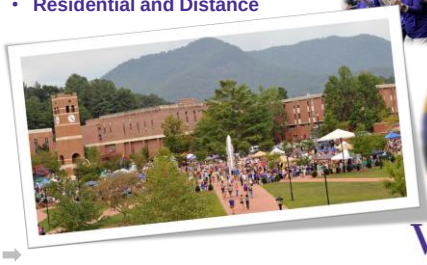
"Power" Tools for IR Reporting

David Onder and Alison Joseph

AIR Annual Forum 2014

- 10,107 students
- Master's Comprehensive
- Mountain location
- Residential and Distance



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Outcomes for workshop

You will:

- leave with a meaningful understanding of the capabilities of the "Power" tools from Microsoft
- learn basic techniques for leveraging multiple software systems to simplify and streamline reporting
- be able to apply basic techniques leveraging the power of Power Pivot, Power View, and Power Map
- have a roadmap for reproducing these concepts into their own offices

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Assumptions for workshop

- Familiarity with Excel
- Comfortable with basic functions (SUM, IF, etc.)
- Desire to connect to “dynamic” data

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Why Pivot Tables

- Summarize large datasets
- Quickly add, remove, rearrange elements
- (Little to) No formula-writing
- Can be a basis for self-service data
- Can connect to a refreshable data source

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Limitations of Pivot Tables

- Connected to only 1 table
- Formatting not maintained
- Calculated fields need to be created for each Pivot Table
- Can’t count the way universities usually want to count

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Connecting to Data

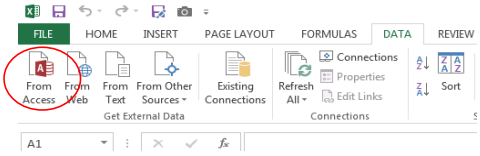
Connecting to Data

- **Wide variety of data sources, including:**
  - Access
  - SQL Server
  - Text files (csv)
  - XML
  - OLEDB
  - Etc.

Connecting to Data

- **Connects to:**
  - Tables
  - Queries

Connecting to Data



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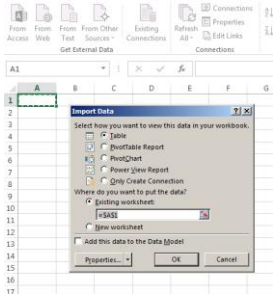
Connecting to Data



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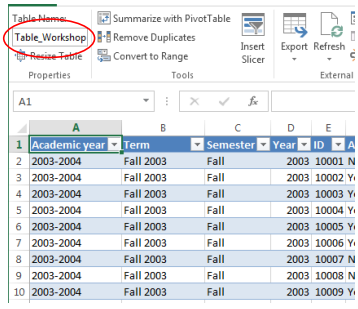
Connecting to Data



	A	B	C	D	E
1	Academic year	Term	Semester	Year	ID
2	2003-2004	Fall 2003	Fall	2003	10001
3	2003-2004	Fall 2003	Fall	2003	10002
4	2003-2004	Fall 2003	Fall	2003	10003
5	2003-2004	Fall 2003	Fall	2003	10004
6	2003-2004	Fall 2003	Fall	2003	10005
7	2003-2004	Fall 2003	Fall	2003	10006
8	2003-2004	Fall 2003	Fall	2003	10007
9	2003-2004	Fall 2003	Fall	2003	10008
10	2003-2004	Fall 2003	Fall	2003	10009

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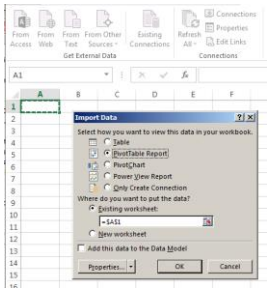
Connecting to Data



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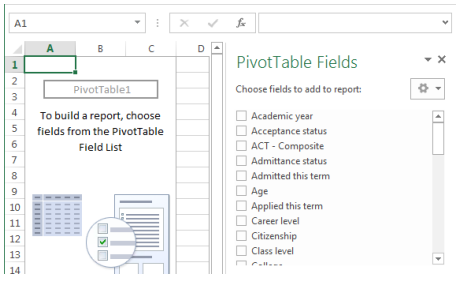
Connecting to Data



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Connecting to Data

External Data Connections

Exercise 1.1

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Connecting to Data

Data is connected

Now What?

