**Module 1 – Excel**

**1.0 – Install Excel**

Content

* How to Install Excel instructions page

**1.1 – Introduction to Excel**

Assignments

* Lab: DataCamp – Introduction to Excel
  + Submission: Upload ‘Statement of Accomplishment’
  + DOWNLOAD workbooks and datasets: [link](https://assets.datacamp.com/production/repositories/6291/datasets/d835da019de0c7a6cb5d7efdf6f8be022321d6cf/Exercises%20and%20Datasets.pdf)

Content (DataCamp) – Introduction to Excel

* Chapter 1 – Getting started with Excel
  + Navigating excel
    - Terminology like cells, formulas, ribbon, etc, summarizing column with #s at bottom
    - Opening files, selecting cells and columns / rows
    - start with =), arithmetic formulas with cell references, copying formulas
  + Tables
    - Structure of table: header, body, totals
    - How to create table, add and delete columns
    - Structured references for column formulas (by column name, dynamic)
    - Filtering (from table header drop down)
    - Sorting: custom sort by multiple columns
    - Formatting: changing data display format, decimals, table style
* Chapter 2 – Managing data and applying aggregate functions
  + Named ranges
    - How to create (formulas tab) and view current named ranges, how to use in a formula
  + Subtotals
    - Sort and filter data first
    - How to generate subtotals (Data ribbon), different views of subtotals (1,2,3)
  + Data validation
    - How to create (Data tab), how to set, error message, and entering data
  + Data formatting
    - Changing format from standard options, custom format
    - Conditional formatting (only top/bottom rule)
  + Order of operations (math and excel), aggregate functions (including count) and how to write (or select them from formulas tab with formula builder) / reference cells (or columns)
* Chapter 3 – Other functions and visualizing data
  + Types of functions and examples
    - Text functions: left(), right(), lower(), upper(), len(), combining functions for more complex string subsetting
    - Date functions: date(), year(), month(), day()
    - Math and trig functions: round(), rounddown(), roundup(), abs(), sum()
    - Statistical functions: < aggregate ones earlier >
  + Data visualization
    - Brief data viz overview, intro of different types of plots
    - Area chart (time series plot filled underneath): how to insert from table
    - Column (bar graph): correct from select data, remove series, select horizontal labels, add data labels (right click on any bar)
    - Pie chart: Recommended chart button
    - Line plot: more editing series and labels
* Not currently shown (common enough, useful)
  + Evaluate formula or part of a formula in bar to check F9
  + (Table ribbon) Totals row and choosing each summary stat
  + Slicers and create pivot tables
  + Removing Table, but keep data (just right click anywhere in table -> table -> convert to range
  + Removing subtotals (click subtotals again -> Remove all
  + Data validation: What input message looks like, drop downs
  + Conditional formatting: Other types of rules, how to manage them

**1.2 – Basic Plots in Excel**

Assignments

* Lab: More Charts in Excel
  + Part 1: Multiple Variable Charts
    - Comparative boxplots and histograms, manually filtering rows to copy and paste subsets of table for new plots, scatterplot
    - Source for data is from this [site](https://regressit.com/data.html)
  + Part 2: Waterfall Chart
    - Setup of data for waterfall chart, creating and modifying waterfall chart
    - Source: [Article](https://journalistsresource.org/home/regression-analysis-primer-for-journalists/) that uses data and [data](https://journalistsresource.org/wp-content/uploads/2014/11/Sample-data-sets-for-linear-regression1.xlsx)
* HW: Plots for Analyses
  + Part 1: Simple Linear Regression
    - Summary stats table (COUNTIF, AVERAGEIF, and SUMIF), scatterplots with trendline lines and regression info
    - Same data as Part 2 of 1.2 Lab
  + Part 2: Plots of Aggregated Data
    - Calculating month from a date and converting to month abb, SUMIF to aggregate data, line chart with two series, calculate quarter from date algebraically and combine text to format result, comparative boxplot with connected mean lines

