

MONASH University MONASH BUSINESS SCHOOL

Chapter 2 (pp. 53-64) & Chapter 4 (pp. 110-121)
Transaction Processing (part 2), ERP systems & Introduction to Relational Databases
Romney and Steinbart (2018)

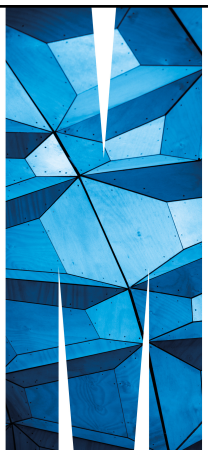
Chief Examiner Edward Tello
Semester 2, 2018

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Recap...

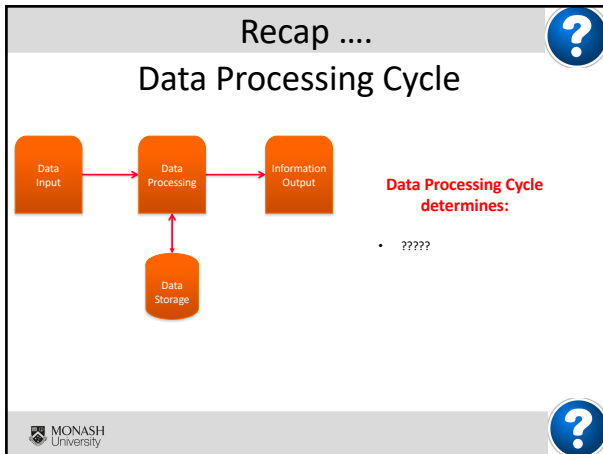
- An Information System ...
 - “a system that captures **data** about an organization, stores and maintains the **data**, and provides meaningful information for management” (Jones & Rama 2006)
- An AIS is a specialised subsystem of IS ...
 - “Collect, process and report information related to **financial aspects** of business activities or events”
 - “They record **transactional accounting data**, convert data into information, and provide information to external & internal decision makers” (Parkes et al., 2016)

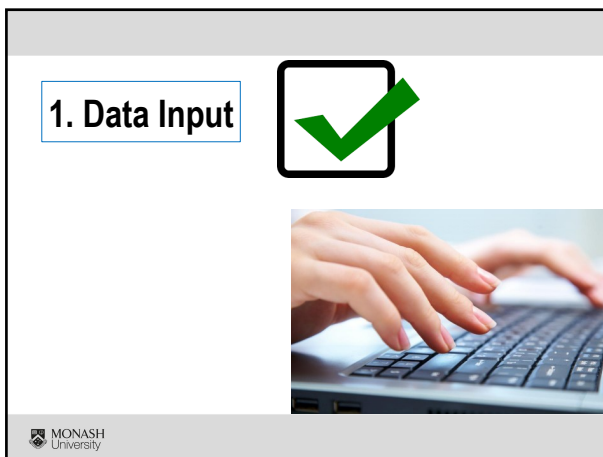


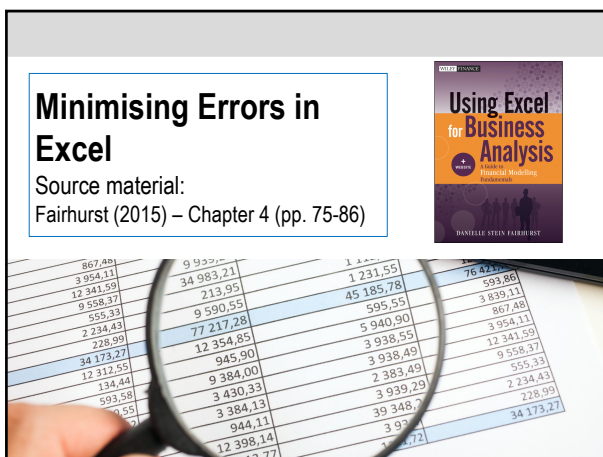
Recap...

