ADM1370 MODULE 2 NOTES

You may be tested on your familiarity with concepts such as:

- Purpose of creating Excel tables
- Difference between conditional and logical functions
- Difference between absolute, relative, and mixed references
- Purpose of decision analysis/ what-if analysis tools such as Conditional Formatting, Goal Seek, and Solver

While you are required to know the purpose of various Excel features and functions that were discussed in class, you will not be asked to recall parameters for functions or their order

- For example, you should know that VLOOKUP allows you to search for values in a table that correspond to a lookup value, you will not be asked to write the function or specify what parameters are required

Section 1

Excel: computerized spreadsheet application used to build & manipulate worksheets & workbooks

- ➢ Program used to enter, analyze, & present (quantitative) data
- ➢ Excel aids a multitude of problem-solving & decision-making processes through providing:
  - Data management features
  - automatic calculation functions
  - Presentation tools
  - Decision analysis functions
- ➢ Excel Table can enhance presentation & facilitate sorting & filtering of data in the ranges

Spreadsheet: collection of text & numbers laid out in a rectangular grid

- Often used in business for accounting, budgeting, financial analysis, inventory management, etc.

Worksheet "Chartsheet"**:** spreadsheet that may contain data including text, numbers, formulas, charts, etc.

- ➢ **Workbook:** collection of related worksheets w/in 1 file

Cells, Ranges, & References

- ➢ **Cell:** each cell is referenced by its intersecting column (letter) & row (number):
  - E.g. cell A1 = topmost left cell in spreadsheet

    - Cell reference is shown in the name box beside formula bar
- ➢ **Range:** rectangular group of cells in a worksheet
    - Can be one single cell or may be entire worksheet
    - Range of cells w/ column headings (arranged as a flat table) = good starting point for analysis of data in the range
- ➢ Range can consist of contiguous (together) or non-contiguous (not together) cells:
    - Hold "Ctrl" key to select non-contiguous ranges
- ➢ Contiguous range of cells: referenced by top left cell reference & bottom right cell reference
    - E.g. B2:D5

Auto-Fill Feature: use to repetitively copy contents of 1 cell or a range of cells

- ➢ Used to complete a sequence, pattern or lists like numbers, increments, months
- ➢ Enables you to copy or continue content of a cell or a range of cells to its adjacent cells (below or to the right)
- ➢ Also be used to duplicate formulas; formula references are updated according to target cell for formula results

Formula: expression that returns a value thru performing operations on literal values specified in formula itself or referenced values from other cells; most commonly used operators are arithmetic operators

- ➢ Used to automate calculations that were once done manually
- ➢ Formulas may contains:
    - Mathematical operators
    - Literal values
    - Referenced values
    - Functions
- ➢ Must begin w/ an equals (=) sign

Arithmetic operators

Operation	Arithmetic Operator	Example	Description
Addition	+	=10+A1 =B1+B2+B3	Adds 10 to the value in cell A1 Adds the values in cells B1, B2, and B3
Subtraction	–	=C9–B2 =1–D2	Subtracts the value in cell B2 from the value in cell C9 Subtracts the value in cell D2 from 1
Multiplication	*	=C9*B9 =E5*0.06	Multiplies the values in cells C9 and B9 Multiplies the value in cell E5 by 0.06
Division	/	=C9/B9 =D15/12	Divides the value in cell C9 by the value in cell B9 Divides the value in cell D15 by 12
Exponentiation	^	=B5^3 =3^B5	Raises the value of cell B5 to the third power Raises 3 to the value in cell B5

Complex formulas: formulas follow "order of precedence"

- ➢ A set of predefined rules used to determine sequence in which operators are applied in a calculation

Order of precedence rules

Formula (A1=50, B1=10, C1=5)	Order of Precedence Rule	Result
=A1+B1*C1	Multiplication before addition	100
=(A1+B1)*C1	Expression inside parentheses executed before expression outside	300
=A1/B1–C1	Division before subtraction	0
=A1/(B1–C1)	Expression inside parentheses executed before expression outside	10
=A1/B1*C1	Two operators at same precedence level, leftmost operator evaluated first	25
=A1/(B1*C1)	Expression inside parentheses executed before expression outside	1