Content (my video) – Basic Plots in Excel

* Formulas
  + Creating new column, autofill, absolute vs relative reference, inserting formula different ways (typing, formula menu), summary stats, frequency table manually with sumif()
* Plots
  + Histogram (bin width effect), boxplot, line plot, bar graph, two variable bar graph, how to interpret all plots (distribution ones with shape, mode, etc.)
* Styling plots
  + Adding / removing elements (gridlines, legends, etc.), add and customize data labels (position, different label options, font), combo chart (change chart series, line series with bar graph), changing appearance of series (line, markers and marker options, fill of bar chart), edit axis lines and font
* Design thinking
  + Why side-by-side is not ideal, ways to improve it with demo (line chart with just labels and markers that are customized, making elements stand out (bold font, brighter color, darker color, thicker line) and others not (neutral colors)
* Tables
  + How to create, how to reference, total row, subtotals, slicer
* Exercises
  + Design thinking of quick layouts and if they add value to plot, pie chart (show proportions vs counts), comparing bar graph to pie chart

**1.3 – Reports**

Assignments

* Lab: Combining Data and more on Pivot Tables
  + Part 1: Recreate pivot table report
    - Organizing pivot table with several summary stats for same measures, different layout settings, slicer and modifying appearance, styling report to be more presentable (extra headers, borders, empty background)
    - Problem based on this [tutorial](https://www.contextures.com/exceldatahockeyplayeranalysis.html)
  + Part 2: Combine data with XLOOKUP and create simple reports with Map chart
    - Data quality checking when merging, sorting pivot table, map chart
* HW: Creating More Engaging Reports
  + Part 1: Create report with different displays for measures, including custom formatting
    - Standard pivot table, group date by quarters, use % difference from for sum measure (based on quarters), custom formatting for summary (colored symbol), styling report for better display
    - Source for custom formatting and data bars for part 2 ([video](https://youtu.be/yHzT_BUggQk) and [tutorial](https://www.xelplus.com/excel-advanced-pivot-tables/))
  + Part 2: Combining data with XLOOKUP and creating report with added visual via data bars
    - Creating report based on regular data (not aggregated), remove duplicates to create unique list (before they know UNIQUE()), XLOOKUP with different search mode (last-to-first) to bring in multiple columns, XLOOKUP with different match mode (next smallest), display function of columns raw value and with colored data bars for negative and positive,
    - Source for data is from the workbook in this [tutorial](https://www.datacamp.com/blog/working-with-pivot-tables-excel)

Content (her video) – Introduction to Pivot Tables ([video](https://youtu.be/UsdedFoTA68) and [tutorial](http://xelplus.com/pivot-tables-in-10-minutes/))

* ADD IN PREFACE
  + Treat these videos as legit lectures, follow along with own workbook
  + Introduced Pivot Tables as a way to summarize data like we did with the count is, but much more automated and flexible
  + Insert ‘Pivot Table’ into existing worksheet, will be prompts for where to put them
* Insert pivot table
  + Make source data table, how to insert pivot table, insert copy of existing pivot table to easily create another one (formatting comes in), demo how they are dynamic and update with new data
* Summary measures
  + Change summary measure from ‘Values’ in Filed List, change from right click in pivot table and ‘Show Value As’, format measure (format cells vs number format), sort by measure, bringing in same column twice as value, converting measure by ‘Show Value As’
* Customizing pivot table structure
  + Adding filters, adding field to columns or rows, turn grand / subtotals on and off, report layouts (tabular form gives column headers), collapse / expand fields (and how to remove this ability +/- button)
* Customize pivot table design
  + Updating headers, update pivot table style, turn off autofit columns with update
* Slicers
  + What they do, how to insert, customize design, connect slicer to multiple pivot tables (click on one that doesn’t have it and go to filter connections)
* Exercise
  + Creating own report from goal of what final report should include
  + Think about: what variables, where do they go, in what order, what summary measures, how to format them, need subtotals / grand totals based on context, format of headers