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Displaying Data – Pivot Tables

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Displaying Data – Pivot Tables

1. Get a data source ✔
2. Insert a pivot table ✔
3. Populate pivot table grid

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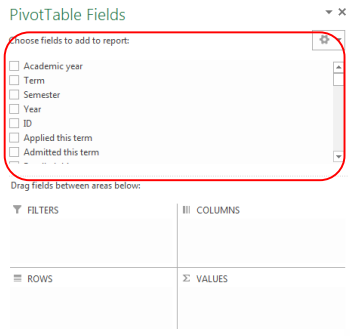
Displaying Data – Pivot Tables



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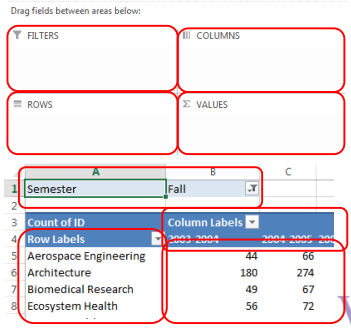
Displaying Data – Pivot Tables



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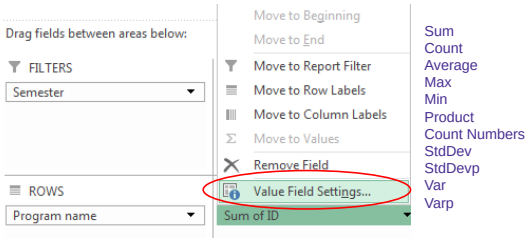
Displaying Data – Pivot Tables



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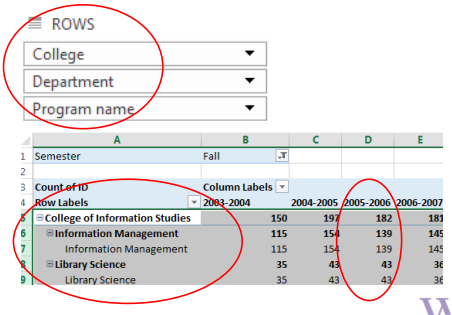
Displaying Data – Pivot Tables



	A	B	C	D	E
1	Semester	Fall			
2					
3	Count of ID	Column Labels			
4	Row Labels	2003-2004	2004-2005	2005-2006	2006-2007
5	College of Information Studies	150	197	182	181
6	Information Management	115	154	139	145
7	Information Management	115	154	139	145
8	Library Science	35	43	43	36
9	Library Science	35	43	43	36

Displaying Data – Pivot Tables

Pivot Table Introduction

Exercise 2.1

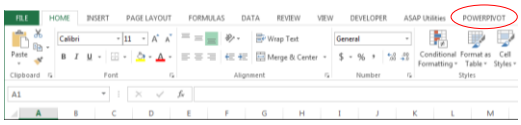
Structure, Features, and Deficiencies of Pivot Tables

Exercise 2.2

Displaying Data – Power Pivot

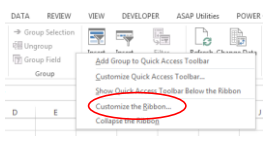
Displaying Data – Power Pivot

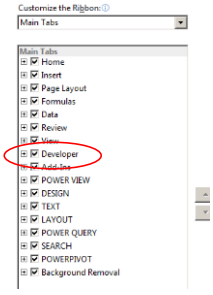
- **Set-up**



  - Installed with Excel 2013
  - Downloadable add-in for Excel 2010
  - **Not available prior to Excel 2010**

