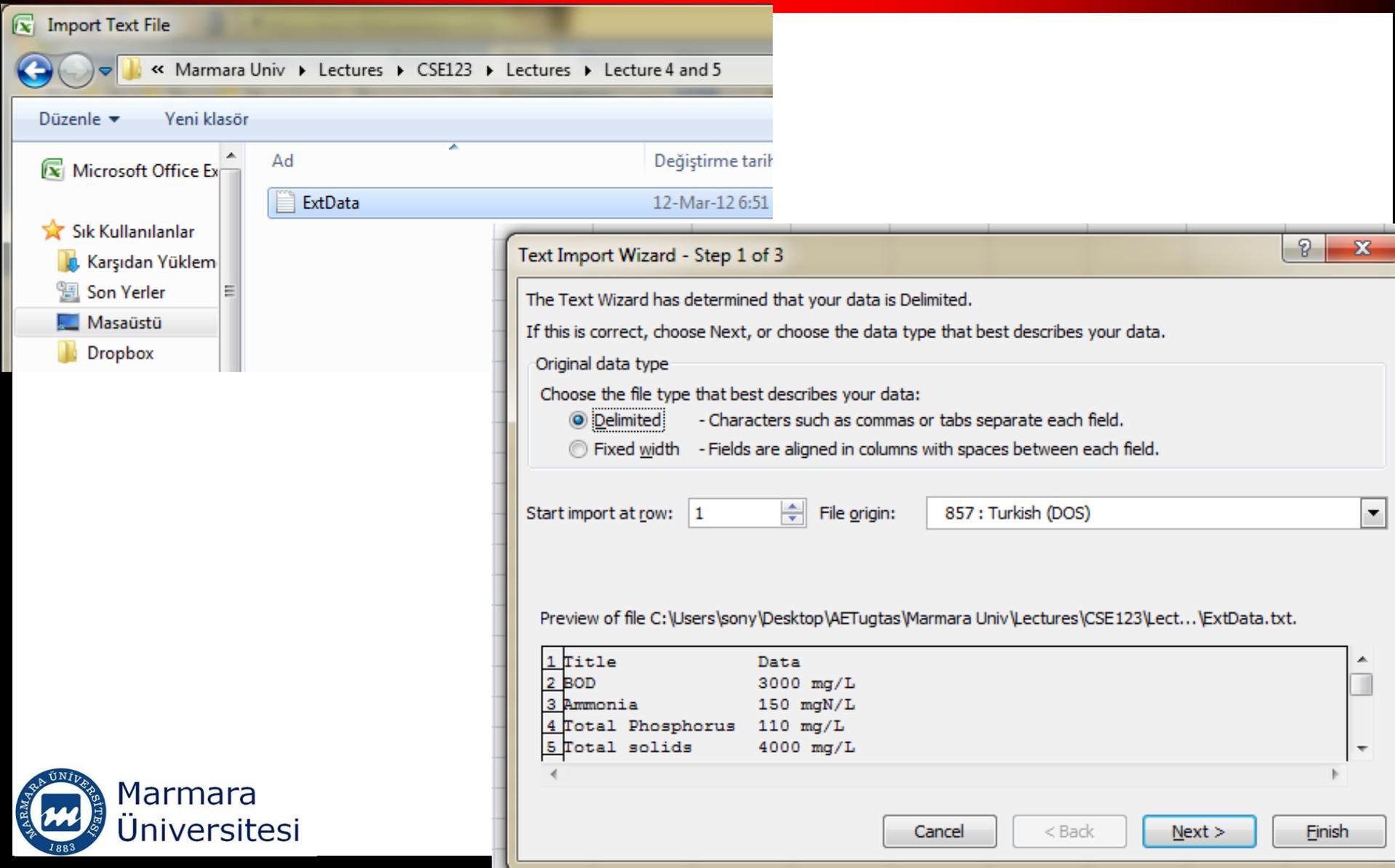
Dosya	Düzen	Biçim	Görünüm	Yardım
title			Data	
BOD		3000	mg/L	
Ammonia		150	mgN/L	
Total Phosphorus		110	mg/L	
Total solids		4000	mg/L	
Flow rate		10000	m ³ /L.d	

External Data Sources

- Data/Get External Data/From Text



External Data Sources



The image shows a Windows Explorer window displaying a folder structure: Marmara Univ > Lectures > CSE123 > Lectures > Lecture 4 and 5. A file named 'ExtData' is selected, with a modification date of 12-Mar-12 6:51. Overlaid on this is the 'Text Import Wizard - Step 1 of 3' dialog box. The wizard indicates that the data is delimited and offers two options: 'Delimited' (selected) and 'Fixed width'. The 'Start import at row' is set to 1, and the 'File origin' is set to '857 : Turkish (DOS)'. A preview of the file content is shown below, displaying a table with 5 rows of data.