- A Business Function is ...
 - “an activity that a person is employed to perform”
- A Business Process is ...
 - “a set of related, coordinated and structured **activities and tasks** that help to accomplish an **organisational goal**” (Monk & Wagner 2006)









Dirty Data

It is a database record that contains errors (e.g. inaccurate, incomplete or erroneous data)



Source: Vinnik, T (2017) – Umbel

'Big Data's Dirty Problem' by Kopytoff (2014)

- Data is inevitably **"dirty"** thanks to obsolete, inaccurate, and missing information
- Cleaning it up is an increasingly important and overlooked job that can help prevent costly mistakes
- A constellation of companies offer software and services for cleaning data (e.g. IBM, SAP)
- Healthcare, with all its dirty data, is one of the toughest industries for big data technology.

Source: Kopytoff, 2014 (see [Reading List](#) on Moodle – recommended / voluntary)

Try to minimise errors

- Avoid **'dirty data'**!!

What would be the result if you make input errors?

E.g. see spreadsheet errors from the website: <http://www.eusprig.org/horror-stories.htm>



**'Spreadsheet errors cost Clallam \$494,157' by Ollikainen
(Daily News, 2017)**

- Errors on a pair of Clallam County Sheriff's Office budget documents cost the county \$494,157 in February 2017
- A **\$331,074 Excel spreadsheet calculation error** was made on a sheriff's operations salary worksheet during the annual budget cycle last year and a **\$163,083 spreadsheet error** was made on a sheriff's jail salary worksheet

Source: <http://www.peninsuladailynews.com/news/spreadsheet-errors-cost-clallam-494157/>



Types of Errors: Quantitative Errors

- **Mechanical errors** (i.e. simple mistakes)
 - e.g. typing errors, wrong number, pointing to wrong cell when constructing formulas etc (easiest to detect)
- **Logic errors**
 - wrong algorithm or incorrect expression of algorithm in S/S formula (less likely to be detected)
- **Omission errors**
 - omit a variable or parameter (very low detection rate)

Source: Rajalingham et al., 2000 (see **Reading List** on Moodle – recommended / voluntary)



Qualitative Errors (potential errors)

- These are issues likely to induce errors in future:
 - **Poor model layout/design**
 - Data entry errors more likely when layout is confusing
 - Complicated/confusing layouts are hard to maintain
 - **Poorly designed formulas**
 - data values embedded in formulas – hard coding (e.g. **=PMT(5.5%, B22, C22)**)
 - Overly complex formulas
 - **Poor or non-existent model documentation**
 - **Unprotected worksheet**
 - User may accidentally delete important formulas



Auditing spreadsheet models

- Using **Excel's audit tools**:
 - Trace precedents
 - Trace dependents
 - Trace error
- Manual spreadsheet auditing techniques
 - Inbuilt audit tools do not detect logic errors
 - Need to calculate result manually
 - Test using extreme and out-of-range values
 - Should be performed by an independent person

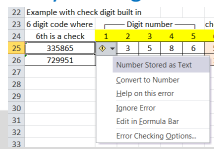


Excel warns about some potential errors automatically!!

- Green triangle flags a potential error
- Select cell to find out more about problem

24	6th is a check	1	2	3	4	5	6	sum	mod10	check	check digit
25	335865	3	3	5	8	6	5	25	5	5	5
26	729951										

- May be able to fix by clicking on warning icon



Can also trace cell dependencies

- **Trace dependents**
 - see which cells depend on a data point, and how those, in turn, feed into other calculations
- **Trace precedents**
 - See which cells feed into selected calculation

	A	B	C	D	E	F	G	H	I	J	K	L	M
1													
2		Code	1	2	3	4	5	6	7	sum	mod10	check	check digit
3		3358649	3	3	5	8	6	4	9	38	8	2	2
4		7299515	7	2	9	9	5	1	5	38	8	2	2



Program solutions:

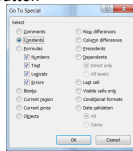
Examining inputs

- Data source issues:
 - Where are the input values?
 - Where is each used?
 - Are any inputs sourced from other sheets or databases?



1) Where are the input values?