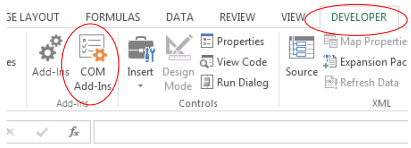
Displaying Data – Power Pivot



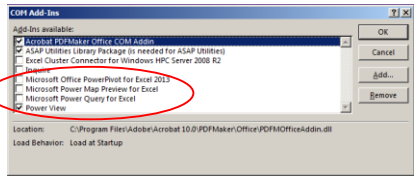


  - Right-click on ribbon
  - *Customize the ribbon*
  - Select *Developer*

Displaying Data – Power Pivot

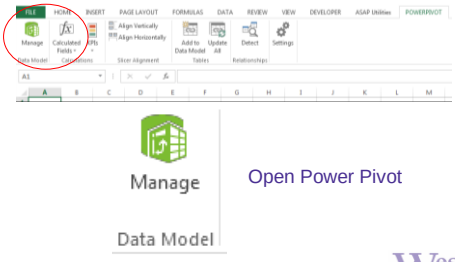


Displaying Data – Power Pivot



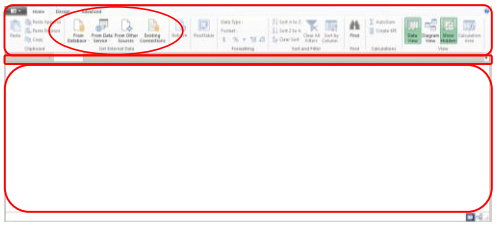
Displaying Data – Power Pivot

- **The Power Pivot environment**



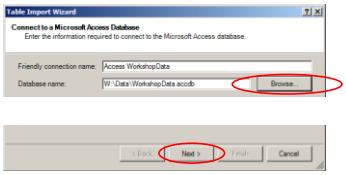
Displaying Data – Power Pivot

- **The Power Pivot environment**



Displaying Data – Power Pivot

- Import data

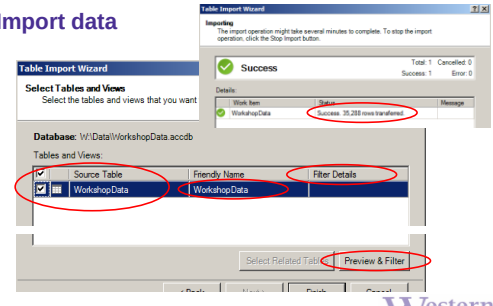


Displaying Data – Power Pivot

- Import data

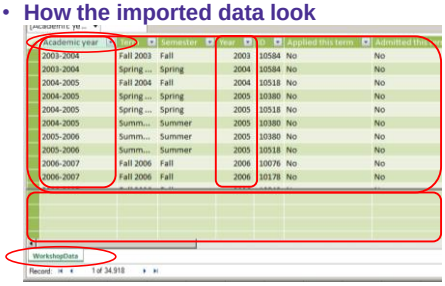
Displaying Data – Power Pivot

- Import data



Displaying Data – Power Pivot

- How the imported data look



Academic year	Term	Semester	Year		Applied this term	Admitted this
2003-2004	Fall 2003	Fall	2003	10584	No	No
2003-2004	Spring ...	Spring	2004	10584	No	No
2004-2005	Fall 2004	Fall	2004	10518	No	No
2004-2005	Spring ...	Spring	2005	10380	No	No
2004-2005	Spring ...	Spring	2005	10518	No	No
2004-2005	Summ...	Summer	2005	10380	No	No
2005-2006	Summ...	Summer	2005	10380	No	No
2005-2006	Summ...	Summer	2005	10518	No	No
2006-2007	Fall 2006	Fall	2006	10076	No	No
2006-2007	Fall 2006	Fall	2006	10178	No	No

WorkshopData

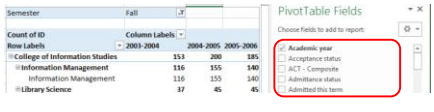
Record: 1 of 34,918

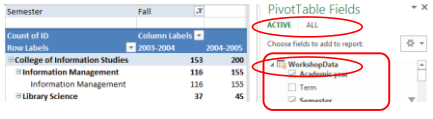
Displaying Data – Power Pivot

- Bringing data into Excel

Displaying Data – Power Pivot

- PivotTable vs. Power Pivot PivotTable





Displaying Data – Power Pivot

Power Pivot Introduction

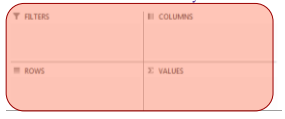
Exercise 3.1

Displaying Data – Power Pivot

- **DAX**
  - Data Analysis Expressions (DAX)
  - Formula language for Power Pivot
  - Used to create **Calculated Columns** and **Calculated Fields**

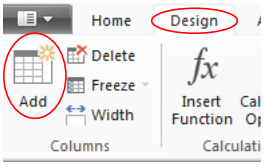
Displaying Data – Power Pivot

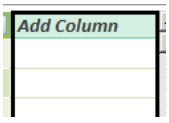
- **Calculated Columns**
  - Used to add an additional column to data table
  - Can be a column added from a related table (like a VLOOKUP) or new data, derived from existing data (sum to combined SAT, length of name, substring of longer string, etc.)
  - Column can be used in any area of the pivot



Displaying Data – Power Pivot

- Adding a calculated column





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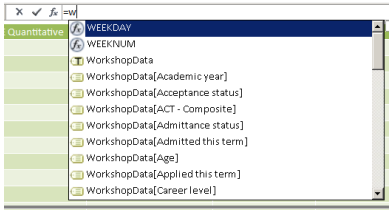
Displaying Data – Power Pivot

- Adding a calculated column



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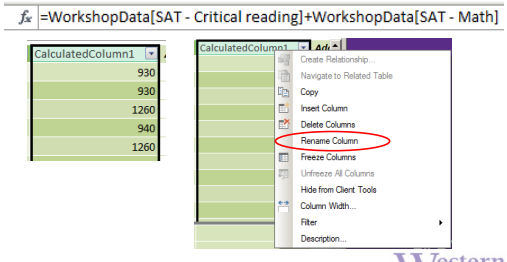
Displaying Data – Power Pivot

- Adding a calculated column



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Displaying Data – Power Pivot

- **Adding a calculated column to pivot table**

	Column Labels		
	2003-2004		2004-20
Row Labels	Count of ID	Average SAT	Count o
College of Information Studies	153	1062.592593	
Information Management	116	1081.188119	
Information Management	116	1081.188119	
Library Science	37	1007.352941	
Library Science	37	1007.352941	
College of Journalism	67	1045.5	
Journalism	67	1045.5	
Journalism	67	1045.5	

Evaluation Contexts

- Row context
- Filter context

Evaluation Contexts

- Row context
  - The one row being evaluated
  - Automatic for calculated columns
  - Can be created in other ways as well (SUMX, AVERAGEX, etc.)
- Filter context

