

Excel-Word Practice Assignment

Presented to the Incoming Engineering Class

Microsoft Excel-Word Assignment

APSC 101

1st Year Engineering

Smith Faculty of Engineering and Applied Science

Smith Engineering

Prepared by the Smith Faculty of Engineering

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1. Foreword

While highly recommended as preparation for the Excel-Word Assignment, this practice exercise is **optional** and **will not be graded**. Solutions to this assignment **have been posted** using the expected formatting. This assignment was based off of a **previous year's assignment**, and the requirements/tasks that it requires may differ from tasks required in the actual assignment in any given year. Please be sure to **consult the rubric** while completing the actual assignment in order to ensure all tasks have been completed.

2. Overview

The Excel-Word assignment is designed to ease your transition into university by ensuring you have fundamental skills in using Microsoft Word and Microsoft Excel, and that you are able to format a technical document in a prescribed format. This skill is critical for many professions, including engineering.

For this assignment you are required to turn in one Microsoft Word document that includes, background research, discussion and sample calculations completed using Microsoft Excel. The formatting requirements of this document will hold throughout APSC 101 and 103 and generally align with the requirements in Queen's Engineering and the engineering profession

2.1 Purpose

This assignment will prepare you to analyze data and create technical reports using Microsoft Excel and Word. It will require the use of Microsoft Excel to create tables, scatter plots and complete data analysis, and the use of Microsoft Word to import tables/graphs, create equations, captions, and drawings. Built in tools in Microsoft Word will be used for heading styles, citations, cross-referencing, and creating a table of contents, list of figures and list of tables.

By completing this assignment successfully, students will be able to:

1. Input experimental data into Microsoft Excel
2. Perform calculations in Microsoft Excel using manually inputted formulae and built-in functions
3. Generate simple and effective tables and graphs to describe experimental data in Microsoft Excel
4. Perform basic data analysis in Microsoft Excel, specifically regression and residual analysis as a part of laboratory error analysis
5. Properly format and organize a formal report in Microsoft Word
6. Integrate both graphs and tables created in Microsoft Excel into a report in Microsoft Word
7. Generate equations and sample calculations in Microsoft Word
8. Correctly reference resources used in a formal laboratory report using IEEE formatting
9. Critically evaluate experimental results on a basic level

2.2 Relevant Resources

Microsoft Excel and Word tutorials have been designed to help you and are available [HERE](#). It is expected that you read these resources and refer to them when completing the assignment. If there are additional questions about the assignment, you may contact engineering.first.year@queensu.ca for assistance.

2.3 Required Software

This assignment can be completed on PCs, Macs and Online. The online version should be a last resort. You will need the following software and plug-ins:

1. Download and install “Microsoft 365 Apps for Enterprise” from Queen’s University.
 - <https://queensuca.sharepoint.com/sites/software-centre/SitePages/Microsoft-Office.aspx>
2. From 365, you will be using
 - Microsoft Excel – Ensure the “Analysis ToolPak” plug-in is installed in your version. Instructions are included in the **Microsoft Excel Tutorial**.
 - Microsoft Word – Ensure you have the option to use the IEEE reference style in the Word citation tool. Information on the citation tool and IEE can be found in the Word Tutorial.

If you encounter issues obtaining your own version of Office as described above, it can be accessed through [Apps Anywhere](#). You’ll have to log in with your NetID and password, then install Apps Anywhere on your device. From there, you can launch Excel and Word from the list of Apps.

Ensure that the version of Microsoft Word/Excel that you are using is the most recent version. You may have to remove old copies of the program in order to update to the newest version.

2.3.1 Troubleshooting Mac Issues

If you are experiencing issues using Office for Mac, check that it is activated.

1. First ensure your MS Office is up to date and that all updates are applied to your Operating System.
 - For Office: Open Word the click Help -> Check for Updates
 - For the OS: Click on the Apple Menu -> System Preferences -> Software Update
2. Check if you can Activate Office from Within Word
 - Open Word then click file -> Account 0 -> Log in to Queen’s Account

If still not activating, here are the instructions we follow to resolve activation issues with Office or Mac when updates are complete.