Function: predefined formulas (named operation) that returns a value

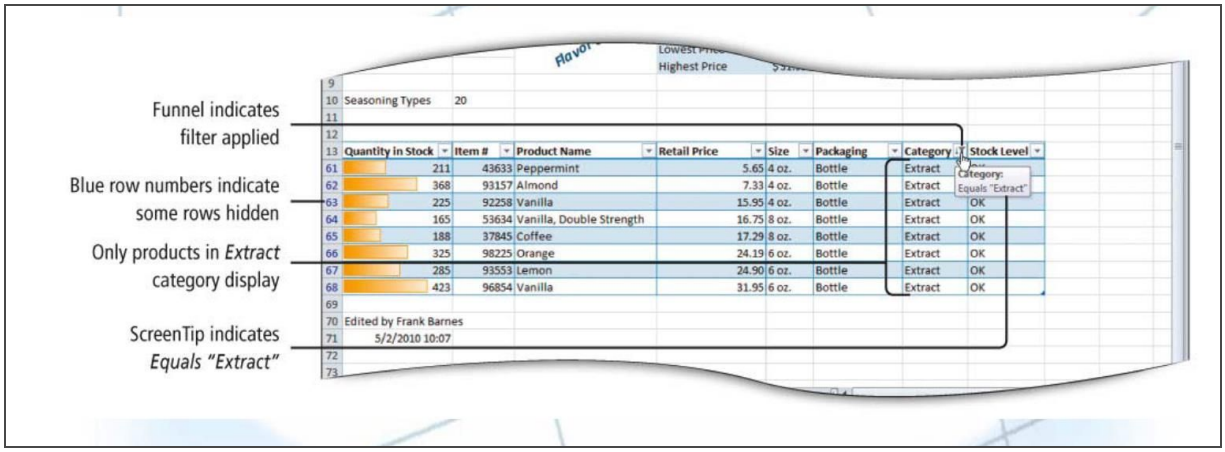
- ➢ Function take values (literal values or referenced values), perform operations, & return results:
  - Values are passed to function as parameters enclosed in brackets
- ➢ Begins w/ an equal (=) sign, Function's NAME, no space, (parameter 1, parameter 2)
- ➢ Ex: to add values in the range A1:A3
  - You could =A1+A2+A3 OR you could use SUM function =SUM(A1:A3)

Creating Effective Formulas

- ➢ Do not embed important data in a formula (rather, put that data in a seperate cell)
  - Using referenced values is better than using literal values
  - This prevents hiding important data
  - This prevents easily changing important data w/o need to edit formulas
- ➢ Keep formulas simple
- ➢ Sometimes it's useful to break formulas into intermediate results

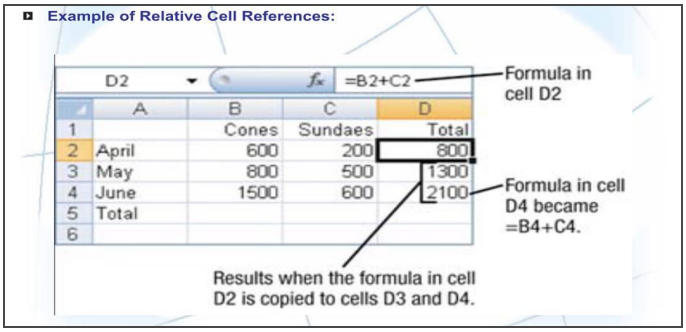
Sorting & Filtering

- ➢ Sort data in ascending or descending order
- ➢ Filter data to display portion that meets criteria specified
- ➢ Data can be sorted or filtered by selecting sorting arrow filtering arrow
- ➢ Exploring Auto-Fill & Custom Lists:
  - Objectives are to familiarize you with:
    - Auto-Fill Features
    - Using Default & Custom-Lists
- ➢ Employees List Example:
  - Objectives are to familiarize you with:
    - Basic Formulas & Functions
    - Converting from Ranges to Tables
    - Simple Sorting & Filtering
- ➢ Sales Revenue Example:
  - Objectives are to familiarize you with:
    - Simple Formulas and Functions
    - Using SUMPRODUCT to consolidate multiplication & addition functions