Row Context

=WorkshopData[SAT - Critical reading]+WorkshopData[SAT - Math]

mulative GPA	HS GPA	SAT - Critical reading	SAT - Math	SAT - Total	AC
3.13800001144409	3.150000...	540	390	930	
3.17499995231628	3.150000...	540	390	930	
3.53699994087219	4.559999...	520	740	1260	
1.8289999961853	3.25	510	430	940	
3.58999991416931	4.559999...	520	740	1260	
1.94900000095367	3.25	510	430	940	

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Evaluation Contexts

- Row context
  - The one row being evaluated
  - Automatic for calculated columns
  - Can be created in other ways as well (SUMX, AVERAGEX, etc.)
- Filter context
  - The filters being applied by the pivot table
  - Filters can be explicit or implicit
  - Can add additional filters only with CALCULATE

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Filter Context

Semester	Fall		
	Column Labels		
	2003-2004		200
Row Labels	Count of ID	Average SAT	Cou
College of Information Studies	153	1062.592593	
Information Management	116	1081.188119	
Information Management	116	1081.188119	
Library Science	37	1007.352941	
Library Science	37	1007.352941	

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Displaying Data – Power Pivot

DAX & Calculated Columns Introduction

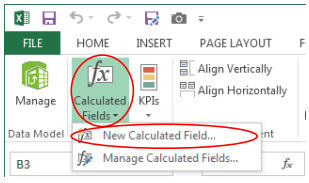
Exercise 3.2

Displaying Data – Power Pivot

- **Calculated Fields**
  - Used to add a calculated element
  - Aggregate function that applies to whole table, column, or range
  - Something that needs to be recalculated
  - Fields can only be used in the VALUES section

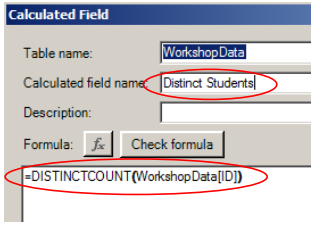
Displaying Data – Power Pivot

- **Adding a Calculated Field**



Displaying Data – Power Pivot

- **Adding a Calculated Field**



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Displaying Data – Power Pivot

- **DISTINCTCOUNT**

  DISTINCTCOUNT(<column>)

  – Counts unique values in column

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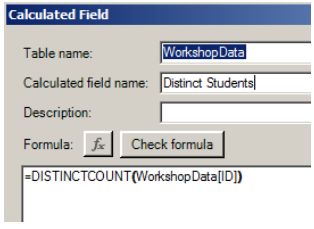
Displaying Data – Power Pivot

- **Adding a Calculated Field**



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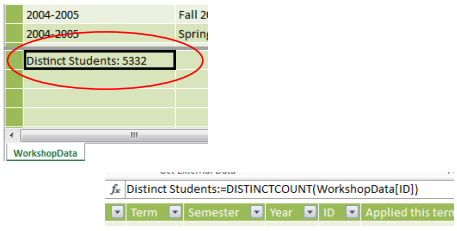
Displaying Data – Power Pivot

- Adding a Calculated Field

Row Labels	Column Labels 2003-2004 Count of ID	Distinct Students
College of Information Studies	153	152
Information Management	116	116
Information Management	116	116
Library Science	37	37

Displaying Data – Power Pivot

- Calculated Field in Power Pivot



Displaying Data – Power Pivot

DAX & Calculated Fields Introduction

Exercise 3.3

Displaying Data – Power Pivot

DAX
CALCULATE, ALL, FILTER

Displaying Data – Power Pivot: DAX CALCULATE

- **CALCULATE**

CALCULATE(expression, <filter1>, <filter2>…)

- Supercharged SUMIFS
- Allows filtering (IFs) on any aggregate function (imagine "MAXIFS", "MEDIANIFS", etc.)
- Operators for filters: =, <, >, <=, >=, <>
- Can also use | | in filter on same column

Displaying Data – Power Pivot: DAX CALCULATE

```
First-time Freshmen Distinct Students:=
    CALCULATE(
        [Distinct Students],
        WorkshopData[Class level]="Freshman",
        WorkshopData[Is new student this term]="Yes"
    )
```

Displaying Data – Power Pivot: DAX CALCULATE

Row Labels	Column Labels 2003-2004 Distinct Enrolled Students	First-time Freshmen Distinct Students	First-t
Aerospace Engineering	44	10	
Freshman	12	10	
No	2	10	
Yes	10	10	
Sophomore	15	10	
No	12	10	
Yes	3	10	
Junior	9	10	
No	6	10	

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Displaying Data – Power Pivot: DAX CALCULATE

DAX - CALCULATE

Exercise 3.4

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Displaying Data – Power Pivot: DAX ALL

- **ALL**

ALL(table_or_column, <column1>, <column2>, …)