- Open KeyChain Access, search for “Microsoft” and delete all entries
- Download script from Microsoft - <https://docs.microsoft.com/en-us/samples/browse/?redirectedfrom=TechNet-Gallery>
- Run the script by right-clicking, choosing Open, then choose Open again or Press Control Key while running the App to be promoted whether you would like to open an app from an unidentified developer. The script runs quickly and usually opens Outlook.
- Restart the computer
- Open an Office app again try signing in and activating. Your exact experience may vary, and you may also have to sign out and back in again to make it work.

If that script does not work, you can download the Office License Removal tool and it may work to help activate again: <https://go.microsoft.com/fwlink/?linkid=849815>

If you get Error 0xD000000C when activating Office for Mac: <https://support.microsoft.com/en-us/office/error-0xd000000c-when-activating-office-for-mac-da865931-4658-4829-ba2d-8133390c6d25?ui=en-us&rs=en-us&ad=us>

3. Instructions

This assignment contains two questions:

Question 1: Luminol and Fluorescin to Detect Blood

Question 2: Climate Change in Kingston

Both questions are described in detail, with question 1 starting on [page 7](#) and question 2 starting on [page 9](#). To complete the two questions, you will need to create tables and graphs in Microsoft Excel, then import them into a properly formatted Microsoft Document. The specific formatting requirements are listed in [section 4](#).

3.1 Saving your work

Make sure you have a good system for saving and organizing your university work. Ensure that your work is stored in a place with backups, like your Queen's Microsoft OneDrive folder. Without this system in place, it is very likely that work could be lost. Bad habits in saving files are not a valid excuse for late work.

Most students find that it is useful to have a single cloud folder for all academic work. It is highly suggested that you create a folder in your Microsoft OneDrive for each course, named with the course code, e.g. "APSC 101". In many cases it is helpful to have a subfolder within that folder if there are multiple files related to the same assignment, e.g., "Assignment 1 - Word-Excel". You should also get in the habit of naming each file something meaningful that you can search for and recognize. If there is a naming convention for an assignment, it is usually best to name the file in line with the convention right at the beginning.

3.2 Important Academic Integrity Principles

DO NOT share your Word or Excel files with any other students. It is permitted to discuss and ask questions with other students, but ensure your work is all your own. In terms of Academic Integrity, if you share your work with other students, it may be considered *facilitation*. Every year there are students who start later and are tempted to use someone else's work. Remember for all university assignments: **discuss, question, talk, and help each other, but do not share**. For more on academic integrity, please review: <https://engineering.queensu.ca/policy/academic-integrity>

4. Formatting Requirements

The following are the formatting requirements for the Word document that will be submitted. Ensure you read them carefully before starting the Word document, while working on it, and again before you submit. If you are ever in doubt of the formatting requirements, come back and check this section. This document was created using the same formatting requirements to provide an example.

4.1 Filename

- The assignment should be saved as a Word File named:
STUDENT#_LASTNAME_FIRSTNAME_APSC100_Assignment1

- Most of your assignments in APSC 101 will use this kind of naming format.

4.2 Text

- Text should either be left or full justified. DO NOT use right or center justified.
- Paragraphs should not be indented
- Paragraphs should be separated by one line
- Use size 11 Calibri font, and 1.15 spacing
- Edit your writing for spelling, grammar and concision

4.3 Title Page

- Include a title page with your name, student number, course number (APSC 100) and submission date

4.4 Point of View

- The report should be written in **3rd person**. Do not use “I” or “we” aside from reflections and descriptions of individual work.

4.5 Headers and Page Numbers

- Use Word **Header & Footer** tool to insert a header, including your last name and the page number, positioned at the top right side of the page.
- Your name should be separated from the number using a vertical line, like “Johnson | 1”
- There should be **no page numbers on the title page**
- Use Roman Numerals (i, ii, iii, etc.) for the page numbers for pages including the Table of Contents, List of Figures and List of Tables pages.
- Arabic Numbers (1, 2, 3, etc) begin on the first page of the assignment and should be used for all subsequent pages (including appendices when applicable).

