# Lecture Note #20: Data Analysis Tools Part #3

BUSI 201: Business Data Analysis

# **Topic 1. Power Query: Pivot**

Utilizing the Power Query tool, we can seamlessly transform data between the 'wide' and 'long' formats. The table on the left represents the 'long' format, while the one on the right represents the 'wide' format. The ability to switch between these formats proves valuable for tasks such as data cleaning and analysis. The choice of format may depend on the specific task at hand or the statistical software available to the user. Moving from the left to right is known as "Pivot," and moving from the right to the left is "Unpivot."

Variable 1	Variable 2	Value
Name1	Var1	20
Name1	Var2	50
Name1	Var3	30
Name2	Var1	40
Name2	Var2	70
Name2	Var3	10

Variable 1	ValueVar1	ValueVar2	ValueVar3
Name1	20	50	30
Name2	40	70	10

Let's retrieve some data from the internet to practice. We'll use the 2023 Worldwide Box Office statistics available at Box Office Mojo. Navigate to the Data tab, choose From Web, enter the address, and click OK. The web URL is https://www.boxofficemojo.com/year/world/2023/.

		×
From Web		
Basic O Advanced     Ad		
URL		
https://www.boxofficemojo.com/year/world/2023/		
	ОК	Cancel

Figure 1: Importing 2023 Box Office Data

Select Table 0 and eliminate unnecessary columns, specifically Rank, %, and %2. It's important to note that the current data is in the 'wide' format, with separate columns for domestic, foreign, and worldwide box office numbers. Our goal is to convert this into the 'long' format, where each movie occupies three rows, and each row contains information on worldwide, domestic, and foreign box office statistics. Go to Transform, and then choose the columns with box office statistics in the blue box. Next, select Unpivot.

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	2 The Super Mario Bro	ns. Movie		1.017.00 \$574.934.330	\$786,953,687	-		^	Name		
	3 Oppenheimer			5,530.00 \$325,326,530	\$624,879,000	-			Table 0 (2		
	4 Guardians of the Gal	laxy Vol. 3		5,777.00 \$358,995,815	\$486,559,962	-			All Propert	ties	
	5 Fast X			8,660.00 \$145,960,660	\$558,749,000	-			A APPLIED		
	6 Spider-Man: Across t	the Spider-Verse		5,673.00 \$381,311,319	\$309.205.354						
	7 The Little Mermaid			5,289.00 \$298,172,056	\$271,454,233				Source		
	8 Mission: Impossible	- Dead Reckoning Part One		5,383.00 \$172,135,383	\$395,400,000				Naviga		
	9 Elemental	-	495.85	.987.00 \$154.426.697	\$341,425,290					ed Type ved Columns	
	10 Ant-Man and the Wa	asp: Quantumania	476.07	.180.00 \$214.504.909	\$261,566,271				× Kemo	red Columns	
	11 John Wick: Chapter 4	4	440,14	5,694.00 \$187,131,806	\$253,014,888						
	12 Transformers: Rise o	of the Beasts	438,96	5,392.00 \$157,066,392	\$281,900,000						
	13 Meg 2: The Trench		395,00	,317.00 \$82,600,317	\$312,400,000						
	14 Indiana Jones and th	e Dial of Destiny	383,96	057.00 \$174,480,468	\$209,482,589						
	15 Five Nights at Freddy	y's	275,92	,182.00 \$133,709,340	\$142,214,842						
	16 Creed III		275,24	8,615.00 \$156,248,615	\$119,000,000						
	17 The Flash		270,63	8, <i>313.00</i> \$108,133,313	\$162,500,000						
	18 The Nun II		268,06	7,073.00 \$86,267,073	\$181,800,000						
	19 Sound of Freedom		247,80	1,879.00 \$184,174,541	\$63,627,338						
	20 Taylor Swift: The Era	is Tour	246,62	5,030.00 \$175,935,894	\$70,690,136						
	21 Dungeons & Dragons	s: Honor Among Thieves	208,17	,026.00 \$93,277,026	\$114,900,000						
	22 PAW Patrol: The Mig	ghty Movie	192,49	5,899.00 \$65,195,899	\$127,300,000						
	23 The Equalizer 3		190,42	8,846.00 \$92,367,957	\$98,055,889						
	24 Insidious: The Red D	oor	189,08	5,877.00 \$82,156,962	\$106,929,915						
	25 Teenage Mutant Nin	ija Turtles: Mutant Mayhem	180,51	8,586.00 \$118,613,586	\$61,900,000						
	26 Scream VI		168.96	389.00 \$108.161.389	560 800 000						

Figure 2: Unpivoting Box Office Statistics

By following the instructions above, you will achieve the results depicted in Figure 3. Now, you can observe that the data is arranged in the 'long' format, with each movie spanning three rows. Each row represents the film's worldwide, domestic, and foreign performance.

