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**BUS 443 Business Analytics**

**Intermediate Excel Exercises – Part 1**

1. Open a new workbook in Excel. Name the workbook: ***Intermediate Excel Exercises***.
   1. Create a spreadsheet that will calculate student grades and name the spreadsheet Exercise 1. Copy the data found on the last sheet of Part 1 of this document and paste it into the Exercise 1 sheet.
   2. Enter the data to assign a student number for students 1 and 2. Use the fill handle to create the series of student numbers for all 30 students.
   3. Calculate the Grade column. Each student gets an A (if score is 90 or above), or S for satisfactory (if score <90 but >= 60). If the score is below 60, the student receives a U for unsatisfactory. Use the following example of **nested IF and AND functions** in the formula to help you. =IF(M26>=90,"A",IF(AND(M26<90, M26>=60),"S","U"))
   4. Select the range of exam scores. Use “Quick Analysis” to format the data in various ways that show quick information. Check out the Data Bars feature.
   5. Use the conditional formatting tool from the Home Ribbon to show all exam scores less than 65 in red.
2. Copy the Exercise 1 worksheet into a new Exercise 2 worksheet. (Right-click on the sheet tab and choose Move or Copy. Check the Create a Copy checkbox.)
   1. Create a vertical lookup table (in the range P4:Q8) of your sheet using the following data:

|  |  |  |
| --- | --- | --- |
| 0 | F |  |
| 60 | D |  |
| 70 | C |  |
| 80 | B |  |
| 90 | A |  |

* 1. Instead of using a nested IF functionto assign a grade of U, S, or A, use a vertical lookup function to assign *specific* student grades. Use this formula as an example: =VLOOKUP(D2,$G$2:$H$6,2). Be sure to use the absolute references in the formula before copying it to other cells in the column. Save your work.

1. Reference Functions of INDEX, SMALL, MATCH:
   1. In cell H8 the Exercise 2 spreadsheet, use the **SMALL** function to determine the lowest score (k=1) in the class. Label this result as “Lowest Score:” in cell G8.
   2. Use this function again in cell H9 to determine the fifth lowest score (k=5) in the class. Label the result.
   3. In cell H10 use the **INDEX** function to determine the score of the fifth person in the class list. Label the result.
   4. Use the **MATCH** function to determine the location in the class list of the person who made a 99. Label the result.
2. In this exercise, you will use a variety of functions on the Exercise 2 worksheet to calculate the student data from several different perspectives. Be sure to label each result appropriately in an adjacent cell.
   1. In cell H12 use the COUNT function (Counts the number of cells in a range that contain numbers) to count the number of students in the class.
   2. In cell H13 use the COUNTA function (Counts ***all*** the number of cells in a range that are not empty) to count the number of students who took the exam.
   3. In cell H14 use the COUNTBLANK function (Counts the number of blank cells in a range) functions to count the number of students who didn’t take the exam. Remember that spaces are not the same as blanks. To ensure your cells have blanks, right-click the cell, and choose Clear Contents.
   4. Sort the exam data by exam grade in descending order. After checking the results, Undo the Sort result. Save your work.
   5. In cell H15 calculate the number of “high” scores (scores = 87 or higher) using the COUNTIF function.
   6. In cell H16 sum the scores for males using SUMIF.
   7. In cell H17 average the scores for males using AVERAGEIF.
   8. Suppose our cutoff age for young people is considered less than or equal to age 22 and for old people, over 22. In cell H18 calculate the sum of scores for "young" people using SUMIF. In cell H19 (using the AVERAGEIF function), what is the score average of “young people?
   9. In cell H20 sum the scores for "old" people using SUMIF. In cell H21 (using the AVERAGEIF function), what is the score average of “old people?
   10. In cell H22 (using the COUNTIF function), calculate the number of female students.
   11. Filter the data for females only using the **FILTER** tool and double-check the spreadsheet calculation for the COUNTIF function above.
3. Open a new worksheet in the workbook. Name it Exercise 5 and key the data shown on the next page.