– Returns all the rows in a table, or all the values in a column, removing any filters that might have been applied

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Displaying Data – Power Pivot: DAX ALL

```
All Distinct Enrolled Students:=
  CALCULATE(
    [Distinct Enrolled Students],
    ALL( WorkshopData[Class level] )
  )
```


Displaying Data – Power Pivot: DAX ALL

	2009-2010	
Row Labels	Distinct Enrolled Students	All Distinct Enrolled Students
Aerospace Engineering	107	107
Freshman	18	107
Sophomore	13	107
Junior	37	107
Senior	39	107
Architecture	276	276
Freshman	40	276

Displaying Data – Power Pivot: DAX ALL

```
% of All Distinct Enrolled Students:=
  DIVIDE([Distinct Enrolled Students],
     [All Distinct Enrolled Students] )
```

Displaying Data – Power Pivot

- **DIVIDE**

  DIVIDE(<num>, <den>, [<alt>])

  – "Safe" divide

  – Can specify alternate result for divide by zero

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Displaying Data – Power Pivot

	2009-2010		2010
Row Labels	Distinct Enrolled Students	% of All Distinct Enrolled Students	Dist
Aerospace Engineering	**107**	**100.00 %**	
Freshman	18	16.82 %	
Sophomore	13	12.15 %	
Junior	37	34.58 %	
Senior	39	36.45 %	
Architecture	**276**	**100.00 %**	
Freshman	40	14.49 %	

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Displaying Data – Power Pivot: DAX ALL

DAX - ALL

Exercise 3.5

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Displaying Data – Power Pivot: DAX FILTER

- **FILTER**

FILTER(TableToFilter, FilterExpression)

– Returns a table filtered by FilterExpression

Displaying Data – Power Pivot: DAX CALCULATE

```
Above Average GPA Enrolled Undergraduates:=
    CALCULATE(
        [Distinct Enrolled Students],
        FILTER(
            WorkshopData,
            WorkshopData[Institutional cumulative GPA] >
                [Average GPA Enrolled Undergraduates]
            )
    )
```


Displaying Data – Power Pivot: DAX CALCULATE

	2003-2004	
Row Labels	Distinct Enrolled Students	Average GPA Enrolled Undergraduates
College of Information Studies	152	2.922505829
Information Management	116	2.922505829
Information Management	116	2.922505829
Library Science	37	2.922505829
Library Science	37	2.922505829
College of Journalism	66	2.922505829
Journalism	66	2.922505829

Displaying Data – Power Pivot: DAX FILTER

Row Labels	Column Labels: 2003-2004 Distinct Enrolled Students	% Above Average GPA Enrolled Undergraduates	2004- Distin
College of Information Studies	152	42.11 %	
Information Management	116	44.83 %	
Information Management	116	44.83 %	
Library Science	37	32.43 %	
Library Science	37	32.43 %	
College of Journalism	66	45.45 %	
Journalism	66	45.45 %	
Journalism	66	45.45 %	

Displaying Data – Power Pivot: DAX FILTER

- **ALLEXCEPT**

ALLEXCEPT(<table>, <column>[, <column>…])

– Similar to ALL function, but excludes the column(s) specified from the ALL

Displaying Data – Power Pivot: DAX FILTER

```
=CALCULATE(
  AVERAGE( WorkshopData[Institutional cumulative GPA] ),
  ALLEXCEPT( WorkshopData, WorkshopData[Semester] ),
  WorkshopData[Career level]="Undergraduate",
  WorkshopData[Enrolled this term]="Yes“
)
```

Displaying Data – Power Pivot: DAX FILTER

DAX - FILTER

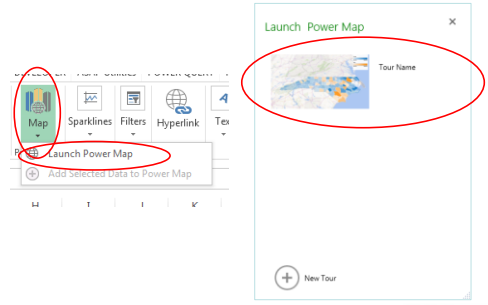
Exercise 3.6

Displaying Data – Power Map & Power View

Displaying Data – Power Map and Power View

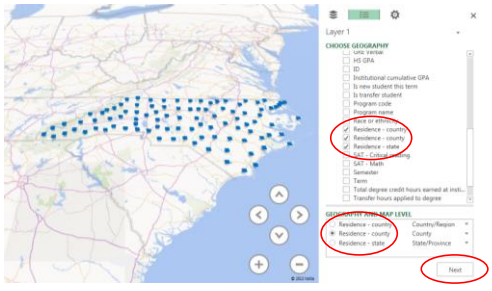
- **Power Map**
  - Automated way to map geographic data
  - Doesn't require geo-location information like longitude and latitude (just country, state, or county names)
  - Can add elements to look at aggregate function on variables across physical space