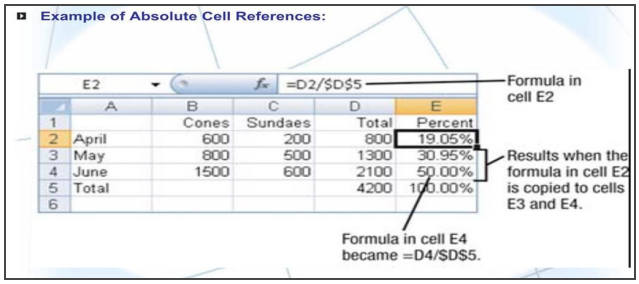


Section 2

Relative Cell Reference: cell addresses that are adjusted as a formula containing these addresses is copied within spreadsheet

- ➢ Used by default in most spreadsheet calculations
  - Ex. B6 copied over two columns to the right will become D6
  - Ex. K12 copied over one column to the left and one row above will become J11
  - 

Absolute Cell References: cell addresses that stay fixed & are not adjusted as a formula is copied

- ➢ Used when the formulas should always use the venue in a particular cell
- ➢ Used for constant values (ex. Sales tax rate, etc.)
  - Ex. B6
- ➢ 

Mixed Cell References: cell addresses where either row or column is fixed

- Ex. $B6 refers to a cell address where the column is fixed to B but the row can increase or decrease as the formula is copied vertically
- Ex. J$11 refers to a cell address where the column can vary as the formula is copied horizontally but the row is fixed to 11

Flash Fill (New in Excel 2013): allows you to specify column or row entries based on other adjacent columns or rows, & recognizes pattern in your data to automatically complete rest of column or row

- ➢ Works best for extracting information from columns that have a consistent data entry pattern or for combining values from multiple columns

- ➢ Makes data entry more efficient

Data Delivery functions do not perform calculations per say:

- ➢ They can be used to verify data, search for data, transform data or deliver from 1 point to another
    - Ex. ***Filter Unique Values:***
        - Used to filter and deliver unique values from a list
    - Ex. ***Data Validation & Drop-Down Menus:***
        - Used to allow end-users to select from a predefined lists of values
    - Ex. ***Lookup Functions***
        - Used to retrieve values from tables based on lookup values

Lookup table: table the organizes data you want to retrieve into different categories

- ➢ Categories for lookup table "compare value" = located in table's 1st column or row
- ➢ To retrieve a particular value from table, a lookup value (value you are trying to find) needs to match the compare values
    - =VLOOKUP(lookup_value,table_array,col_index_num[,range_lookup])
    - =HLOOKUP(lookup_value,table_array,row_index_num[,range_lookup])
    - Last parameter (shown in square brackets) is optional:
        - By default, it is assumed that you need a closest match to the compare value
        - Set this parameter to FALSE if you need an exact match to the compare value
- ➢ Using VLOOKUP
    - For Closest Matches:
        - Ex. mapping numerical markets to letter grades
    - For Exact Matches
        - Ex. mapping salary levels to employee categories

Section 3

Formula Auditing

- ➢ Trace cells that provide data to a formula (**precedents**)
    - Select the cell that contains the formula for which you want to find precedent cells

- To display a tracer arrow to each cell that directly provides data to the active cell, on the Formulas tab, in the Formula Auditing group, click Trace Precedents

➢ Trace formulas that reference a particular cell (**dependents**)

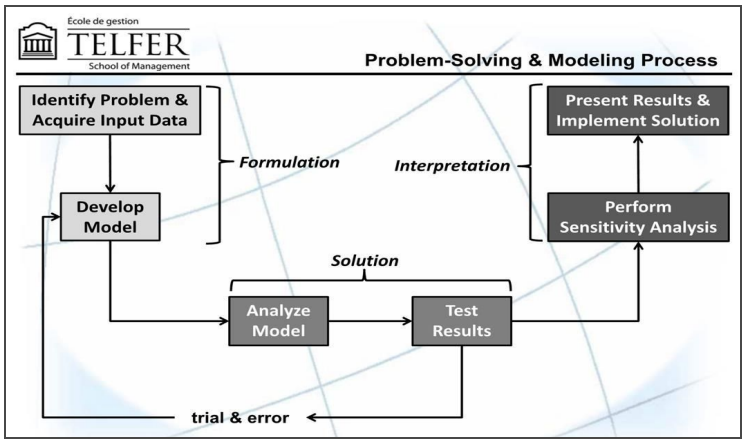
- Select the cell for which you want to identify the dependent cells.
- To display a tracer arrow to each cell that is dependent on the active cell, on the Formulas tab, in the Formula Auditing group, click Trace Dependents