Text Import Wizard - Step 1 of 3

The Text Wizard has determined that your data is Delimited.
If this is correct, choose Next, or choose the data type that best describes your data.

Original data type

Choose the file type that best describes your data:

- Delimited - Characters such as commas or tabs separate each field.
- Fixed width - Fields are aligned in columns with spaces between each field.

Start import at row: 1 File origin: 857 : Turkish (DOS)

Preview of file C:\Users\sony\Desktop\AETugtas\Marmara Univ\Lectures\CSE123\Lect...\ExtData.txt.

1	Title	Data
2	BOD	3000 mg/L
3	Ammonia	150 mgN/L
4	Total Phosphorus	110 mg/L
5	Total solids	4000 mg/L

Buttons: Cancel, < Back, Next >, Finish

External Data

Text Import Wizard - Step 2 of 3

This screen lets you set the delimiters your data contains. You can see how your text is affected in the preview below.

Delimiters

Tab
 Semicolon
 Comma
 Space
 Other:

Treat consecutive delimiters as one

Text qualifier: ▼

Data preview

Title			Data	
BOD			3000	mg/L
Ammonia			150	mgN/L
Total Phosphorus	110	mg/L		
Total solids		4000	mg/L	

Cancel < Back Next > Finish

External Data

Text Import Wizard - Step 3 of 3

This screen lets you select each column and set the Data Format.

Column data format

General
 Text
 Date: DMY
 Do not import column (skip)

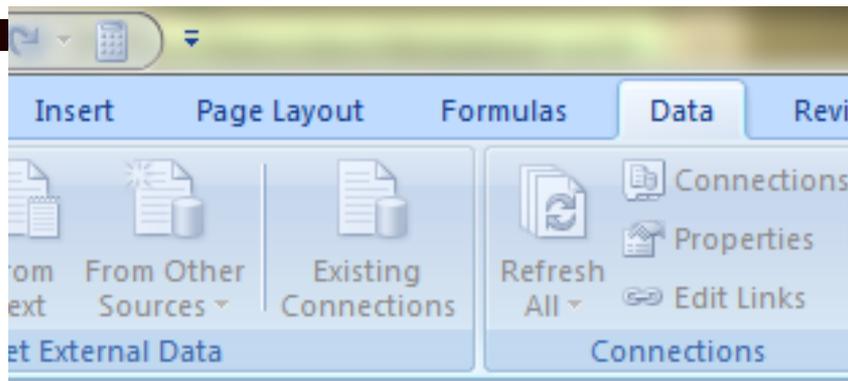
'General' converts numeric values to numbers, date values to dates, and all remaining values to text.

Advanced...

Data preview

General	Gener	Gener	Genera	General
Title			Data	
BOD			3000	mg/L
Ammonia			150	mgN/L
Total Phosphorus	110	mg/L		
Total solids		4000	mg/L	

Cancel < Back Next > Finish



	B	C	D	E	F
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					
13					
14					
15					
16					
17					
18					

External Data Range Properties

Name: ExtData_1

Query definition

- Save query definition
- Save password

Refresh control

- Prompt for file name on refresh
- Refresh every 5 minutes
- Refresh data when opening the file
- Remove external data from worksheet before closing

Data formatting and layout

- Include field names
- Preserve column sort/filter/layout
- Include row numbers
- Preserve cell formatting
- Adjust column width

If the number of rows in the data range changes upon refresh:

- Insert cells for new data, delete unused cells
- Insert entire rows for new data, clear unused cells
- Overwrite existing cells with new data, clear unused cells

- Fill down formulas in columns adjacent to data

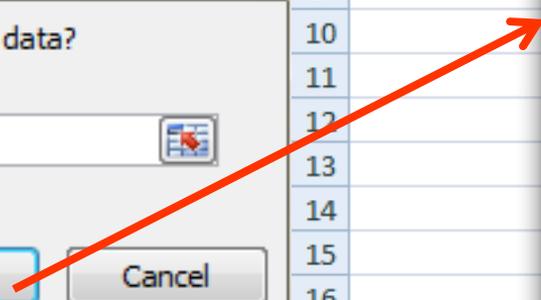
OK Cancel

Import Data

Where do you want to put the data?

- Existing worksheet:
=ExternalData!\$A\$3
- New worksheet

Properties... OK Cancel



Home Insert Page Layout Formulas

From Access From Web From Text From Other Sources Existing Connections Refresh All

Get External Data

G10 f_x

	A	B	C	D	E
1					
2					
3	Title		Data		
4	BOD		3000 mg/L		
5	Ammonia		150 mgN/L		
6	Total Phosphorus		110 mg/L		
7	Total solids		4000 mg/L		
8	Flow rate		10000 m3/L.d		
9					
10					
11					