- This is a **field check** and a **completeness check**: checks data type and whether all items have been entered
- Press **F5** key (go to)
- Click on **Special** button
- Nominate type of input (number, text, logical, error)



SAMPLE PROFIT & LOSS PROJECTION				
	Actual Data		Variance	
DATA SECTION				
Period & Dates	12/01/17	12/01/17	12/01/17	12/01/17
Periods & Expenses	12/01/17	12/01/17	12/01/17	12/01/17
REPORT SECTION				
ARTHUR'S MIXED BUSINESS PROJECTED PROFIT STATEMENT				
	1	2	3	4
SALES				
Period & Dates	12/01/17	12/01/17	12/01/17	12/01/17
Periods & Expenses	12/01/17	12/01/17	12/01/17	12/01/17
EXPENSES				
Period & Dates	12/01/17	12/01/17	12/01/17	12/01/17
Periods & Expenses	12/01/17	12/01/17	12/01/17	12/01/17
NET PROFIT				
Period & Dates	12/01/17	12/01/17	12/01/17	12/01/17
Periods & Expenses	12/01/17	12/01/17	12/01/17	12/01/17

- Can also use this dialog box to highlight formulas, empty cells, objects, cells with conditional formatting, cell with data validation rules attached

2) Where is each value used?

- Select data cell
- From formulas menu, click on **Trace Dependents** to see formula cells that refer to cell
- Keep clicking to see sequence of processing

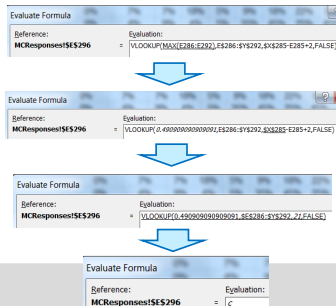
	A	B	C	D	E	F	G	H
	SIMPLE PROFIT & LOSS PROJECTION							
DATA SECTION								
		Sales	Annual Costs	Gross Profit	COGS%			
Food & Drinks		50,000	12,300	37,700	40.60%			
Newspapers & Magazines		75,000	12,300	62,700	16.40%			
REPORT SECTION								
ARTHUR'S MIXED BUSINESS								
PROJECTED PROFIT STATEMENT								
	1	2	3	4	5	6	7	TOTAL
SALES								
Food & Drinks	20,000	22,400	25,000	28,000	30,000	33,450	35,247	352,904
Newspapers & Magazines	10,000	11,000	12,500	14,000	15,000	16,725	17,623	180,304



1	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z
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3	DATA SECTION																									
4	Actual Data																									
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427	4200.00%																									
428	4210.00%																									
429	4220.00%																									
430	4230.00%																									
431	4240.00%																									
432	4250.00%																									
433	4260.00%																									
434	4270.00%																									
435	4280.00%																									
436	4290.00%																									
437	4300.00%																									
438	4310.00%																									
439	4320.00%																									
440	4330.00%																									
441	4340.00%																									
442	4350.00%																									
443	4360.00%																									
444	4370.00%																									
445	4380.00%																									
446	4390.00%																									
447																										

Examining formulas

- Can **show formulas**: Press **ctrl + ~**
- Can **trace precedents** to see where data comes from
- Can **Evaluate formulas** to check intermediate calculations in complex formulas (Click **Formulas** then **Evaluate Formula**)



3) Any inputs sourced from other sheets or databases?

- **Linking to External Files:**
 - One of the important principles in Excel modelling best practice is to link to the source data
 - However, if your source data exists in an external file, this can cause many problems (e.g. broken links, incorrect data, and error messages)
 - But if done properly, external links add value to your models
 - It is recommended to use **Named Ranges** in External Links (in the source file)

Learning Objectives ch.2 (cont.)

- Describe how data is stored, and processed and how information is outputted.
- Discuss how organizations use enterprise resource planning (ERP) systems to process transactions and provide information.

2) Data Storage



- Important to understand how data is organised:
 - **Chart of accounts**
 - Coding schemas that are well thought out to anticipate management needs are most efficient and effective
 - **Transaction journals (e.g., Sales)**
 - **Subsidiary ledgers (e.g., Accounts receivable)**
 - **General ledger**

??????



• General

- Summary level data for each:

Asset, liability, equity, revenue, and expense

• Subsidiary

- Detailed data for a General Ledger (Control) Account that has individual sub-accounts
 - Accounts Receivable
 - Accounts Payable



Coding Techniques

- **Sequence codes:** Invoice 101, 102, 103, 104, etc.