Content (my video) – Combining Data and More on Pivot Tables

* Overview of problem
  + Why need this method (need report with information from multiple tables), how going to solve problem (adding columns by bringing in information from master data table)
* XLOOKUP
  + What arguments mean, how to use it, bringing in more than one column, blanks in return array
* Strategy of building report
  + Think about sketch and how to get there
* Fancier pivot table methods
  + Date groups, creating and editing regular groups, expand and collapse all groups, break out by filter, show details of measure and categorical variables, timelines, calculated fields
* Exercise
  + Just repeating stuff from video
* Additional resources
  + [Tutorial](https://www.automateexcel.com/formulas/xlookup-return-blank-not-zero/) for how to fix XLOOKUP bringing in zeros instead of blanks
    - PREFACE: When learning / applying new methods, will probably keep running into specific mini problems. So when searching solutions, be sure to use *solutions that you can understand* as much as possible so you learn more and can reapply it later.
  + Combining data via Data models and PowerPivot ([video](https://youtu.be/mTdIEhtcqlo) and [tutorial](https://www.xelplus.com/relationships-pivot-tables-multiple-sheets/))
    - PREFACE: Currently this can’t be done in Excel on Mac or Excel Online, but pretty much all companies have Windows Excel (so it will likely be available to you). And more importantly, a lot of software and technology is knowing *what can be done*, then deciding if it is useful for your application. So this is still a GREAT WATCH!

Content (her video) – More on XLOOKUP ([video](https://youtu.be/4c0CLUER6nw) and [tutorial](https://www.xelplus.com/excel-xlookup-5-examples/))

* Basic XLOOKUPs
  + What arguments mean and what supply, absolute references (fixing) the lookup and return arrays, skipping optional arguments
  + Vertical lookup example first, then horizontal lookup, why organization of master table doesn’t matter
* Optional arguments
  + If\_not\_found: why happens and supplying value
  + Match\_mode: Default is EXACT match = 0, WILDCARD character match = 2 and how to specify using “\*”&, APPROXIMATE match = -1 (exact or next smallest) or 1 (exact or next largest)
  + (Not demonstrated) Search\_Mode: Default is FIRST match = 1 (first-to-last), =-1 (last-to-first = -1)
* Two-way lookup
  + Adding data validation lists to select items to lookup, how to nest XLOOKUPS, demo, showing that inside XLOOKUP returns entire array (using F9) which is why can do 2-way lookup
* Exercise
  + XLOOKUP with wildcards and a different pattern, different return value when not found, return multiple columns, return value when not found for two-way (nested) lookup
  + Think about: what to include in data validation list and how to improve when there are multiple records that aren’t found
  + Data used for exercises from early XLOOKUP explained ([video](https://youtu.be/xnLvEhXWSas) and [tutorial](https://www.xelplus.com/excel-xlookup-explained/))

Content (my video: setting up hers and just beginning of hers) – Pivot Table Setup ([tutorial](https://www.automateexcel.com/charts/panel-template/)) and Panel Chart ([video](https://youtu.be/5nf8rucx80E) and [tutorial](https://www.xelplus.com/excel-panel-charts-matrix-excel-chart/))

* Overview
  + Pivot table application to organize data for the panel chart video, but only doing the basics of the plot (stopping at the dividers, too convoluted and not possible in Excel Mac)
* Pivot table setup
  + One off application of pivot table to organize data a certain way for a specific plot, manually adding values for a new column using filter and autofill, cell styles (for header),
* Panel chart
  + Multiple series appearing in legend, how line plots connect with consecutive data, changing colors to be consistent and make sense with context, how this plot could be improved with dividers but will be much easier later with different software (another decision to make when planning a visualization)

**1.4 – Dynamic Charts and Reports**

Assignments

* Lab: Dynamic Charts and Dashboards
  + Part 1: Line chart with highlighting multiple points
    - Fancier IF() checking for additional two series to highlight smallest and largest 2 points
  + Part 2: Dynamic dashboard via pivot table and chart
    - Add new column to table, simple pivot table (but reorganize rows) with line chart, adding slicers
* HW: Dynamic Charts and Dashboards
  + Part 1: Dynamic bar chart ([video](https://youtu.be/C9beIaL-cBA) and [tutorial](https://www.xelplus.com/excel-infocharts-special-excel-graphs/)) that colors based on relationship to dynamic target line
    - Creating two conditional formatting series (one for target line and one for colored bars)
  + Part 2: Dynamic dashboard using Excel Functions
    - Create dynamic dropdown, dynamic target line based on XLOOKUP, line chart with title dynamic ([tutorial](https://trumpexcel.com/dynamic-chart-titles-in-excel/)) and dynamic target line where all is based on dropdown, move to new tab and hide for dashboard effect ([video](https://youtu.be/p2bFHuAR8Z0) and [tutorial](https://www.xelplus.com/excel-hidden-dashboard-tips/))
    - Data setup from this example ([video](https://youtu.be/22jcw5slQJk) and [tutorial](https://www.xelplus.com/excel-dynamic-chart-with-drop-down/))
  + **Additional resource -> locking excel sheet (could use for dashboard)**