Displaying Data – Power Map and Power View



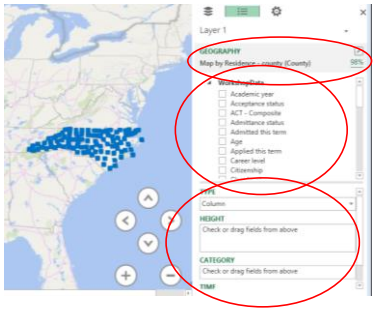
79

Displaying Data – Power Map and Power View



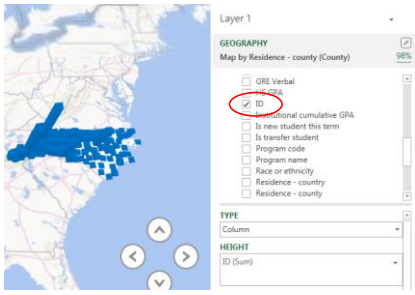
80

Displaying Data – Power Map and Power View



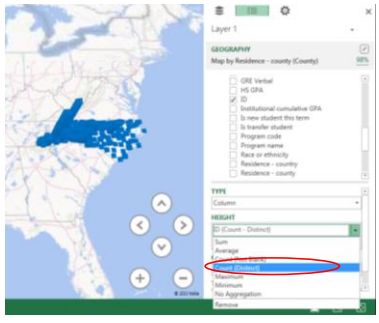
81

Displaying Data – Power Map and Power View



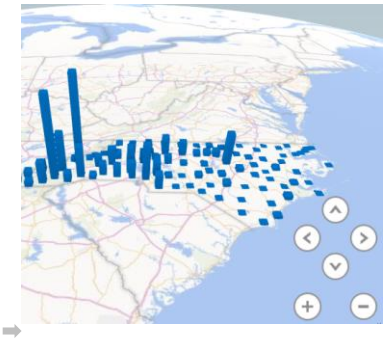
82

Displaying Data – Power Map and Power View



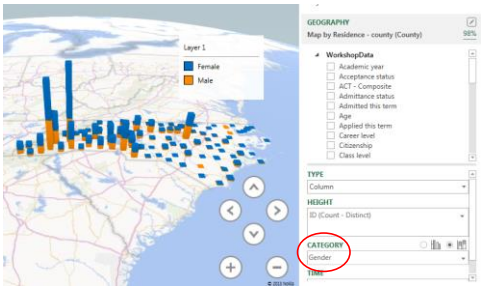
83

Displaying Data – Power Map and Power View



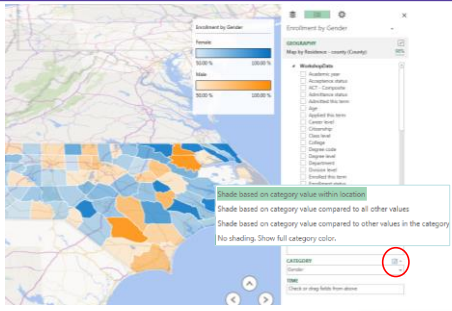
84

Displaying Data – Power Map and Power View



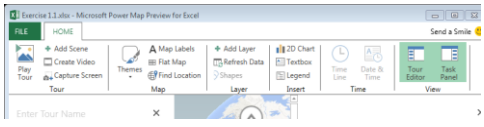
85

Displaying Data – Power Map and Power View



86

Displaying Data – Power Map and Power View



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Displaying Data – Power Map and Power View

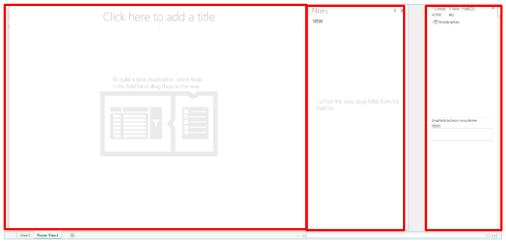
Power Map

Exercise 4.1

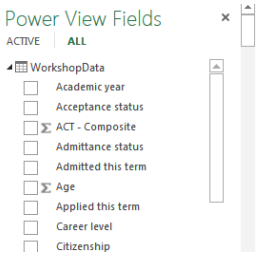
Displaying Data – Power Map and Power View

- **Power View**
  - Dashboard builder
  - Allows synchronized filtering
  - Bring together tables, graphs, maps