• Block codes:

Product Code	Product Type
1000 – 1999	Television
2000 – 2999	Computers

- **Group codes:** E.g. 4 6 16

Digit Position	Meaning
1	Brand name (4 = Sunbeam)
2	Color (6 = Red)
3	Year of manufacture (2016)



- **Mnemonic codes:** Dry300W05 → dryer



SALES JOURNAL

Date	Invoice Number	Account Debited	Account Credited	Post Ref	Amount
Oct. 15	151	Brown Hospital Supply	120-015	✓	788.00
15	152	Greenhollows Hotel Suites	120-122	✓	1,267.00
15	153	Medicare Apartments	120-057	✓	6,887.00
15	154	AMS Construction	120-173	✓	2,312.50
15	155	Goodwin Apartments	120-084	✓	2,280.00
15	156	KDR Builders	120-135	✓	1,876.50
		KTOM	120-520		15,511.00

GENERAL LEDGER

Date	Description	Post Ref	Debit	Credit	Balance
Oct. 14	Sales	514	12,432.00		67,283.00
14	Collection	428		22,162.00	79,219.00
15	Sales	515	15,511.00		73,066.00

GENERAL LEDGER

Date	Description	Post Ref	Debit	Credit	Balance
Oct. 14	Sales	514		242,742.00	242,742.00
14	Sales	514	12,432.00		250,194.00
15	Sales	515	15,511.00		275,705.00

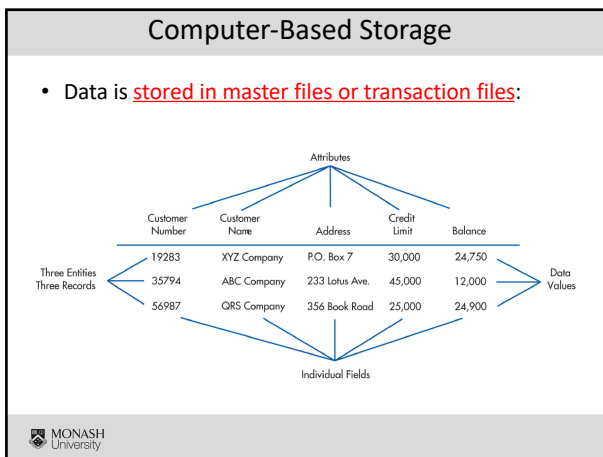
ACCOUNTS RECEIVABLE SUBSIDIARY LEDGER

Date	Description	Post Ref	Debit	Credit	Balance
Sept. 12	Sales	511	3,682.00		3,682.00
Oct. 1	Payment	414		3,682.00	0.00
Oct. 13	Sales	515	1,876.50		1,876.50

Amount of PAYMENT MADE

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• Audit trail for Invoice #156 for \$1,876.50 sold to KDR Builders



3) Data Processing

4 types of processing (CRUD):

- **C**reating new records (e.g., adding a customer)
- **R**ead existing data
- **U**ppdating previous record or data
- **D**eleting data

?????

?

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For the following scenario identify which data processing method (batch or online, real-time) would be the most appropriate:

Preparation of customer bills by a local utility

????

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4) Information Output

The data stored in the database files can be viewed

↓

Online (soft copy)
Printed out (hard copy)

Information presented in 1 of 3 forms

{

- Document
- Report
- Query

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Enterprise Resource Planning (ERP)




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Enterprise Resource Planning Systems (ERP)??

“It is a **business process management software** that allows an organization to use a system of **integrated applications** to manage the business and automate many back office functions related to technology, services and human resources”

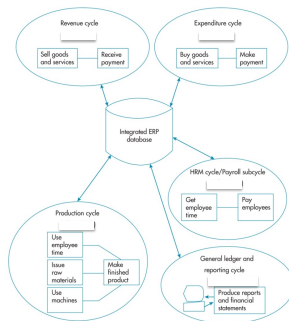
Source: Webopedia (2017)



Enterprise Resource Planning (ERP)

Combination of:

- Centralised (integrated) **data storage**
- **Workflow management**
 - Allocate a task to someone (e.g. prepare an order for stationery)
 - When that is finished allocate the follow-on task (e.g. authorise order)