Content (her videos) – Dynamic Charts Part 1 ([video](https://youtu.be/OqtFvB6B7E4) and [tutorial](https://www.xelplus.com/highlight-max-min-values-in-an-excel-line-chart/)) and Part 2 ([video](https://youtu.be/tp9OXKcn7sA))

Part 1 – Highlight min and max on line plot

* Insert line chart with markers
* Strategy of conditionally changing color of points
  + Format points individually, logic of conditionally formatting color to be dynamic -> conditional formatting = add new data series (two different colors / styles means two different series)
* Implementing above
  + if() to test if have max or min and set everything else to NA() (not “” which means zero), format entire min or max series, change marker (marker options) using built in type with bigger size and no fill, border color and thicker border, change original series to have neutral color and markers with no border to not stand out, add data labels to min and max in correct position
* Formatting helper table / series
  + Want to avoid errors in sheets (#N/A)s, group instead of hide, then correct plot to not hide hidden rows / columns, or just change the color to lighter for the min / max series
* Exercise
  + Conditional formatting series based on greater than target, formatting new series to highlight relationship to target based on context, hiding helper series with font change and grouping

Part 2 – Target line

* Logic of target line
  + How not to do it (manually), \*You picked the wrong thing to be good at (work hard to be lazy) -> Dynamic / automate as much as possible\*
* Implementing above
  + Want to make dynamic and make data in to table to update with new data, new series for target, change series chart type to line, formatting line (thickness, adding arrows), data label of single point of target line and format (position and font), group target series and have plot show hidden cells, result when adding data and updated target
* Horizontal bar graph
  + Why excel ‘bar chart’ doesn’t work (tough with two series), hack (linked picture), formatting of new linked picture via the formatting of the original (thinner, gap width to make bars closer, rotating axis labels and all data labels), show still dynamic
* Exercise
  + Average line, adding series name and value data label for single point, manually moving data label and formatting it
  + Think about: indicate average line on plot without legend, data label from first dataset when new data applied and how to generalize the label to work with all new data

Content (my video from her) – Dynamic Dashboards Part 1 ([video](https://youtu.be/G6ImRBn3cQk) and [tutorial](https://www.xelplus.com/pivot-slicer-excel/))

* Pivot chart logic
  + If ever need aggregated data for a chart, make pivot table then make the plot
  + If just are making one static plot (data for the most part is not going to change), then can copy data to new tab like in panel chart. Else if want the flexibility can make pivot chart
* Pivot table
  + Pivot chart needs pivot table, which should be based on excel table
  + Change summary measure to average and number format
* Pivot chart
  + How to insert, removing elements, adding data labels, editing chart title, want slicer to make it dynamic, slice by date but have to group by months, temporarily using pivot table to get month field (putting in columns), how to group by month
* Slicer
  + Slice by month, using slicer, greyed out values and how to remove them from slicer settings, remove slicer caption (to keep filtering buttons)
* Dashboard
  + Organize together, format bars (gap width, color), color background of cells, remove background and border of chart, customize slicer format (columns, creating new style and applying specific format like changing background color and removing border), confirm dynamic with new data using find and replace, refreshing pivot table to update
* Exercise
  + Dashboard with line pivot chart instead with multiple series, add and format data labels for all points but different label (with series name) for specific point
  + thinking about: overplotting with all data labels, other plot features needed (gridlines, vertical axis)

Content (her video) – 5 Excel Functions ([video](https://youtu.be/_EWcAR_Hkvg) and [tutorial](https://www.xelplus.com/excel-functions-office-365/))