	0 (2) - Power Query Editor Transform Add Column View								,
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	2 Barbie	Domestic	1441/694 \$636,169,400			^	Name		
	3 Barbie	Foreign	\$805,600,000				Table 0 (2)		
	4 The Super Mario Bros. Movie	Worldwide	13618880	7			All Propertie	es .	
	5 The Super Mario Bros. Movie	Domestic	\$574,934,330						
	6 The Super Mario Bros. Movie	Foreign	\$786,953,687				APPLIED ST	IEPS	
	7 Oppenheimer	Worldwide	9502055	34			Source		
	8 Oppenheimer	Domestic	\$325,326,530				Navigat		
	9 Oppenheimer	Foreign	\$624,879,000					d Type d Columns	
	10 Guardians of the Galaxy Vol. 3	Worldwide	8455557	77				ed Columns	
	11 Guardians of the Galaxy Vol. 3	Domestic	\$358,995,815				onprov		
	12 Guardians of the Galaxy Vol. 3	Foreign	\$486,559,962						
	13 Fast X	Worldwide	7047096	54					
	14 Fast X	Domestic	\$145,960,660						
	15 Fast X	Foreign	\$558,749,000						
	16 Spider-Man: Across the Spider-Verse	Worldwide	6905166	73					
	17 Spider-Man: Across the Spider-Verse	Domestic	\$381,311,319						
	18 Spider-Man: Across the Spider-Verse	Foreign	\$309,205,354						
	19 The Little Mermaid 20 The Little Mermaid	Worldwide Domestic	5696262 5298.172.056	85					
	20 The Little Mermaid 21 The Little Mermaid	Foreign	\$298,172,056 \$271.454.233	-					
	21 The Little Mermaid 22 Mission: Impossible - Dead Reckoning Part One	Worldwide	5271,454,233 5675353	-					
	22 Mission: Impossible - Dead Reckoning Part One 23 Mission: Impossible - Dead Reckoning Part One	Domestic	\$172,135,383						
	24 Mission: Impossible - Dead Reckoning Part One	Foreign	\$395,400,000	-					
	24 Mission: impossible - Dead Reckoning Part One 25 Elemental	Worldwide	4958515	87					
	26 Elemental	Domestic	\$154.426.697			~			

Figure 3: Box Office Statistics in 'Long'

# **Changing Data Types**

Upon observing Figure 3, it becomes apparent that the data type is not consistent across all entries. Specifically, the values for worldwide box office performance do not seem to match the other two. To address this disparity, navigate to Home, select the Value column, click Data Type, and then choose Currency. After following these steps, you will notice that the entire Value column now adheres to a uniform style.

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ose & oad •	Refresh	Properties	Choose Remov Columns • Columns		₽↓ X↓	Split Group Column • By	Data Type: Currency T Decimal Number Currency	Merge Queries   Merge Queries  Append Queries  Combine Files	Manage Parameters •	Data source settings	New Source   Recent Sources  Enter Data	
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		3 Barbie		Foreign		805,600,000.00	Time				Table 0 (2)	
		4 The Super Mario Bro		Worldwide		1,361,888,017.00 574,934,330.00	Date/Time/Timezone				All Properties	
		6 The Super Mario Bro		Foreign		786,953,687.00	Duration				A APPLIED STEPS	
		7 Oppenheimer		Worldwide		950,205,530.00	Duration				Source	+
		8 Oppenheimer		Domestic		325,326,530.00	Text				Navigation	+
		9 Oppenheimer		Foreign		624,879,000.00					Changed Type Removed Columns	
		10 Guardians of the Gal	laxy Vol. 3	Worldwide		845,555,777.00	True/False				Unpivoted Columns	
		11 Guardians of the Gal	laxy Vol. 3	Domestic		358,995,815.00	Binary				× Changed Type1	
		12 Guardians of the Gal	laxy Vol. 3	Foreign		486,559,962.00	Sindiy				r changed typer	
		13 Fast X		Worldwide		704,709,660.00						
		14 Fast X		Domestic		145,960,660.00						
		15 Fast X		Foreign		558,749,000.00						
		16 Spider-Man: Across	the Spider-Verse	Worldwide		690,516,673.00						
		17 Spider-Man: Across	the Spider-Verse	Domestic		381,311,319.00						
		18 Spider-Man: Across	the Spider-Verse	Foreign		309,205,354.00						
		19 The Little Mermaid		Worldwide		569,626,289.00						
		20 The Little Mermaid		Domestic		298,172,056.00						
		21 The Little Mermaid		Foreign		271,454,233.00						
		22 Mission: Impossible	- Dead Reckoning Part One	Worldwide		567,535,383.00						
		23 Mission: Impossible	- Dead Reckoning Part One	Domestic		172,135,383.00						
		24 Mission: Impossible	- Dead Reckoning Part One	Foreign		395,400,000.00						
		25 Elemental		Worldwide		495,851,987.00				~		
		26 Elemental		Domestic		154 426 697 00				~		

Figure 4: Changing Data Types

# **Importing to Excel**

By selecting Close & Load after importing the results mentioned above, we will successfully import the target data from the Box Office Mojo webpage into an Excel worksheet, as illustrated in Figure 5. Choose Attendance in the navigator window and proceed to select Transform Data as usual.

A	Attribute *	c	D	E	F	G	н	J	К	L	M	N	0 P	Queries & Connections $\checkmark$ ×
1 Release Group														Queries & connections V X
2 Barbie		\$1,441,769,400.00												Queries Connections
3 Barble	Domestic	\$636,169,400.00												queries Connections
4 Barbie	Foreign	\$805,600,000.00												1 query
5 The Super Mario Bros. Movie	Worldwide	\$1,361,888,017.00												-
6 The Super Mario Bros. Movie	Domestic	\$574,934,330.00												Table 0 (2)
7 The Super Mario Bros. Movie	Foreign	\$786,953,687.00												600 rows loaded. 93 errors.
8 Oppenheimer	Worldwide	\$950,205,530.00												
9 Oppenheimer	Domestic	\$325,326,530.00												
10 Oppenheimer	Foreign	\$624,879,000.00												
11 Guardians of the Galaxy Vol. 3	Worldwide	\$845,555,777.00												
12 Guardians of the Galaxy Vol. 3	Domestic	\$358,995,815.00												
13 Guardians of the Galaxy Vol. 3	Foreign	\$486,559,962.00												
14 Fast X	Worldwide	\$704,709,660.00												
15 Fast X	Domestic	\$145,960,660.00												
16 Fast X	Foreign	\$558,749,000.00												
17 Spider-Man: Across the Spider-Verse	Worldwide	\$690,516,673.00												
18 Spider-Man: Across the Spider-Verse	Domestic	\$381,311,319.00												
19 Spider-Man: Across the Spider-Verse	Foreign	\$309,205,354.00												
20 The Little Mermaid	Worldwide	\$569,626,289.00												
21 The Little Mermaid	Domestic	\$298,172,056.00												
22 The Little Mermaid	Foreign	\$271,454,233.00												
23 Mission: Impossible - Dead Reckoning Part One	Worldwide	\$567,535,383.00												
24 Mission: Impossible - Dead Reckoning Part One	Domestic	\$172,135,383.00												
25 Mission: Impossible - Dead Reckoning Part One	Foreign	\$395,400,000.00												