|  |  |  |  |
| --- | --- | --- | --- |
| ***Unit shipping costs*** | ***Atlanta*** | ***Boston*** | ***Chicago*** |
| ***Plant1*** | 1.25 | 1.35 | 1.55 |
| ***Plant2*** | 1.15 | 1.45 | 1.25 |
| ***Plant3*** | 1.35 | 1.55 | 1.15 |
|  |  |  |  |
| ***Units shipped*** | Atlanta | Boston | Chicago |
| ***Plant1*** | 155 | 180 | 0 |
| ***Plant2*** | 250 | 130 | 185 |
| ***Plant3*** | 0 | 210 | 140 |
|  |  |  |  |
| ***Total cost*** |  |  |  |

* 1. Use the SUMPRODUCT function (e.g.,*=SUMPRODUCT(M4:O6,M9:O11)* to calculate total cost. SUMPRODUCT does exactly what its name implies; it adds the products of two similar ranges. It is absolutely indispensable in many business models.
  2. Format your work and check your results. Save your work.

1. In this exercise you will use the INT, ROUND, CEILING, and FLOOR functions on the Exercise 5 worksheet.
   1. The INT function takes a decimal value and returns an integer by "chopping off" the decimal. More exactly, it returns the integer just to the left of the given decimal number on the number line. It does *not* round to the nearest integer. To use it: Enter the formula **=INT(*value*)**, where *value* is a number or a reference to a cell with a number. In the cell with the cost from Plant 1 to Atlanta, apply the INT function.
   2. The ROUND function rounds a value to the number of decimals you specify. To use it, enter the formula **=ROUND(*value,decimals)****,* where *value* is a number or a reference to a cell with a number, and *decimals* indicates the number of decimal places to round to. If *decimals* is 0, it rounds to the nearest integer. If *decimals* is positive, it rounds to this many decimals. If *decimals* is negative, it rounds to the nearest ten (*decimals*=-1), the nearest hundred (*decimals*=-2), the nearest thousand (*decimals*=-3), and so on. In the cell with the cost from Plant 2 to Atlanta, apply the ROUND function and round the number to one decimal.
   3. The **CEILING** function returns a number rounded up, away from zero, to the nearest multiple of significance. For example, if you want to avoid using pennies in your prices and your product is priced at $4.42, use the formula =CEILING(4.42,0.05) to round prices up to the nearest nickel. In cell with the cost from Plant 3 to Atlanta, apply the CEILING function to the nearest dime.
   4. The **FLOOR** function rounds a number down, toward zero, to the nearest multiple of significance. In cell with the cost from Plant 1 to Boston, apply the FLOOR function to the nearest dime. Save your work.
2. There are three main cost analysis tools used in business: payback analysis, return on investment (ROI), and net present value (NPV). **Payback analysis** determines how long it takes a project to pay for itself through reduced costs and increased benefits. **ROI** measures the efficiency of an investment and is a percentage rate that compares the total net benefits (the return) received from a project to the total costs (the investment) of the project. The **net present value** (NPV) of a project measures the cash flow of an investment by calculating future cash flow. It is the total value of the benefits minus the total value of the costs, with both the costs and benefits being adjusted to reflect the point in time at which they occur. It is simply a number by which the investor is aware of the amount of cash flow he is receiving as a result of an investment. A positive NPV is an indicator of a good investment; a negative NPV is an indicator of a bad investment.
   1. Open a new worksheet in the workbook, named Exercise 7. Do a Net Present Value analysis using the NPV function and the data shown below. A NPV Analysis always starts at year 1 and assumes payments to be made in the future are made on a regular basis, at the end of the year. The cash outflow (in this case, a cost of $95,000) is at the beginning of Year 1 and is left out of the formula, as it doesn’t need to be discounted. The interest rate (.09) is the rate the company believes it can earn on its money.
   2. Is this project a good investment? Why or why not?
   3. Use the =TODAY() or =NOW() to list the current date at the top of the spreadsheet.
   4. Insert a comment into cell A1 stating the purpose of the spreadsheet. Choose Review, New Comment.
   5. Name each of your cells (Formulas, Name Manager), then redo your formulas to use the cell names instead of cell locations. Save your work.