* PRAFACE
  + Using these as another way to make dynamic reports and charts (which combined we will call dashboards)
  + Already covered XLOOKUP, but included here as well. So extra practice
* Sort
  + Purpose: Dynamically sort dataset based on a column (always returns entire dataset), if add new data, gets resorted accordingly
  + Arguments: array = dataset to be sorted and returned (formatting does not come with), [sort\_index] = what to sort by (index of column number in array, default sorting is ascending by first column), [sort\_order] = 1 (ascending) or -1 (descending), [by\_col] = FALSE (data is in rows) or TRUE (data is in columns, horizontal)
* Sortby
  + Purpose: Sort dataset by column that isn’t in end result
  + Arguments: array = columns to get back, by\_array1 = sorting column, [sort\_order1] = ascending or descending (same as sort), (not demonstrated) can add additional [by\_array2, sort\_order2] pairs
* Unique
  + Purpose: get a dynamic list of distinct values
  + Arguments: array = column or columns (which gives unique combinations), [by\_col] = FALSE (data is in rows) or TRUE (data is in columns, horizontal), [exactly\_once] = FALSE (return every distinct item) or TRUE (return items that only appear only once)
* Xlookup
  + Purpose: returns
  + Arguments: lookup\_value = value searching for, lookup\_array = array where searching, return\_array = array to return, [if\_not\_found] = what to return when not found
* Filter
  + Purpose: Dynamically filter results based on some condition
  + Arguments: array = range to return (formatting does not come with), include = condition (not demonstrated: can involve columns not in return range)
  + Pair with sort to get filtered results automatically sorted -> sort(array = filter(), [sort\_index], [sort\_order])
* Sequence
  + Purpose: gives numbers in order that want (total number of numbers = rows x cols)
  + Arguments: rows = # number of rows to fill, [columns] = # of columns to fill (default = 1, just gives rows of numbers), [start] = number to start from (default = 1), [step] = accumulator (default = 1)
  + A practical use in reports: giving indices to dynamic list of rows -> this application uses counta() because counting text and also spill ranges (# suffix)
* Exercise
  + sortby() with multiple sorting columns (and still returning one of them)
  + xlookup() with different search modes (first-to-last and last-to-first), creating data validation list using sort(unique())
  + using counta() and a spill range of unique() to count the number of duplicates (unique list - only once list)

Content (her video) Dynamic Dashboards Part 2 ([video](https://youtu.be/ehrXyFPljBo))

Example 1

* Goal
  + Create dynamic chart where can switch view based on dropdown and chart only shows the corresponding information with no extra blank spaces
* Creating data
  + Use filter to conditionally show rows of interest (checking condition based on column that isn’t returned and if\_empty argument, just mentioned), copy formats (don’t come with results), sorting results with sort(filter())
* Chart
  + Insert chart based on dynamic range, demo changing dropdown and chart updates, adding new data updates in data and chart because Excel Table
* Exercise
  + Build to creating dynamic dropdown, then repeating chart based on dropdown like the video

Example 2

* Goal
  + Create dynamic chart that automatically updates based on from date and to date (two conditions)
* Creating data and chart
  + Additional explanation for data validation note
  + How to filter for more than one condition: include = (condition 1) \* (condition 2) = {T, F, T, …} \* {F, T, T} = {1, 0, 1, …} \* {0, 1, 1} = {0, 0, 1} = {F, F, T}, F9 to evaluate formula for debugging and then pressing esc to not hardcode, demo updating dates and chart, adding new data and everything updates
  + Dashboard formatting tips (put data on different sheet or put out of view, just mentioned)
* Exercise
  + Dynamic bar chart to show values only outside of a variable range (less than X and greater than Y), checking OR condition with (cond 1) + (cond 2), demo optional argument for cases when no matches are returned, formatting chart and input spots for more dashboard feel
* Additional resources (for extra stuff to learn)
  + Dynamic arrays to use for drop down ([video](https://youtu.be/2USJsIyIzvo) and [tutorial](https://www.xelplus.com/excel-dynamic-arrays-how-excel-will-change/))