Figure 5: Imported Data

#### Another Use of Pivot in Power Query

This time, let's explore the Pivot function in Power Query and learn how to import data from another spreadsheet. Refer to Figure 6 for guidance on importing data from other workbooks. Choose BUSI201-LEC20-Workbook.xlsx, which includes a hypothetical attendance sheet for a college-level course. We will use the Power Query Pivot function to transform this data.

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From Power Platform	From JSON					
From Online Services	From PDF					
From Other Sources	> From <u>Folder</u>					
Combine Queries	> From SharePoint Folder					
2 3 Launch Power Query Editor.						
4 Data Source Settings						
5 6 🗈 Query Options						
7						

Figure 6: Importing from Workbooks

The attendance sheet will be visible in Power Query, as illustrated in Figure 7. Before proceeding with pivots, there are some changes we need to make. As the first row of the data contains variable names, select Use First Row as Headers.

ose & pad •	Refresh	Properties	Choose Remove Columns * Columns *	Keep Remove Rows * Rows *	Ž↓ Ž↓ Split Group Column + By	Signature ⇒2 Replace Values	as Headers 👻 🧮	Merge Queries • Append Queries • Combine Files	Manage Parameters • Data source settings	New Source •	
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		1 Student ID	Name	Major	Class		9/4/2023	9/6/2023	9/8/2023 9		
		2	1 John Doe	BUSI	FR	A	P	A	L	Name	
		3	2 Jane Smith	ACCT	so	P	P	L	L	Attendance	
		4	3 Alex Johnson	ECON	SR	L	L	P	P	All Properties	
		5	4 Emily Davis	ECON	SO	A	A	A	A	▲ APPLIED STEPS	
		6	5 Michael Brown	ACCT	FR	L	P	A	P	Source	
		7	6 Olivia Wilson	ACCT	SO	L	A	A	P	Navigation	
		8	7 Daniel Lee	BUSI	so	A	P	A	A	× Changed Type	
		9	8 Sarah Martinez	ECON	JR	A	A	P	L	in changed type	
		10	9 Brian Taylor	ACCT	JR	P	P	A	A		
		11	10 Chloe Anderson	BUSI	JR	A	L	A	P		
		12	11 Eric Robinson	ECON	FR	L	L	L	P		
		13	12 Jessica White	BUSI	SO	A	L	P	A		
		14	13 Matthew Miller	BUSI	JR	P	A	P	A		
		15	14 Emma Garcia	ECON	SO	L	L	P	P		
		16	15 Nathan Turner	ECON	FR	A	A	P	L		
		17	16 Lily Moore	ECON	JR	A	P	L	P		
		18	17 Ethan Hall	ECON	SO	L	L	L	P		
		19	18 Sophia Clark	ECON	SR	L	P	L	L		
		20	19 Jackson Adams	BUSI	SO	P	P	A	P		
		21	20 Ava Rodriguez	BUSI	SO	P	L	P	L		

Figure 7: Power Query Editor for Attendance

Our goal is to transform this data into a form that will work with PivotTables. In its current form, building a PivotTable based on this data is challenging, as each date's attendance record takes up an entire column. We will transform this data by "unpivoting" some columns. Select the variables that should not be "unpivoted," which are Name, Major, and Class in this example. Then, navigate to Transform, select the drop-down menu next to Unpivot Columns, and choose Unpivot Other Columns.

	Transpose	Data Type: Text 🔻		Unpivot Columns  Unpivot Columns		Merge Columns	Xơ ∑ Statistics ▼ Standard ▼ .00 Standard ▼ .00 Rou		ime •
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endance	. Ac Name	<ul> <li>A<sup>B</sup>C Major</li> </ul>	▼ A <sup>0</sup> C Class	✓ A <sup>8</sup> ⊂ 9/4/2023	▼ A <sup>8</sup> <sub>C</sub> 9/6/2023	▼ A <sup>2</sup> C 9/8/2023	▼ A <sup>0</sup> <sub>C</sub> 9/11/2023	▼ A <sup>0</sup> C 9/13/2023	. , ,
	1 John Doe	BUSI	FR	Р	P	A	A	P	A PROPERTIES
	2 Jane Smith	ACCT	SO	P	P	A	P	P	Name
	3 Alex Johnson	ECON	SR	P	P	A	P	P	Attendance
	4 Emily Davis	ECON	SO	P	P	A	P	A	All Properties
	5 Michael Brown	ACCT	FR	P	P	A	P	P	A APPLIED STEPS
	6 Olivia Wilson	ACCT	so	P	P	P	P	P	Source
	7 Daniel Lee	BUSI	SO	P	P	P	P	P	- Navigation
	8 Sarah Martinez	ECON	JR	P	P	P	P	P	Changed Type
	9 Brian Taylor	ACCT	JR	P	P	A	A	P	Promoted Headers
	10 Chloe Anderson	BUSI	JR	P	P	P	P	P	× Changed Type1
	11 Eric Robinson	ECON	FR	A	P	P	P	A	5 37
	12 Jessica White	BUSI	SO	P	P	P	P	P	
	13 Matthew Miller	BUSI	JR	P	A	P	P	P	
	14 Emma Garcia	ECON	SO	A	P	P	P	A	
	15 Nathan Turner	ECON	FR	P	P	P	A	P	
	16 Lily Moore	ECON	JR	P	P	P	P	P	
	17 Ethan Hall	ECON	SO	P	P	P	P	P	
	18 Sophia Clark	ECON	SR	P	A	P	P	P	
	19 Jackson Adams	BUSI	SO	P	A	P	P	P	
	20 Ava Rodriguez	BUSI	SO	P	P	P	P	P	