<u>Statistical Functions</u>

➢ =AVERAGE(number1, number 2,...)
➢ =STDEV(number1, number 2,...)
➢ =MAX(number1, number 2,...)
➢ =MEDIAN(number1, number 2,...)
➢ =PEARSON((number1, number 2,...)
  - Pearson correlation coefficient

<u>Summarizing Data through Subtotals & Grouping</u>

➢ Subtotals: before you can subtotal, you must first sort the list by the field on which you want the list subtotaled
➢ Grouping: create an outline, organizing data so that it can viewed as a collapsible & expandable outline
  - To group data, each column must have a label in the first row and the column must contain similar facts. The data must be sorted by the column or columns for that group



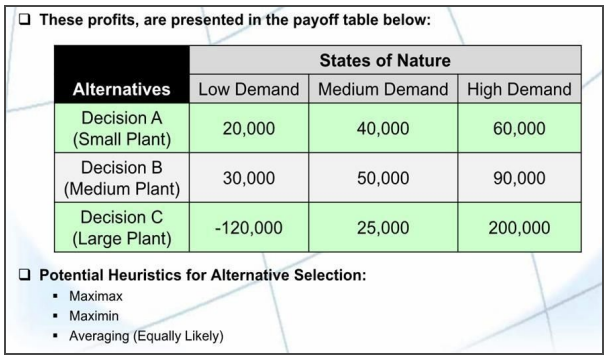
Data Modeling Example: Decision Heuristics

Heuristics: methods are used to speed up the process of finding a good enough solution, where an exhaustive search or advanced problem-solving techniques are impractical

Most fundamental heuristic = **TRIAL & ERROR **

- ➢ Examples of heuristics:
  - Maximax method
  - Maximin method
  - Averaging method
  - Expected monetary value (EMV)

Ex. The management estimates the profits when choosing from the three alternatives (A, B, and C) under the differing probable levels of demand

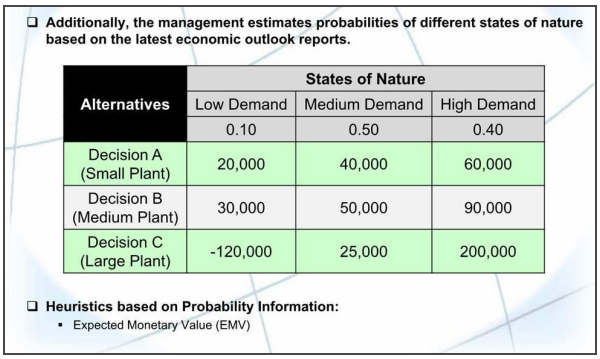


❑ These profits, are presented in the payoff table below:

Alternatives	States of Nature		
	Low Demand	Medium Demand	High Demand
Decision A (Small Plant)	20,000	40,000	60,000
Decision B (Medium Plant)	30,000	50,000	90,000
Decision C (Large Plant)	-120,000	25,000	200,000

❑ Potential Heuristics for Alternative Selection:

- Maximax
- Maximin
- Averaging (Equally Likely)



❑ Additionally, the management estimates probabilities of different states of nature based on the latest economic outlook reports.