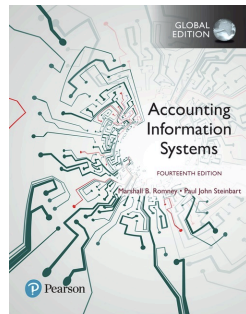
Advantages & Disadvantages of ERP systems

- Although ERP systems offer many advantages to organisations, they also have significant disadvantages:

- ✓ Costly
- ✓ Significant amount of time to implement
- ✓ Customizing or standardizing a business process
- ✓ Complexity
- ✓ User resistance (learning new things is sometimes hard for employees)



Chapter 4 (pp. 110-121)
Relational Databases
Romney and Steinbart (2018)

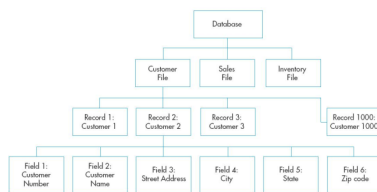


Learning Objectives ch.4

- Explain the importance and advantages of databases, as well as the difference between database and file-based legacy systems.
- Explain database systems, including logical and physical views, schemas, the data dictionary, and DBMS languages.
- Describe what a relational database is, how it organizes data, and how to create a set of well-structured relational database tables.

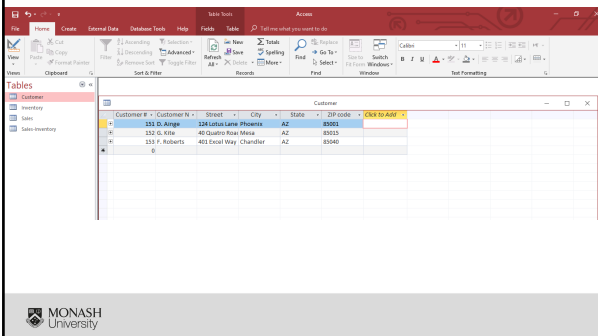
Data Hierarchy

- **Field**
 - Attributes about an entity
- **Record**
 - Related group of fields
- **File**
 - Related group of records
- **Database**
 - Related group of files



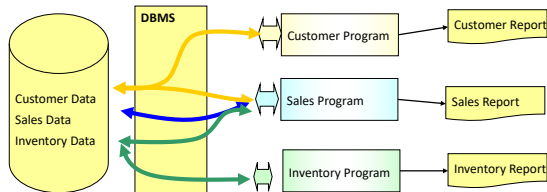
Source: Romney & Steinbart (2018)

Using Microsoft Access ...



File Approach vs. Database Approach

- Database Approach:
 - Centralised repository
 - Standardised data format (e.g. dd/mm/yyyy)
 - Standardised access path (via DBMS)



What is a database?

A database is a set of interrelated, centrally coordinated files (...) For example, an A/R file might be combined with customer, sales analysis and related files to form a customer database

Romney & Steinbart (2018)

A database is a logical grouping of data. It contains a set of related table spaces and index spaces. Typically, a database contains all the data that is associated with one application or with a group of related applications. You could have a payroll database or an inventory database, for example

IBM, n.d. (<https://www.ibm.com>)

A database is a data structure that stores organized information. Most databases contain multiple tables, which may each include several different fields

TechTerms, 2017 (<https://techterms.com/definition/database>)

How is data stored in a database?

- **In linked lists/tables of data**

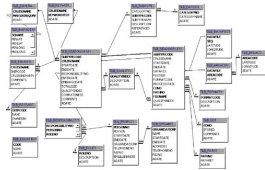
- Layout a bit like a spreadsheet (rows and columns)
- Cross-references to minimise duplication

- **Transaction file:**

- Contains records of a business from a specific period of time
- Refers to master files

- **Master file:**

- Permanent records
- May be updated by transaction (e.g. stock on hand)
- Does not refer to transaction file



Emp. No	Name	Age	Department	Salary
001	Alex S	26	Store	5000
002	Gareth K	32	Marketing	5600
003	Ruben R	31	Marketing	5600
004	Joni	26	Security	5100