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| NPV Analysis | | |  |  |  |  |  |  |  |
| Benefits: |  | | Year 1 | Year 2 | Year 3 | Year 4 | Year 5 | NPV: |  |
|  |  | | 35000 | 20000 | 20000 | 20000 | 20000 | \_\_\_\_\_\_\_\_ |  |
|  |  | |  |  |  |  |  |  |  |
| Costs: | 95000 | |  |  |  |  |  |  |  |
| Interest Rate: | .09 | |  |  |  |  |  |  |  |
|  |  |  | |  |  |  |  |  |  |
|  |  |  | |  |  |  |  |  |  |

1. If a company incurs cash inflows or outflows at *irregular* times, such as January 1, then May 25, then July 1, and so on, the NPV function cannot be used. You could go back to a finance book to see how to discount future payments directly, but it is easier to use the little-known XNPV function. This function is actually part of the Analysis ToolPak that ships with Excel. However, you might not have it loaded. To check, click the File button, then Options, then Add-Ins, and then Go. If the Analysis ToolPak item isn’t checked, check it. Then you can use the XNPV function.

To use the XNPV function: Enter the formula **=XNPV(*discountrate*,*cashvalues*,*dates*)**, where *discountrate* is the same as with NPV, *values* is a stream of cash values, and *dates* is a stream of the dates when they are incurred. Typically, the first cash value will be an outflow and the rest will be inflows. In this case, the initial outflow (investment) *should* be included in the XNPV function, and the NPV will be discounted back to the date of this initial payment. This payment should be entered as a negative number. Using a discount rate of 12%, key the following investment dates and numbers and do this analysis.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | 1/1/15 | 5/25/15 | 9/15/15 | 1/15/16 | 6/30/16 |
|  | -85000 | 22500 | 31000 | 65500 | 55000 |

1. **RANDOM (RAND) and RANDBETWEEN**:

In an unused part of your active spreadsheet, use the RAND function to pick a random number between 0 and 1. = RAND()

Use the RANDBETWEEN function to pick a random number between 1 and 20. = RANDBETWEEN(1,20)

1. **DATA TABLES AND FLASH FILL**:

Download the ***Data Table and Flash Fill Starting Templates*** worksheet from Moodle.

1. Click the Flash Fill sheet tab and practice using Flash Fill by using the instructions in the comment in cell B4.
2. Copy the sheet named ***Data Tables*** into your current workbook. Suppose you need to determine the monthly payments on the purchase of a new vehicle that costs $20,000. You put a down payment of $5000 on the vehicle and agree to an annual 6.76% interest rate for 36 months.
3. Calculate the Amount Financed as Price of New Vehicle – Down Payment.
4. Calculate the monthly payment using the PMT function. Be sure to divide the 6.76% interest rate by 12 in the formula to produce a ***monthly*** payment.
5. Create a data table (Data, What-If Analysis, Data Table) to show the monthly payments at this rate for 24, 36, 48, and 60 months. The row is the original length of the loan (in months), the column is

* Select E10:F14.
* Choose Data, What-If Analysis, Data Table
* Click the Column Input Cell.
* Click the Length of Loan (B7).

1. Create a two-data table to show the monthly payments at various rates of 5%, 6%, 6.76%, 7%, and 8% for 24, 36, 48, and 60 months.

* Select I10:N14
* Choose Data, What-If Analysis, Data Table
* Click the Row Input Cell, then click the rate, B6
* Click the Column Input cell, then click the length of loan, B7

***Student Gender Age Exam Score Grade***

Male 18 62

Female 21 73

Female 18 74

Female 18

Male 18 77

Female 20 57

Female 18 67

Male 19 90

Male 19 77

Male 22 83

Female 20 71

Female 20 75

Female 20 72

Female 24 82

Female 18 68

Male 18 86

Female 24 77

Male 21 68

Male 20 86

Female 21

Male 20 80

Female 18 81

Male 20 84

Female 19 71

Female 18 76

Male 21 81

Female 18 99

Male 20 72

Female 18 78

Female 21 77

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**BUS 443—Business Analytics**