Figure 8: Unpivoting the Attendance Sheet

The "unpivoted" data will appear as shown in Figure 9. We will now demonstrate how to efficiently handle dates in Excel using Power Query and construct tables showing monthly/weekly attendance of the students in the dataset.

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	1 John Doe	BUSI	FR	9/4/2023	P				PROPERTIES	
	2 John Doe	BUSI	FR	9/6/2023	P			^	Name Attendance	
	3 John Doe	BUSI	FR	9/8/2023	A					
	4 John Doe	BUSI	FR	9/11/2023	A				All Properties	
	5 John Doe	BUSI	FR	9/13/2023	P				▲ APPLIED STEPS	
	6 John Doe	BUSI	FR	9/15/2023	P					
	7 John Doe	BUSI	FR	9/18/2023	A				Source	
	8 John Doe	BUSI	FR	9/20/2023	P				Navigation Changed Type	
	9 John Doe	BUSI	FR	9/22/2023	P				Promoted Headers	
	10 John Doe	BUSI	FR	9/25/2023	P				Changed Type1	
	11 John Doe	BUSI	FR	9/27/2023	P				× Unpivoted Other Colum	ns
	12 John Doe	BUSI	FR	9/29/2023	P					
	13 John Doe	BUSI	FR	10/2/2023	P					
	14 John Doe	BUSI	FR	10/4/2023	P					
	15 John Doe	BUSI	FR	10/6/2023	P					
	16 John Doe	BUSI	FR	10/9/2023	P					
	17 John Doe	BUSI	FR	10/11/2023	A					
	18 John Doe	BUSI	FR	10/13/2023	P					
	19 John Doe	BUSI	FR	10/16/2023	P					
	20 John Doe	BUSI	FR	10/18/2023	P					
	21 John Doe	BUSI	FR	10/20/2023	P					
	22 John Doe	BUSI	FR	10/23/2023	P					
	23 John Doe	BUSI	FR	10/25/2023	P					
	24 John Doe	BUSI	FR	10/27/2023	A					
	25 John Doe	BUSI	FR	10/30/2023	P					
	26 John Doe	BUSI	FR	11/1/2023	P					
	27 John Doe	BUSI	FR	11/3/2023	A					
	28 John Doe	BUSI	FR	11/6/2023	P			~		

Figure 9: Unpivoted Attendance Data

# **Dates in Power Query**

Let's start by renaming the columns from Attribute to Date and from Value to Attendance.<sup>1</sup> At this point, Excel may not recognize the unpivoted Date column as dates. Refer to Figure 11, and notice that all options in the blue box are unavailable because the variables are not recognized as dates.

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U	se First Row	2 Count Rows	■ Rename	🖳 Pivot Column	Convert to List	Split Format	10 <sup>2</sup> Scientific • III Information •		Date Only
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		2 John Doe	BUSI	FR	9/6/2023	P			
		3 John Doe	BUSI	FR	9/8/2023	A			Week 🕨
		4 John Doe	BUSI	FR	9/11/2023	A			Day
		5 John Doe	BUSI	FR	9/13/2023	P			Day P
		6 John Doe	BUSI	FR	9/15/2023	P			Combine Date and Time
		7 John Doe	BUSI	FR	9/18/2023	A			
		8 John Doe	BUSI	FR	9/20/2023	P			Earliest
		9 John Doe	BUSI	FR	9/22/2023	P			Latest
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		11 John Doe	BUSI	FR	9/27/2023	P			Unpivoted Other Columns
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		13 John Doe	BUSI	FR	10/2/2023	P			
		14 John Doe	BUSI	FR	10/4/2023	P			
		15 John Doe	BUSI	FR	10/6/2023	P			
		16 John Doe	BUSI	FR	10/9/2023	P			
		17 John Doe	BUSI	FR	10/11/2023	A			
		18 John Doe	BUSI	FR	10/13/2023	P			
		19 John Doe	BUSI	FR	10/16/2023	P			
		20 John Doe	BUSI	FR	10/18/2023	P			
		21 John Doe	BUSI	FR	10/20/2023	P			
		22 John Doe	BUSI	FR	10/23/2023	P			
		23 John Doe	BUSI	FR	10/25/2023	P			
		24 John Doe	BUSI	FR	10/27/2023	A			
		25 John Doe	BUSI	FR	10/30/2023	P			
		26 John Doe	BUSI	FR	11/1/2023	P			
		27 John Doe	BUSI	FR	11/3/2023	A			~
		28 John Doe	BUSI	FR	11/6/2023	P			

Figure 10: Dates Not Recognized

Select the **Date** column, go to **Data** Type, and set the data type to **Date**. This will enable the Power Query editor to properly recognize that the **Date** column consists of dates.