Advantages of Database Systems

DATA
SHARING

DATA
INTEGRATION

MINIMISING DATA REDUNDANCY AND DATA INCONSISTENCY

DATA
INDEPENDENCE

CROSS-
FUNCTIONAL
ANALYSIS



Database Terminology

Database Management System (DBMS):

- Interface between software applications and the data in files

Database Administrator (DBA):

- Person responsible for maintaining the database

Data Dictionary:

- Information about the structure of the database
 - ✓ Field names, descriptions and uses
 - ✓ "Blueprint" of the structure of the database

Microsoft
Access



It is a database management
system (DBMS) from
Microsoft



Schemas

A **schema** is a description of the data elements in a database, the relationships among them & the logical model used to organise & describe the data

3 levels

- **Conceptual-level**
→ Organization wide view
- **External-level**
→ Individual user's view
- **Internal-level**
→ Low level view

Relational Database

- A relational database is a **collection of data items organized as a set of formally-described tables from which data can be accessed or reassembled in many different ways without having to reorganize the database tables**

Source: TechTarget (www.searchsqlserver.techtarget.com)

A Relational Table

Item Number	Description	Color	Vendor Number	Quantity on Hand	Price
1038	Refrigerator	White	10023	12	1199
1038	Refrigerator	Almond	10023	7	1299
1038	Refrigerator	Hunter Grey	10023	5	1499
2061	Range	White	10011	6	799
2063	Range	Black	10011	5	999
3541	Washer	White	10008	15	499
3544	Washer	Black	10008	10	699
3785	Dryer	White	10019	12	399
3787	Dryer	Almond	10019	8	499

Each row contains multiple attributes describing an instance of the entity. In this case, inventory.

Same type of data

Column (Field)

Example ...

Sales Invoice #	Date	Salesperson	Customer #	Click to Add
101	15/10/2015	J. Buck	151	
102	15/10/2015	S. Knight	152	
103	15/10/2015	S. Knight	151	
104	15/10/2015	J. Buck	152	
105	14/11/2015	J. Buck	153	
			0	

Customer #	Customer N	Street	City	State	Click to Add
151	D. Ainge	123 Lotus Lane	Preston	VI	
152	G. Kite	40 Quatro Road	Melbourne	VI	
153	F. Roberts	401 Excel Way	Carlton	VI	

Customer

Inventory

Sales

Sales-Inventory

Customer

Customer #

Customer Name

Street

City

State

Sales

Sales Invoice #

Date

Salesperson

Customer #

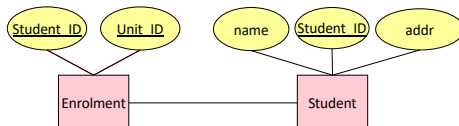
Attributes

- ❑ A **key** is a set of attributes for a list such that every entry has a unique identifier
- E.g. the Monash student ID is a unique identifier for each Monash student
 - Other universities use a similar numbering scheme, so a multiple university database will identify each student with the combination University ID + Student ID

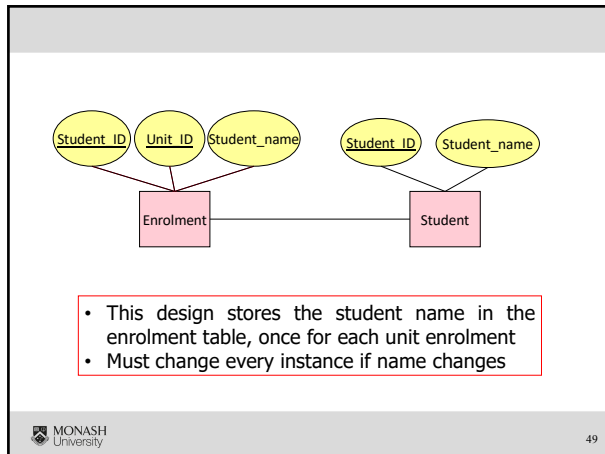


❑ Non-Key Attributes:

Columns which can't be used to identify a record uniquely for example, but store important information about that entity



This design gives the name and address of each student exactly once



Types of Keys



- **Primary Key:**
 - An attribute or combination of attributes that can be used to uniquely identify a specific row (record) in a table

Usually, the primary key is a single attribute, but in some cases 2 or more attributes are needed

- **Foreign Key:**
 - An attribute in one table that is a primary key in another table.