Displaying Data – Power Map and Power View

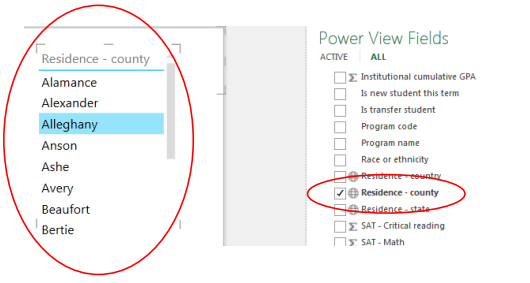


Displaying Data – Power Map and Power View



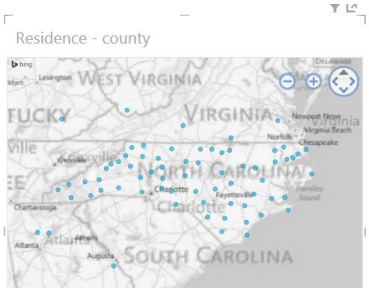
91

Displaying Data – Power Map and Power View



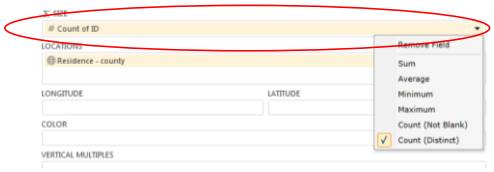
92

Displaying Data – Power Map and Power View



93

Displaying Data – Power Map and Power View

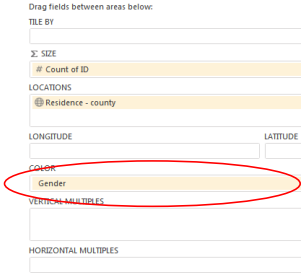


94

Displaying Data – Power Map and Power View

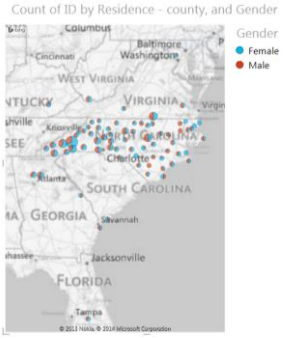
95

Displaying Data – Power Map and Power View



96

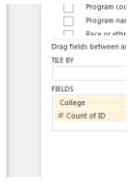
Displaying Data – Power Map and Power View



97

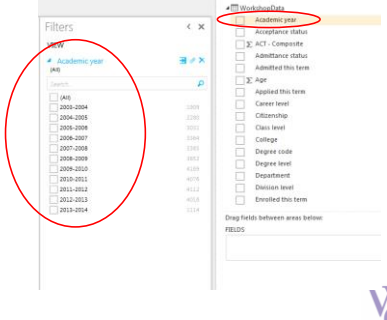
Displaying Data – Power Map and Power View

College	Count of ID
College of Information Studies	1,301
College of Journalism	516
College of Veterinary Medicine	3,061
No college	2,150
School of Architecture	1,783
School of Engineering	658
Total	**5,332**



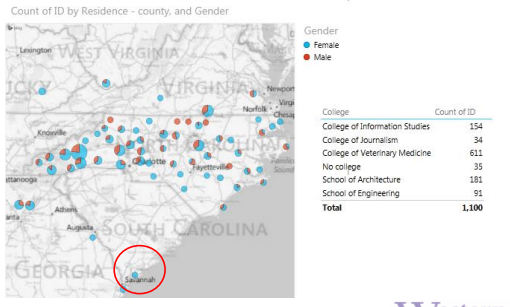
98

Displaying Data – Power Map and Power View



99

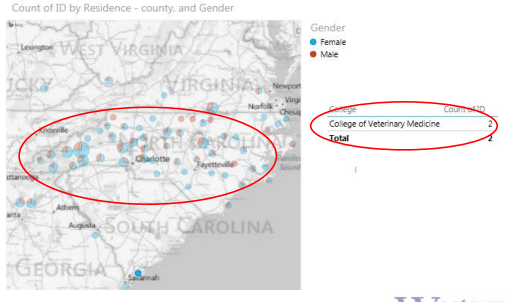
Displaying Data – Power Map and Power View



College	Count of ID
College of Information Studies	154
College of Journalism	34
College of Veterinary Medicine	611
No college	35
School of Architecture	181
School of Engineering	91
Total	**1,100**

100

Displaying Data – Power Map and Power View



College	Count of ID
College of Veterinary Medicine	2
Total	**2**

101

Displaying Data – Power Map and Power View

Power View

Exercise 4.2

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Power Query – Advanced

103

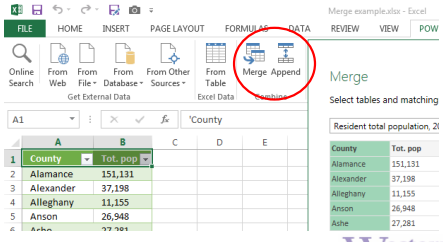
Power Query – Advanced

- Retrieve data from a variety of external sources
  - Pull in external data from the Internet
- Limit the data you bring into your model (filter on rows and columns)
  - Keep you model to a reasonable size (< 1M records) to prevent processing problems
  - Bring in only what you need

104

Power Query – Advanced

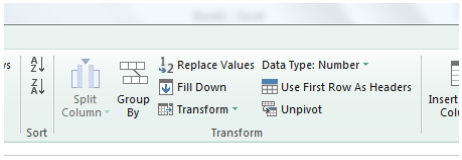
- **Consolidate multiple tables into one**