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	2 John Doe		-	9/6/2023	P			Attendance	
	3 John Doe	Time		9/8/2023	A			All Properties	
	4 John Doe	Date/Time/Timezone		9/11/2023	A			All Properties	
	5 John Doe			9/13/2023	P			APPLIED STEPS	
	6 John Doe	Duration		9/15/2023	P			Source	
	7 John Doe	Test		9/18/2023	A			Navigation	
	8 John Doe	Text		9/20/2023	P			Changed Type	
	9 John Doe	True/False		9/22/2023	P			Promoted Headers	
	10 John Doe	1100,1000		9/25/2023	P			Changed Type1	
	11 John Doe	Binary		9/27/2023	P			Unpivoted Other Columns	
	12 John Doe			9/29/2023	P			× Renamed Columns	
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	14 John Doe		FR	10/4/2023	P				
	15 John Doe		FR	10/6/2023	P				
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	17 John Doe		FR	10/11/2023	A				
	18 John Doe		FR	10/13/2023	P				
	19 John Doe		FR	10/16/2023	P				
	20 John Doe		FR	10/18/2023	P				
	21 John Doe		FR	10/20/2023	P				
	22 John Doe		FR	10/23/2023	P				
	23 John Doe		FR	10/25/2023	P				
	24 John Doe		FR	10/27/2023	A				
	25 John Doe		FR	10/30/2023	P				
	26 John Doe		FR	11/1/2023	P				
	27 John Doe		FR	11/3/2023	A		~		
	28 John Doe	BUSI	FR	11/6/2023	P		*		

Figure 11: Dates Not Recognized

<sup>&</sup>lt;sup>1</sup>Double-click the variable names at the top of the table to rename the columns.

Now, let's add additional columns to this dataset. Navigate to Add Column, select Date, and from the dropdown menu, choose Month. Refer to Figure 12 for the process displayed in the Power Query Editor. Following a similar process, we will add Weeks to this dataset.

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		7 John Doe	BUSI	FR	9/18/2023 A		Davi				
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		12 John Doe	BUSI	FR	9/29/2023 P		Earliest			Renamed Columns	
		13 John Doe	BUSI	FR	10/2/2023 P		Editiest			➤ Changed Type2	
		14 John Doe	BUSI	FR	10/4/2023 P		Latest				
		15 John Doe	BUSI	FR	10/6/2023 P						
		16 John Doe	BUSI	FR	10/9/2023 P						
		17 John Doe	BUSI	FR	10/11/2023 A						

Figure 12: Adding Column: Month

# Load to Excel: Connections Only

Once you have added the months and weeks, return to the Home tab in the Editor and select Close & Load To. In the pop-up window, click Only Create Connection and select OK. If you wish to use the Power Pivot function, you may also check the Add this data to the Data Model option.

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	5	Pivot		FR			9/13/2023 P		9	37		▲ APPLIED STEPS	
	6		reate Connection	FR			9/15/2023 P		9	37		Source	
	7	Where do you want		FR			9/18/2023 A		9	38		Navigation	
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		John Doe	BUSI	FR			10/9/2023 P		10	40		<ul> <li>Inserted week of rear</li> </ul>	
		John Doe	BUSI	FR			10/11/2023 A		10	41			
		John Doe	BUSI	FR			10/13/2023 P		10	41			
		John Doe	BUSI	FR			10/16/2023 P		10	42			
		John Doe	BUSI	FR			10/18/2023 P		10	42			
		John Doe	BUSI	FR			10/20/2023 P		10	42			
		John Doe	BUSI	FR			10/23/2023 P		10	43			
	23	John Doe	BUSI	FR			10/25/2023 P		10	43			
	24	John Doe	BUSI	FR			10/27/2023 A		10	43			
	25	John Doe	BUSI	FR			10/30/2023 P		10	44			
	26	John Doe	BUSI	FR			11/1/2023 P		11	44			
	27	John Doe	BUSI	FR			11/3/2023 A		11	44			
	20	John Doe	BUSI	FR			11/6/2023 P		11	45	$\sim$		

Figure 13: Loading to Excel

In contrast to our previous cases, we will not be directly importing the data into this new workbook but merely creating a connection. Notice in Figure 14 that no actual data has been imported, but there is a connection shown in the red box.

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Figure 14: Connection Created

Even though the data is not included in this specific workbook, we can still create a PivotTable due to the connection we just established. Navigate to the **Insert** tab and select PivotTable, but be sure to choose From External Data Source. Then, in the new pop-up, select Choose Connection and confirm that the external data source is the Query-Attendance that we just created.

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Figure 15: Pivot Table with External Connections

Then, we can use the standard Pivot Table framework to generate tables that show us the attendance status of all students over three months as shown in Figure 16.

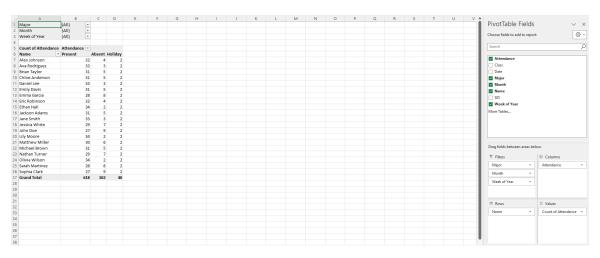


Figure 16: Completed PivotTable

# Topic 2. Merging Data: Manual Approach

Sometimes, we may encounter situations where we need to merge data from different sources. For example, open the workbook BUSI201-LEC20-Workbook.xlsx and go to the worksheet Shell. As shown in the accompanying Figure 17, you will find a worksheet with student IDs, names, classes, and majors, where the quiz, midterm, and final scores are currently empty.