Used to link the two tables

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Relational Data Tables

- **Primary Keys**
- **Foreign Key**

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Why Have a Set of Related Tables?

- ??????



Why Have a Set of Related Tables?

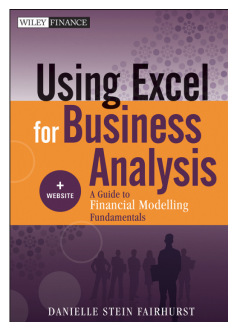
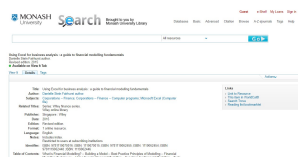
TABLE 4-3 Example of Storing All Sales Data for S&BS in One Table

Order #	Date	Salesperson	Customer #	Invoiced Total	Customer Name	Street	City	State	Zip	Quantity	Description	Unit Price	Subtotal Amount
102	10/15/2018	J. Block	131	1461	D. Ainger	123 Lotus Lane	Phoenix	AZ	30	2	Television	400	180
102	10/15/2018	J. Block	131	1461	D. Ainger	123 Lotus Lane	Phoenix	AZ	30	1	Microwave	445	445
102	10/15/2018	S. Knight	132	4334	G. Kline	40 Quattro Road	Mesa	AZ	30	1	Television	400	400
102	10/15/2018	S. Knight	132	4334	G. Kline	40 Quattro Road	Mesa	AZ	30	3	Fridge	495	1485
102	10/15/2018	S. Knight	132	4334	G. Kline	40 Quattro Road	Mesa	AZ	30	2	Refrigerator	495	990
102	10/15/2018	J. Block	133	188	D. Ainger	123 Lotus Lane	Phoenix	AZ	30	2	Microwave	445	890
104	10/15/2018	J. Block	132	159	G. Kline	40 Quattro Road	Mesa	AZ	40	1	Fridge	700	700
105	11/14/2018	J. Block	133	3194	F. Roberts	401 Excel Way	Chandler	AZ	30	3	Television	400	1200
105	11/14/2018	J. Block	133	3194	F. Roberts	401 Excel Way	Chandler	AZ	30	1	Fridge	400	400
105	11/14/2018	J. Block	133	3194	F. Roberts	401 Excel Way	Chandler	AZ	30	2	Refrigerator	400	800

Source: Romney & Steinbart (2018 p. 119)

Financial Modelling: Logical Functions

Source material:
Fairhurst (2015) – Chapter 5 (pp. 112-119)



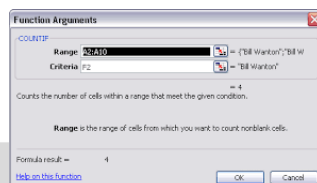
Excel in Financial Modelling

- For use in business analysis, the most useful functions fall into the categories of:
 - Logical functions (e.g. IF, AND, etc)
 - Aggregation functions (e.g. SUMIF, COUNTIF, etc)
 - Lookup functions (e.g. HLOOKUP, VLOOKUP, etc)
 - Financial functions (e.g. NPV, IRR, PMT, etc.)



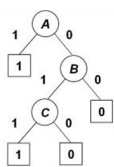
Logical Functions

- Commonly used in financial modelling
- These functions (IF, AND, OR, etc) are **used when you need to evaluate a condition.**
- For example: **"Shall we include tax in our calculation?"** If the answer is 'yes', we include it. If not, we don't.

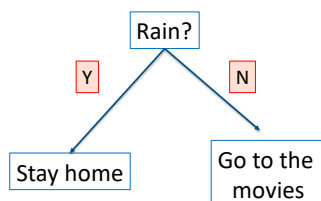


Logical Functions

- A basic logical function is used to compare 2 values or statements



Binary Decision Diagram



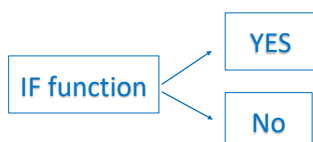
Conditional calculations

- What if some of the values are conditional?