**Intermediate Excel Exercises – Part 2**

**Capacity Model for Lang Drug Case**

**Case Background:**

*Lang Drug, a transnational drug manufacturer, needs to determine the proper capacity level for a new drug, Pylynic. Their goal is to maximize the expected NPV earned from the drug over the next 15 years, assuming a discount rate of 10 percent per year. It costs $10 to build enough capacity to produce one unit of drug per year. All construction costs are assumed to be paid at time 0, while the first profits come in at the end of the first year.*

*It costs $1 per year to maintain a unit of annual production capacity. In year 1, we know demand (sales) will be for 160,000 units of Pylynic. The annual percentage growth of demand for Pylynic is 15 percent. During year 1, each unit of Pylynic sells for $8. The price of Pylynic will grow at 5 percent per year. Unit variable cost is known to be 40 percent of sales price. The depreciation rate is 10 percent per year, so full depreciation will occur after ten years. The tax rate is 35 percent. It is understood that Lang Drug’s unit sales per year must not exceed its capacity level to produce.*

*Since the goal of Lang Drug is to maximize the expected NPV earned from the drug, review the concept of NPV. NPV is an investment term and represents the worth of a series of cash flows, both incoming and outgoing, and is defined as the sum of the present values of the individual cash flows of the same entity. It is the result of a multiyear investment expressed in today’s dollars. This type of analysis is good for long-term projects because it considers the time value of money by expressing future cash flows in terms of their value today. Any analyst knows that money has a cost (interest), so that a person would prefer to have $1.00 today to having $1.00 a year from now. If you earn 10% interest on your money, $1.00 today will be worth $1.10 a year from now. Alternatively, turning that around, the “present” value of $1.10 one year out is $1.00.*

**Your Task:**

Your ultimate task in this case is to validate the NPV for Lang Drug. You will do this by identifying and fixing all the bugs in a spreadsheet already designed and built to calculate Lang Drug’s NPV. Bugs may refer to an error in the data or in a formula that causes the spreadsheet to return the wrong value of the output, not a poor choice of layout, format, or other poor practices. A spreadsheet formula bug may be of three types:

* *Reference errors*: a formula refers to the wrong cell or cells
* *Hard-coded errors*: a formula contains a number that appears as a parameter elsewhere
* *Logic errors*: a formula uses faulty logic

You may assume that the accounting in the model is conceptually correct. Here are some formulas to consider as you view the existing spreadsheet:

* Factors to calculate NPV: Discount rate, Sum of Profits after tax for 15 years. After calculating NPV, add to this equation the Year 0 PAT (shown as negative).
* Profit before tax = Annual Sales Revenue - Annual Variable Cost - Annual Maintenance Cost - Building Cost - Depreciation
* Tax = Tax Rate \* Profits before tax
* Profits after tax = Profit before tax – Tax + Depreciation Cost
* Annual Sales Revenue = Units sold \*Unit price
* Units Sold = min of Demand or Capacity
* Unit Price (after year one) = Unit Price \* (1 + Price inflation rate)
* Building (Capacity) Cost for Year 0 only = Unit Building Cost \* Initial Capacity

**Directions:**

1. Download the Capacity Model for Lang Drug spreadsheet from Moodle. Review the spreadsheet.
2. Using the case description and formulas cited earlier, identify all the bugs in the spreadsheet and fix them as you go. (This will help you to find them all.) List them, giving the cells involved and a short description of how you fixed the bug. (Hint: There are at least nine different bugs.) Here are some tips:
   1. Verify that all of the parameters match the given data in the case.
   2. Verify that no formulas contain hard-coded values instead of references to cell locations. (Use the Formulas, Show Formulas command to eyeball the formulas.)
   3. Verify that no cells have formula inconsistencies. (Use the Formula Auditing, Error Checking command or look for cells with a green colored triangle in the upper left corner, designating a formula with an inconsistency or error.)
   4. Verify that all functions and formulas refer to the correct cell locations. (Click on the cell and choose the Formula Auditing, Trace Precedents command to see the cells to which the formula refers.)
3. Once you have made your changes and the spreadsheet is correct, what is the NPV? \_\_\_\_\_\_\_\_\_\_\_\_\_