105

Power Query – Advanced

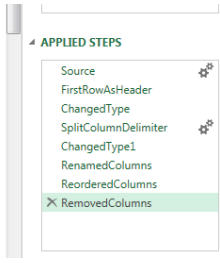
- Consolidate multiple tables into one
- **In-line data transformations**



106

Power Query – Advanced

- Consolidate multiple tables into one
- In-line data transformations
- **All transformation steps are listed, and reversible**



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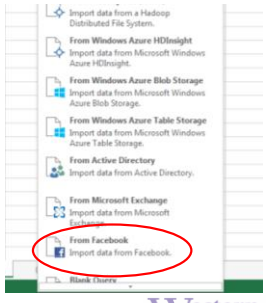
Power Query – Advanced

- Consolidate multiple tables into one
- In-line data transformations
- All transformation steps are listed, and reversible
- **Access to sources of data not readily available to Power Pivot**



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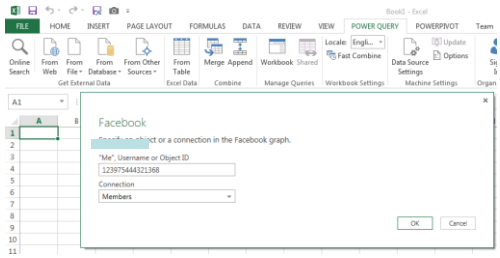
Power Query – Advanced

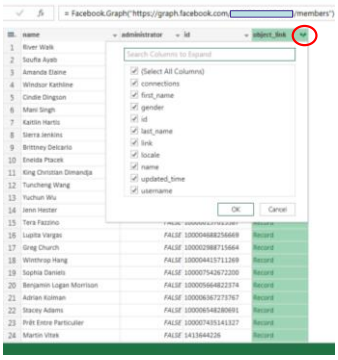
- Facebook pages and groups



109

Power Query – Advanced

- Drill down for additional data fields in facebook records
- Availability of data fields depends on your personal status with the group/page, and facebook data fields completed and available



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Power Query – Advanced

- Employment data

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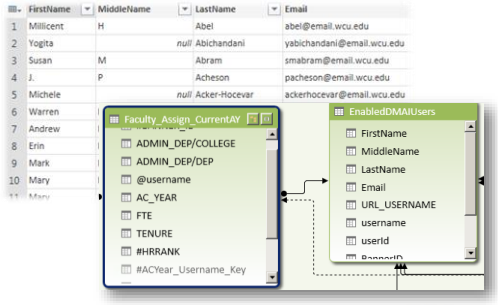
Power Query – Advanced

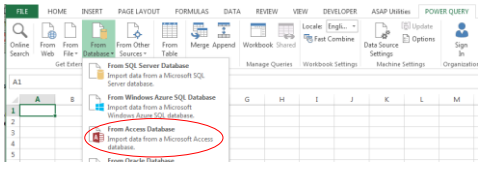
- **Connect to online faculty database**
  - Import active users from Digital Measures
  - Merge with local data
  - Export updated data to Digital Measures

Power Query – Advanced

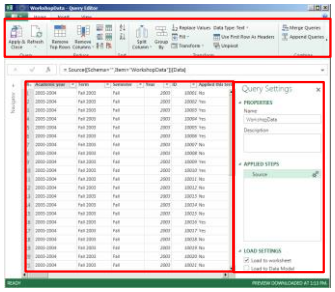


Power Query – Advanced

- **Microsoft SQL Server and Access**

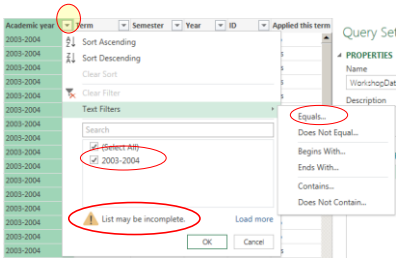


Power Query – Advanced



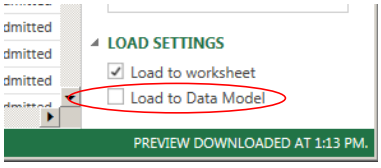
115

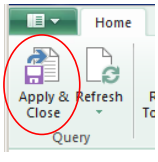
Power Query – Advanced



116

Power Query – Advanced





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Power Query – Advanced

Power Query

Exercise 5.1

Resources

- **Rob Collie (http://powerpivotpro)**
  - DAX Formulas for PowerPivot, 2013
- **Bill Jelen (http://mrexcel.com)**
  - PowerPivot for the Data Analyst: Microsoft Excel 2010, 2010
- **Alberto Ferrari and Marco Russo**
  - Microsoft Excel 2013: Building Data Models with PowerPivot
- **Chris Webb (http://cwebbbi.wordpress.com)**
- **Kasper de Jonge (http://www.powerpivotblog.nl)**
- **Purna Duggirala (http://www.chandoo.org/)**

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