Alternatives	States of Nature		
	Low Demand	Medium Demand	High Demand
	0.10	0.50	0.40
Decision A (Small Plant)	20,000	40,000	60,000
Decision B (Medium Plant)	30,000	50,000	90,000
Decision C (Large Plant)	-120,000	25,000	200,000

❑ Heuristics based on Probability Information:

- Expected Monetary Value (EMV)

Section 4

Logical tests: result of these functions is a logical value (TRUE OR FALSE)

- ➢ Ex. Comparison operators that can be used in logical tests are: Equals = ; less than < ; less than or equal to <= ; greater than > ; greater than or equal to >= ; not equal to < >

Logical Functions: result of these functions is a logical value (TRUE OR FALSE)

- ➢ **AND Function**
  - Allows you to test the condition of more than just 1 criterion (condition)
  - Returns either TRUE or FALSE
  - Only returns TRUE if all tested values are TRUE
  - AND (logical1 [logical2]...)
- ➢ **OR Function**

- Returns a TRUE value if any of logical conditions are true & a FALSE value if all logical conditions are false
- OR (logical1 [logical2]...)
  - Ex. =OR(G2=”A”,M2>=1)

➢ **NOT Function**

- Reverses value of its argument
- Used when you want to make sure value is not equal to 1 particular value
  - Ex. =NOT(G2=”Blah”)

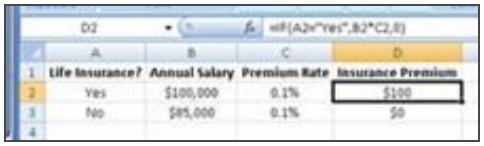
Conditional Functions: result may be a specified value or a calculated value

➢ IF, COUNTIF, SUMIF, AVERAGEIF

➢ COUNTIFS, SUMIFS, AVERAGEIFS (to be used when multiple criteria are to be tested)

➢ **IF Function**

- Evaluates whether a condition or a logical test is true or false & returns 1 value if condition is true, & another value if condition is false
- If true then value “a”, else value “b”
- IF(logical_test, value_if_true, [value_if_false])
  - Ex. IF(A2=”Yes”, B2*C2,0)



➢ Nested IF Function

- A nested IF function is when 1 IF function is place inside another IF function to test an additional condition
- # of IF functions in total would be one less than # of possible outputs
  - IF(D2=1,2%, IF(D2=2,3%, IF(D2=3,4%,”Invalid Pay Grade”)))

Read it as: If the value in D2 is equal to 1, then result is 2%,

Else… If the value in D2 is equal to 2, then result is 3%

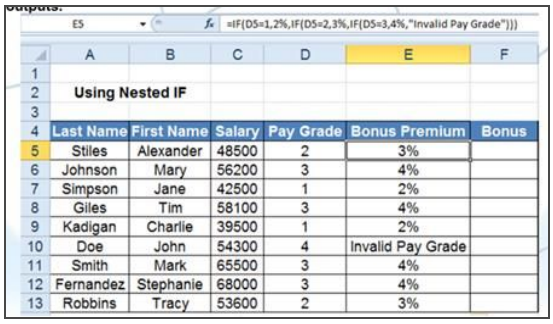
Else… If the value in D2 is equal to 3, then result is 4%

Else… result is “Invalid Pay Grade”

But… Why Not Use VLOOKUP:

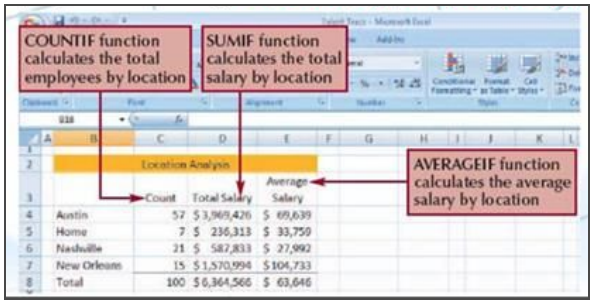
(Nested IF or VLOOKUP?)