	А	В	С	D	E	F	G	н	1	J	K	L	M	N	C
1	SID	Name	Major	Class	Quiz	Midterm	Final								
2	39630	John Doe	BUSI	FR											
3	88741	Jane Smith	ACCT	SO											
4	58518	Alex Johnson	ECON	SR											
5	69909	Emily Davis	ECON	SO											
6	43307	Michael Brown	ACCT	FR											
7	49372	Olivia Wilson	ACCT	SO											
8	95461	Daniel Lee	BUSI	SO											
9	55398	Sarah Martinez	ECON	JR											
10	62040	Brian Taylor	ACCT	JR											
11	32403	Chloe Anderson	BUSI	JR											
12	34358	Eric Robinson	ECON	FR											
13	10536	Jessica White	BUSI	SO											
14	30357	Matthew Miller	BUSI	JR											
15	49615	Emma Garcia	ECON	SO											
16	28778	Nathan Turner	ECON	FR											
17	33565	Lily Moore	ECON	JR											
18	69282	Ethan Hall	ECON	SO											
19	92750	Sophia Clark	ECON	SR											
20	47053	Jackson Adams	BUSI	SO											
21	97585	Ava Rodriguez	BUSI	SO											
	$\langle \rangle$	Attendance Quiz	Midterm	Final	Shell	+									:

Figure 17: Shell Worksheet

To manually merge information, we must first identify a unique identifier. If there is no unique identifier, we must create one. Fortunately, in this specific case, the student ID number (SID) serves as a unique identifier. With a unique identifier available, we can use the VLOOKUP function to retrieve students' performance data from the other three worksheets.

Specifically, the formula we must use will be:

- E2: =VLOOKUP(\$A2,Quiz!\$A\$2:\$E\$21,5,0)
- F2: =VLOOKUP(\$A2,Midterm!\$A\$2:\$E\$21,5,0)
- G2: =VLOOKUP(\$A2,Final!\$A\$2:\$E\$21,5,0)

See Figure 18 for the manually merged results.

	А	В	С	D	E	F	G	Н	I.	J	K
1	SID	Name	Major	Class	Quiz	Midterm	Final				
2	39630	John Doe	BUSI	FR	65.883544	63.848031	89.667084				
3	88741	Jane Smith	ACCT	SO	70.622386	76.023977	94.590742				
4	58518	Alex Johnson	ECON	SR	44.240421	59.19928	94.398706				
5	69909	Emily Davis	ECON	SO	32.011265	73.41517	95.950031				
6	43307	Michael Brown	ACCT	FR	22.790446	90.155576	91.733427				
7	49372	Olivia Wilson	ACCT	SO	72.342314	95.111828	90.850339				
8	95461	Daniel Lee	BUSI	SO	100	78.101099	98.221627				
9	55398	Sarah Martinez	ECON	JR	77.773608	88.937366	87.426706				
10	62040	Brian Taylor	ACCT	JR	74.419605	100	90.713715				

Figure 18: Manually Matched Values

# Topic 3. Power Query: Merging Data

We can also rely on Power Query to merge the data instead of manually merging it. Open another workbook and import the workbook BUSI201-LEC20-Workbook.xlsx into the Power Query Editor. Select the entire workbook, as shown in Figure 19, and choose Transform Data.

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Figure 19: Importing the Entire Workbook

Select the tables in the red box in Figure 20. Right-click and select Add as New Query. Each table will be added as a new query in the orange box. After adding each element as a new query, you may need to navigate to each individual query to set Use First Row as Headers.

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	SID Nam	ne	Major	Class	9/4/2023	9/6/2023	9/8/2023	9/11/2023	9/13/2023	9/15/2023	9/18/2023	9/20/2023	9/22/2023	9/25/202			
	39630 John		BUSI	FR	P	P	A	A				P P		Ρ	P	<u>)</u>	
	88741 Jane	Smith	ACCT	50	Ρ	P	A	P	P	Ρ	P	P P		Ρ	P	×	
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Figure 20: Adding Tables to Query

To merge the data and achieve a result similar to the final product in **Topic 2**, start by selecting the Quiz\_Sheet query. Then, choose Merge Queries as New to create a new query that can be exported later. Alternatively, you can select Merge Queries to merge the data directly into the Quiz\_Sheet query.

-	Quiz_Sheet - Power Q	uery Editor Add Column View						— 🗆	~
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lose	Query	Manage Columns	Reduce Rows	Sort	Transform	Combine Param	eters Data Sources	New Query	
ries (5)		<ul> <li>Table.TransformColumnType:</li> </ul>	s(#"Promoted Headers",{	("SID", Int64.Type), ("Name"	, type text), ("Major", type text)	, ("Class", type text), ("Quiz", type	number}}) 🗸	Query Settings	
BUSI201-LEC2	122 SID	✓ A <sup>B</sup> C Name	▼ A <sup>8</sup> C Major	<ul> <li>Λ<sup>β</sup><sub>C</sub> Class</li> </ul>	* 1.2 Quiz *				
Attendance_S	Sheet 1	39630 John Doe	BUSI	FR	65.88354368			A PROPERTIES	
Quiz_Sheet	2	88741 Jane Smith	ACCT	so	70.6223857			Name	
Midterm_She	et 3	58518 Alex Johnson	ECON	SR	44.24042112			Quiz_Sheet	
Final_Sheet	4	69909 Emily Davis	ECON	SO	32.01126483			All Properties	
	5	43307 Michael Brown	ACCT	FR	22.79044558			▲ APPLIED STEPS	
	6	49372 Olivia Wilson	ACCT	so	72.3423142				
	7	95461 Daniel Lee	BUSI	so	100			Source Navigation	
	8	55398 Sarah Martinez	ECON	JR	77.77360796			Promoted Headers	
	9	62040 Brian Taylor	ACCT	JR	74.41960488			× Changed Type	
	10	32403 Chloe Anderson	BUSI	JR	74.971991			onsingeo rype	
	11	34358 Eric Robinson	ECON	FR	69.76554044				
	12	10536 Jessica White	BUSI	so	69.24128946				
	13	30357 Matthew Miller	BUSI	JR	72.96911753				
	14	49615 Emma Garcia	ECON	so	100				
	15	28778 Nathan Turner	ECON	FR	87.1204835				
	16	33565 Lily Moore	ECON	JR	73.00066166				
	17	69282 Ethan Hall	ECON	SO	100				
	18	92750 Sophia Clark	ECON	SR	60.27391392				
	19	47053 Jackson Adams	BUSI	so	58.81797215				
	20	97585 Ava Rodriguez	BUSI	SO	98.08377044				

Figure 21: Initiate Merge

In the pop-up window, select the query that holds the data you want to merge with Quiz\_Sheet to create a new query. You can do this by choosing the appropriate query in the red box in Figure 22. Then, left-click on the unique identifiers in both queries, as shown in the blue boxes, and click OK.