IF function

- The most important function because it provides decision-making capability in a worksheet
- The IF statement takes 3 arguments:
 - **Field 1:** Logical expression that is evaluated
 - **Field 2:** The result if field 1 is true
 - **Field 3:** The result if field 1 is false



IF function

- Allows you to test a condition:
 - one value is returned if the condition is **TRUE**
 - another value is returned if the condition is **FALSE**

IF(logical-test, value-if-true, value-if-false)

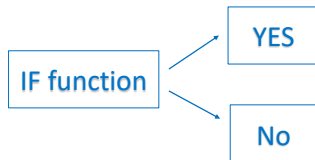
Example:

=IF(D1>26,1,0)

- ✓ Checks whether value in **D1** is greater than **26**
- ✓ If so, Excel returns a value of **1**
- ✓ If not, a value of **0** is returned

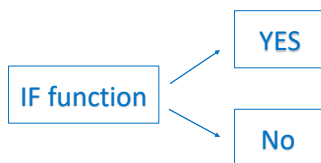
Using IF with a Text

- The IF function can be used to display different information depending on the outcome of the conditional test
- If only you want text to appear if the result is true, you can enter the text in double quotes (" ")



Using IF with Numbers

- A common use of the IF function is to perform numerical computations based on the outcome of a condition test
- To do so, you put formulas that would normally be used to calculate values in place of the TRUE and FALSE components of the function



AND Statement

- The AND statement can take up to 30 logical fields
- It returns TRUE only if all the logical expressions are TRUE. For example: **=AND(2<3,4<5)**
- The AND Statement is commonly used in conjunction with the IF

	A	B	C	D	E
1	Salesperson	Sales Calls	Total Sales	Bonus?	
2	Linda	19	16000.00	No	
3	Dan	12	9000.00	No	
4	Mike	18	10000.00	No	
5	Joe	28	18000.00	Yes	
6	Elly	22	19000.00	Yes	



OR Statement

- The OR Statement is very similar to the AND statement EXCEPT that either field can be true, rather than both
- For example:
 $\text{=OR}(2<3,4<3)$ is TRUE because any these fields is true

D6 $\text{=IF(OR(B6="red",B6="green"),"x","")}$

	A	B	C	D	E	F
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						
11						

If cell is this or that
Do something when a cell contains either X or Y

Color	Price	Flag	New price
red	100.00	x	115.00
green	80.00	x	92.00
red	100.00	x	115.00
blue	90.00		90.00
red	100.00	x	115.00
blue	90.00		90.00



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Nesting: Combining Simple Formulas to Create Complex Ones

- A nested formula is one in which a function is included in the field of another function
- This technique allows building more complex formulas. For example:
 $\text{=AVERAGE(SUM(A3:A23),SUM(D3:D23))}$



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Nesting: IF function (+ AND function)

- Example of an IF function that contains an AND function as the logical test.
- The AND function asks Excel to test multiple conditions. If all the conditions are met, Excel returns a value of TRUE. Otherwise, Excel returns a value of FALSE:
 - Task:** Students pass a course based on two final exam scores. The first score, stored in cell D5, must exceed 19, and the second test score, in cell D6, must exceed 69. Express this functional relationship using IF & AND functions:
 - Solution:** $\text{=IF}(\text{AND}(D5>19,D6>69))$, "Pass", "Fail")
 - Explanation:** The function above reads: If the value in D5 is greater than 19 AND the value in cell D6 is greater than 69, please display the value-if-true, which is "Pass." Otherwise, display "Fail."



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Nesting: IF function (+ OR function)

- IF function that contains an OR function as the logical test:
- **Task:** Students pass a course based on two final exam scores. The first score, stored in cell D5, must exceed 19. Alternatively, the second test score, in cell D6, must exceed 69. Hence, at least one of these two conditions needs to be satisfied. Express this functional relationship using IF & OR functions:
- **Solution:**
`=IF((OR(D5>19,D6>69)),"Pass","Fail")`
- **Explanation:**
 The function above reads: If the value in D5 is greater than 19 OR the value in cell D6 is greater than 69, please display the value-if-true, which is "Pass." Otherwise, display "Fail"