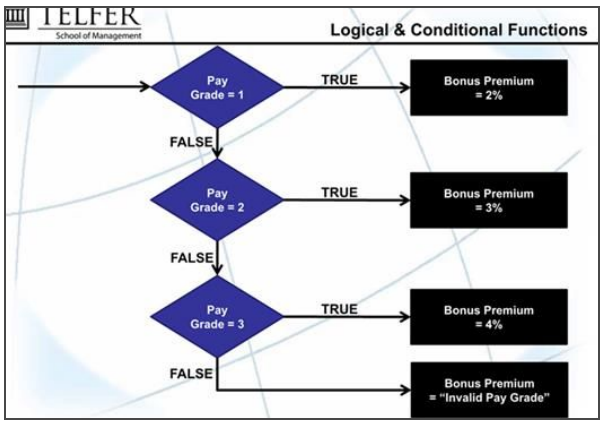
- Remember VLOOKUPs last parameter of "FALSE" specifies that we're interested in an exact match



Last Name	First Name	Salary	Pay Grade	Bonus Premium	Bonus
Stiles	Alexander	48500	2	3%	
Johnson	Mary	56200	3	4%	
Simpson	Jane	42500	1	2%	
Giles	Tim	58100	3	4%	
Kadigan	Charlie	39500	1	2%	
Doe	John	54300	4	Invalid Pay Grade	
Smith	Mark	65500	3	4%	
Fernandez	Stephanie	68000	3	4%	
Robbins	Tracy	53600	2	3%	

COUNTIF, SUMIF, & AVERAGEIF functions specify only 1 condition to summarize the data =____(range, criteria)





Section 5

Modeling Approach to Problem Solving

- ➢ Models are usually simplified versions of the things they represent:
  - Valid model accurately represents relevant characteristics of the object or decision being studied
- ➢ **Types of Models**
  - Mental (e.g. arranging furniture)
  - Visual (e.g. blueprints, road maps)
  - physical/ scale (e.g., aerodynamic, buildings)
  - Mathematical (e.g., financial analysis)
- ➢ **Computer Model:** a set of mathematical relationships & logical assumptions implemented in a computer as an abstract representation of a real-world object or phenomenon

- Spreadsheets provide the most convenient way for business people to build computer models

4 Benefits of the Modeling Approach:

1. **Economy:**
   - It is often less costly to analyze decision problems using models
2. **Timeliness:**
   - Models often deliver needed information more quickly than their real-world counterparts
3. **Feasibility:**
   - Models can be used to do things that would be impossible
4. **Models give us insight & understanding that improves decision making**

Developing an Effective Data Model

It helps to think about data models as a combination of various "layers":

- Data Layer
  - Raw data & any cleansing, prepping, formatting, & other manipulations
- Analysis Layer
  - Formulas & calculation that pull the data, perform calculations, & provide a staging area for reporting & presentation
- Presentation Layer
  - The front-end reports & visualizations of the analysis results

Example of a Mathematical Model:

Specifically:

$$\text{Profit} = \text{Revenue} - \text{Expenses}$$

or

$$\text{Profit} = f(\text{Revenue}, \text{Expenses})$$

or

$$Y = f(X1, X2)$$

Generically:

$$Y = f(X1, X2, \dots, Xn)$$

- Y = dependent variable

- X1 = independent variables (inputs having an impact on Y)
- f(x) = function defining the relationship between the X1 & Y

➢ Most spreadsheet models are similar to the generic model: = f(x1, X2, …, Xn)

➢ Most spreadsheets have input cells (representing X1) to which mathematical functions f(x) are applied to compute an output variable (or Y)

Financial/ Annuity Functions

Annuity: series of constant cash payments made over a continuous period

➢ A car loan or a mortgage is an annuity

➢ Benefits received each period is an annuity

➢ Cash you pay out = a negative #; cash you receive = a positive #

- A $1,000 deposit to the bank would be represented by -1000 if you are the depositor
- A $1,000 deposit to the bank would be represented by +1000 if you are the bank

Future Value Function:

Syntax

➢ **FV(rate, nper, pmt, pv, type)**

➢ **Rate**

- Interest rate per period - e.g., 8% annual interest rate

➢ **Nper**

- Total # of payment periods in an annuity - e.g., 10 years
- Enter 10 into the formula for nper

➢ **Pmt**

- Payment made each period
- Cannot change over the life of the annuity

➢ **Pv**

- (optional) present value or lump-sum amount that a series of future payments is worth right now

➢ **Type**

- (optional) number 0 or 1 indicates when payments are due. If type is omitted, it is assumed to be 0 (end of period)

Section 6

Business Intelligence: a broad category of applications & technologies for gathering, storing, analyzing, sharing & providing access to data to help enterprise users make better business decisions