Advanced Editor Refresh Preview • Manage • Query	Choose Remove Columns • Columns • Manage Columns	Merge Select tables and matching columns to create a merged table.	Recent Source ▼ Enter Data New Query
Pred B	Table i ransform Columityes (#	Quic Sheet       Image: Sheet       I	Query Settings : : • PROPERTIES Name Quiz, freet All Properties • APPLED STEP Source (* Nonjation (*) Nonjation (*) A Changed Type

Figure 22: First Round of Merging

We need to make some changes to the newly generated query. Click the dropdown menu in the red box in Figure 23. Uncheck all elements other than the variable you want to include in the query, as seen in the blue box. You may also uncheck the Use original column name as prefix for brevity.

lose & Refresh	Properties Advanced Editor Manage T	Choose Remove Columns • Columns •	Keep Remove Rows • Rows •	A↓ XA↓	Split Group Column * By	Data Type: Table * Use First Row as Headers 1,2 Replace Values	<ul> <li>Merge Queries </li> <li>Append Queries </li> <li>Combine Files</li> </ul>	Manage Parameters •	Data source settings	New Source   Recent Sources  Enter Data	
Close	Query	Manage Columns	Reduce Rows	Sort		Transform	Combine	Parameters	Data Sources	New Query	
ries (6)	× √ fx =	Table.NestedJoin(Quiz_She	et, ("SID"}, Midterm_	iheet, {'	SID"}, "Midterm_Shee	t", JoinKind.LeftOuter)			~	Query Settings	
II USLOU-ILC21-Vorte Attendanc_Sheet II Attendanc_Sheet II Audionanc_Sheet II And_Sheet II And II And	m.         29         300           2         3         3           4         5         5           5         6         7           7         8         9           9         10         11           11         12         13           12         13         14           15         16         17           18         99         20	Ar: Name     Settion     Are State     Settion     Are State     Are     Are	Acc Major      BUS      BUS      CON      ACCT      CCON      ACCT      BUS      ECON      ACCT      BUS      ECON      BUS      ECON      BUS      ECON      ECON      ECON      BUS      ECON      BUS      ECON      BUS      ECON      BUS      BUS		<ul> <li>アレート・アレート・アレート・アレート・アレート・アレート・アレート・アレート・</li></ul>	1.2 oute     Search Columns to Expand     Search Columns to Expand     Grand      Grand	OK Cancel de de de de de de de de			PROPERTIES Name Merga1 All Properties APPLED STEPS Source	8

Figure 23: First Round of Merging (cont'd)

The newly generated query resulting from the steps detailed above is visible in Figure 24. We can complete this merging process by following similar steps to merge final exam data into this new Merge1 query.

e & Refresh	Properties	Choose Remove Columns • Columns •	Keep Remove Rows • Rows •	Ž↓ Ž↓ Split Column	Group By 12 Replace Values	Merge Queries  Merge Queries  Append Queries  Combine Files	Manage Parameters •	New Source ▼ Recent Sources ▼ Enter Data	
se	Query	Manage Columns	Reduce Rows	Sort	Transform	Combine	Parameters Data Sources	New Query	
15 [6]	× √ fx -	Table.ExpandTableColumn(Sc	ource, "Midterm_Sheet"	, ("Midterm"), ("M	idters"})		~	Query Settings	
BUSI201-LEC21-Work	123 SID	▼ A <sup>R</sup> C Name	✓ A <sup>8</sup> C Major	→ Λ <sup>β</sup> <sub>C</sub> Class	* 1.2 Quiz * 1.2 M	lidterm 👻			
Attendance_Sheet	1	39630 John Doe	BUSI	FR	65.88354368	63.84803122		▲ PROPERTIES	
Quiz_Sheet	2	88741 Jane Smith	ACCT	so	70.6223857	76.02397659		Name	
/lidterm_Sheet	3	58518 Alex Johnson	ECON	SR	44,24042112	59.19927957		Merge1	
inal_Sheet	4	69909 Emily Davis	ECON	SO	32.01126483	73.41516977		All Properties	
/lerge1	5	43307 Michael Brown	ACCT	FR	22.79044558	90.1555764		▲ APPLIED STEPS	
	6	49372 Olivia Wilson	ACCT	so	72.3423142	95.11182753			
	7	95461 Daniel Lee	BUSI	so	100	78.10109853		Source	
	8	55398 Sarah Martinez	ECON	JR	77.77360796	88.93736639		× Expanded Midterm_Sheet	
	9	62040 Brian Taylor	ACCT	JR	74.41960488	100			
	10	32403 Chloe Anderson	BUSI	JR	74.971991	62.26719079			
	11	34358 Eric Robinson	ECON	FR	69.76554044	67.57332321			
	12	10536 Jessica White	BUSI	so	69.24128946	93.20209547			
	13	30357 Matthew Miller	BUSI	JR	72.96911753	84.40235014			
	14	49615 Emma Garcia	ECON	so	100	69.94307312			
	15	28778 Nathan Turner	ECON	FR	87.1204835	75.86425166			
	16	33565 Lily Moore	ECON	JR	73.00066166	88.40781056			
	17	69282 Ethan Hall	ECON	SO	100	83.40013971			
	18	92750 Sophia Clark	ECON	SR	60.27391392	100			
	19	47053 Jackson Adams	BUSI	so	58.81797215	70.92857179			
	20	97585 Ava Rodriguez	BUSI	so	98.08377044	72.35184801			