- ➢ BI applications are decision support tools that enable real-time, interactive access, analysis & manipulation of mission-critical corporate information
- ➢ **Components** (**R-A-D**)
  - **Reporting**
    - Regular Mass Information Dissemination in a standard format
  - **Analytics**
    - Slicing & Dicing with visual feedback and interactivity
    - Mainly for Middle Mgmt. - for Tactical Decisions & to guide Strategic Decisions
  - **Dashboards**
    - Quick Distilled Snapshots, highlighting key indices, for instant decision making

Dashboards: visual tool with graphical displays of key performance indicators (KPIs)

- ➢ More than just data (data -> information)
- ➢ Information is organized & presented in a way that is easy to read and interpret (at a glance)
- ➢ **BI Context:** a visual display of most important information needed to achieve business objectives - consolidated and arranged on a single screen so information can be monitored at a glance

  Excel is a practical & easy-to-use front-end tool for strategic dashboards

3 Types of BI Dashboards

1) **Strategic Dashboards**
   a) Provide quick overview that decision makers need for monitoring the health and opportunities of the business
   b) Typically derived from static snapshots of data, and focus on high-level measures of performance:
      i) Comparisons with targets or levels
      ii) Performance indicated categorically or on scales (good/bad ; high/medium/low)

2) **Analytical Dashboards**
    a) Support more sophisticated data analysis by facilitating rich comparisons, and fine grained performance evaluation (drill-down ; slice-and-dice)
    b) Used to not only see what is going on, but to examine the causes
3) **Operational Dashboards**
    a) For monitoring operations in real-time
    b) Uses simple display media to quickly identify and understand events and to ensure timely responses

Chart: graphic or visual representation of data that provide a means to enhance information, adding visual appeal & making it easy to analyze data

- ➢ Data points: numeric value that describes a single item on a chart
- ➢ Data series: groups of related data points
- ➢ Category labels: describe a group of data points in a chart
- ➢ Multiple data series charts can help compare two or more sets of data:
    - Clustered column chart
        - Groups similar data in columns
        - Makes visual comparison easier
    - Stacked column chart
        - Places (stacks) data in one column with each data series in a different color for each category

Chart Type	Purpose
Column	Compares categories, shows changes over time
Bar	Shows comparison between independent variables. Not used for time or dates
Pie	Shows percentages of a whole. Exploded pie emphasizes a popular category
Line	Shows change in a series over categories or time
Doughnut	Compares how two or more series contribute to the whole
Scatter	Shows correlation between two sets of values
Stock	Shows high low stock prices

Conditional Formatting: offers an easy way to apply dynamic formatting to cells based on the values in those or other specified cells

- Ex. you could apply conditional formatting to a range of cells that contain sales totals, specifying that if any of the totals drops below $10,000, the format of the cell changes to stand out from the other cells

Section 7

What-If Analysis: how uncertainty in the output of a model can be attributed to different sources of uncertainty in the model inputs (what kind of impact does the inputs variables have on the output variables)

- ➢ Using a spreadsheet, what-if analysis involves changing values in cells to see how those changes will affect outcome of formulas on worksheet
- ➢ What-if analysis tools in Excel include: **Scenarios, Goal Seek, Data Tables**

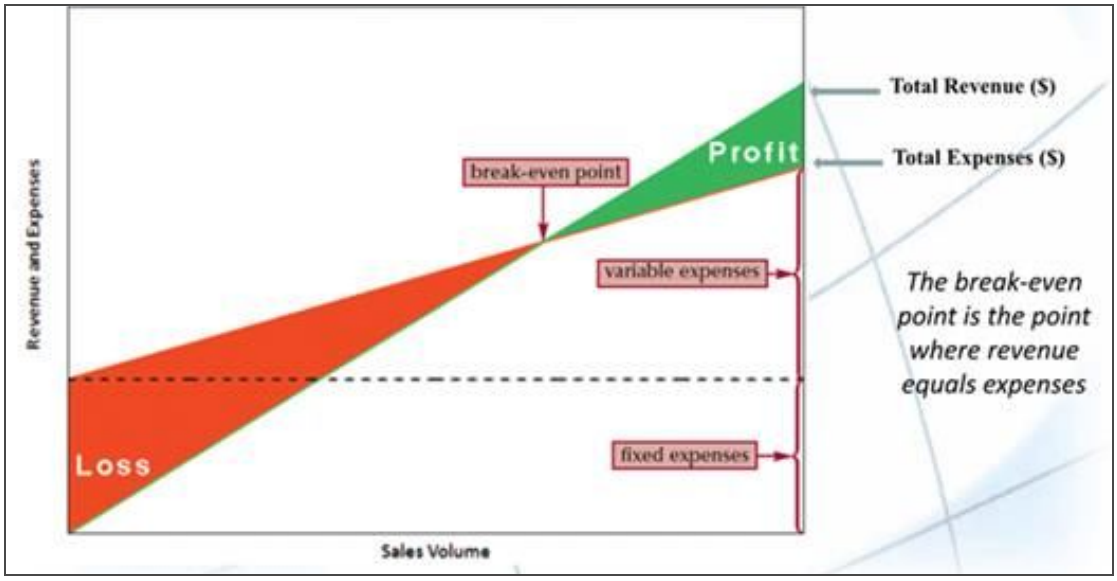
Ex: **Cost-Volume Profit (CVP) Analysis "Breakeven Point Analysis"**

- ➢ **Express relationship btw/ a company's expenses, its volume of business, & resulting profit or net income**
- ➢ **Types of expenses**
  - Variable expenses: change in proportion to amount of business a company does
  - Fixed expense: an expense that must be paid regardless of sales volume

NOTE

Breakeven point: point where revenue = expenses
(above breakeven = profit, below breakeven = loss)

- ➢ Fixed cost = cost that incurs over time
- ➢ Variable cost = wages (paid hourly, if we need more employees, we pay more wages), supplies (materials, if we produce more, we will need more material)
- ➢ At what quantity will I breakeven for an income statement?
  - Net income will be zero (more = profit, less = loss)



Solver: an add-in program that searches for the best solution to a problem with several variables

- ➢ Used to find the best way to allocate resources
- ➢ **Requires 3 parameters:**
    1. **Target cell** typically contains a formula that is directly or indirectly based on the adjustable cells & constraints:
        a. Dependent variables & independent variables need to be formulated appropriately
    2. **Adjustable cells** are the cells whose values are adjusted until the constraints are satisfied
    3. **Constraints** specify the restrictions:
        a. Typically in the form of inequalities or equations

<u>**NOTE**</u>

- ➢ Target cells could be profit or cost you what to maximize or minimize it (with constraints)
- ➢ Adjustable cells "changing cells" → you have more than 1 cell that you want to change
- ➢ Solver is linear program (does not deal with coding) → has to do cost, constraints,

Requirements of Linear Programming (LP):

- ➢ LP problems seek to max. Or min. Some quantity (usually profit or cost) expressed as an ***objective function***
- ➢ Presence of restrictions, or **constraints,** limits degree to which we can pursue our objective
- ➢ There must be alternative courses of action to choose from
- ➢ Objective & constraints in LP problems must be expressed in terms of linear equations or inequalities

NOTE: <> means not equal to

<u>Decision Analysis using Solver (Goal, Miss, Error)</u>

- ➢ Define the problem & using identified input ranges, output cells, & constraints, Solver can minimize or maximize the input cell or set the output cell to a particular value
- ➢ Define the parameters using the Solver dialog box
- ➢ Ex. product mix -> use optimum product mix to determine whether to maximize Product A or Product

WHAT WILL BE ON THE QUIZ:

- 30 multiple choice
- Simple calculations allowed
- Understanding of:
    - Business cases of using excel, problem solving, and decision analysis
    - Phases and best practices in Developing Spreadsheet models
    - Excel features and functions discussed in course
- Not be asked to recall syntax of specific Excel functions,
- know : purpose of function, inputs required, what function outputs

KNOW:

- Relative and absolute referencing
- Lookup functions (VLOOKUP)
- Logical and conditional functions
    - Logical: and, or, not
    - Conditional: if, nested if