Figure 24: First Round of Merging Completed

lose & Refresh	Advanced Editor Manage Query	Choose Remove Columns • Columns • Manage Columns	Keep Remove Rows • Rows • Reduce Rows	A Z↓ Z↓ Sort	Split Column •	Group By	Data Type: Decimal Number * Use First Row as Headers * 1, 2 Replace Values Transform	Append Queries  Append Queries Combine Files Combine	Manage Parameters • Parameters	Data source settings Data Sources	New Source   Recent Sources  Enter Data  New Query	
Jeries (6)	$\times$ $\checkmark$ $/\mu$ - Table.ExpandTableColumn(Source, "Midterm_Sheet", ("Midterm")) $\vee$ Q											×
III Attendance,Sheet () Quiz,Sheet III Mathem,Sheet III Final,Sheet III Mergel	P3 800           1           2           3           4           5           6           7           8           9           10           11           12           13           14           15           16           17           18           20	Me, Name     Me, Name     Me, Name     Sastol, John     Ove     Sastol, John     Ove     Sastol, John     Ove     Sastol, John     Sastol	Mage           BUS           BUS           BUS           ECON           ECON           BUS           ACCT           BUS           BUS           ECON           ACCT           BUS           ECON           ACCT           BUS           ECON           BUS           ECON           BUSI           BUSI           BUSI		Pr.         Class           FR         SO           SR         SO           SR         SO           JR         JR           JR         JR           JR         SO           JR         SO           SR         SO           SO         SO           JR         SO           JR         SO           SO         SO           SR         SO           SO         SO           SO         SO		65.885446 70.22387 44.440212 32.012448 22.704458 72.924542 72.725542 73.725076 74.415048 69.7415946 69.7415946 69.7415946 72.75941 73.750 69.721594 69.721594 72.000826 72.000826 72.000826 98.08577044	68.4403122 70.023785 53.13627857 72.4151697 78.0155784 88.3578639 73.0109853 88.3578639 74.009853 88.3578639 74.26278079 84.26278079 84.26278079 84.26278079 74.5782212 93.2009847 84.40782014 83.407971 73.8627129 70.9847779 72.55184601			<ul> <li>PROPERTIES         Name             Meg1             Meg1             All Properties          </li> <li>All Properties         </li> <li>APPLID STIPS         </li> <li>Source         X Expanded Midterm_Sheet     </li> </ul>	0

Figure 25: All Data Merged in Query

To merge the final exam information into this query, select Merge Queries this time instead of Merge Queries as New, and follow the exact same steps. Choose the student ID numbers, and go through the checkboxes. The Merge1 query following this process is shown in Figure 25. Importing this query into Excel, the result is displayed in Figure 26.

	Α	В	С	D	E	F	G	Н	I	J	K	L	Queries & Connections	v x
1	SID 🛃	Name 🖪	Major	Class	Quiz 🛃	Midterm 🚽	Final 🗾						Queries Connections	
2	39630	John Doe	BUSI	FR	65.88354368	63.84803122	89.66708395						6 queries	
3	88741	Jane Smith	ACCT	SO	70.6223857	76.02397659	94.59074178						BUSI201-LEC21-Workbook xlsx	
4	58518	Alex Johnson	ECON	SR	44.24042112	59.19927957	94.39870638						5 rows loaded.	
5	69909	Emily Davis	ECON	SO	32.01126483	73.41516977	95.95003058						Attendance_Sheet	
6	43307	Michael Brown	ACCT	FR	22.79044558	90.1555764	91.73342698						Quiz Sheet	
7	49372	Olivia Wilson	ACCT	SO	72.3423142	95.11182753	90.85033899						20 rows loaded.	
8	95461	Daniel Lee	BUSI	SO	100	78.10109853	98.22162731						Midterm_Sheet 20 rows loaded.	
9	55398	Sarah Martinez	ECON	JR	77.77360796	88.93736639	87.42670642						Final Sheet	
10	62040	Brian Taylor	ACCT	JR	74.41960488	100	90.71371502						20 rows loaded.	
11	32403	Chloe Anderson	BUSI	JR	74.971991	62.26719079	84.57406171						Merge1 20 rows loaded.	D.
12	34358	Eric Robinson	ECON	FR	69.76554044	67.57332321	86.69297478						20 rows loaded.	_
13	10536	Jessica White	BUSI	SO	69.24128946	93.20209547	97.07938781							
14	30357	Matthew Miller	BUSI	JR	72.96911753	84.40236014	93.17842013							
15	49615	Emma Garcia	ECON	SO	100	69.94307312	88.48818443							
16	28778	Nathan Turner	ECON	FR	87.1204835	75.86425166	95.65823593							
17	33565	Lily Moore	ECON	JR	73.00066166	88.40781056	92.30112903							
18	69282	Ethan Hall	ECON	SO	100	83.40013971	94.87143174							
19	92750	Sophia Clark	ECON	SR	60.27391392	100	87.99410653							
20	47053	Jackson Adams	BUSI	SO	58.81797215	70.92857179	88.74993291							
21	97585	Ava Rodriguez	BUSI	SO	98.08377044	72.35184801	86.68562663						•	
22													•	

Figure 26: Merged Query Imported