4.6 Headings

- Use Word **Styles** tool to consistently format your headings for sections and subsections.
- Use Heading 1 for Sections, Heading 2 for Subsections, Heading 3 for sections in subsections, etc
- Each section should start with a number, ordered chronologically.
- Each subsection adds an extra decimal place to the section number that it is housed in.
- Within the section, the subsections should be ordered chronologically.
- At minimum, each question and the references should have its own heading.

4.7 Tables and Graphs

- Use **consistent formatting** for tables and graphs
- Consider the following guidelines for effective graphics in a formal report

4.7.1 Tables

- Maximize white space by:
 - Eliminating vertical lines between cells
 - Where possible, minimizing the number of horizontal lines between cells.
- Center the text in cells
- Limit the use of colour where possible

4.7.2 Graphs

- DO NOT include chart titles. Your figure caption should sufficiently introduce the contents of your graph.
- Include axis titles, with appropriate units where applicable. You can use (a.u.) for dimensionless quantities, standing for “arbitrary units”.
- Include trendlines for the line of best fit. The equation of the trendline should be displayed on the graph, using appropriate variables, units and significant figures.
- Limit the use of colour where possible, except to differentiate between the series.
- Maximize white space and include your legend as part of the graph itself without covering data.
- When inserting graphs into a report, ensure they are an appropriate size. Graphs/Figures should be as small as possible, while remaining clear and legible to the naked eye. The reader should not need to magnify the report in order to see the graph clearly. If the page were to be printed, the graph should still be legible. It is appropriate to conserve space and place figures side-by-side if they are clear, legible, and their content is related.

4.8 Captions

- Include captions **below figures** and **above tables** using the Word **Captions** tool.
- Refer to each figure and table in the body of your report using **cross-referencing**, also found under the Word **Captions** tool. Use the “Only Label and Number” option when inserting cross-references such that the references appear as “Table 1” or “Figure 1” in the body of the report.
- The first reference of a Table or Figure should occur before the first time the Figure or Table is presented. Every Table or Figure **must be cross-referenced**.

4.9 List of Figures/List of Tables

- Use Word **Captions** to insert a List of Figures and List of Tables immediately after the Table of Contents, generated from the captions used in the report.
- The Table of Contents, List of Figures, and List of Tables should **not** be included in the Table of Contents.

4.10 Table of Contents

- Use Word **Table of Contents** tool to generate a Table of Contents page from the headings.
- Word will automatically do this provided that the **Styles** tool was used for section headings.

4.11 References

- Use Word **Citations and Bibliography** tool to insert in-text citations and add a references section to the end of your document.
- Reference **all** documents used
- Citations must be in IEEE style
- It is not mandatory that you use the Microsoft Word citation management tool. You are free to use other citations management tools.
- In-text citations are mandatory
- **No citation management tools are perfect. It is always expected that you manually check that your citations are generated in proper IEEE format and that you make all necessary adjustments.**

4.12 Significant Figures

- Error should be reported to **one significant figure**
- Quantities associated with error should be taken to the same digit as the one significant error digit. *Example: 654.89 ± 0.76 should be reported as 654.9 ± 0.8*
- If there is no error, unless otherwise instructed, report all numerical values to 2 decimal places.

4.13 Equations

- Number all equations used in the body of the report.
- Any equations included should be referenced at least once by number in the report body.
- It is **not** expected that students use Word **Captions** to generate equation captions, cross-references or a List of Equations.

4.14 Sample Calculations

Sample calculations are a special case, as the way that you will have to do them will change between first and second year. The criteria below are all that is required for a first-year report and should be okay for the purposes of first year, changing in second.

- Include the generic form of the equation. Ensure the equation is numbered.
- Define all variables.
- Report the final answer **with units**

A proper sample calculation has been modelled below, depicting the equation separately first with equation #.

$$y = mx + b \quad (\#)$$

The slope, m , can be used along with the y-intercept, b and the independent variable, x , in order to calculate the response y .

$$\begin{aligned} y &= mx + b \\ y &= 4 \times 5 - 5 \\ y &= 15 \text{ units} \end{aligned}$$

4.15 Units

- Report units in axis titles, at the top of table columns, and in trendline equations.
- When reporting units, ensure there is a space between the numerical value and the unit.
- A space **should not be left** if the unit is percentages or degrees.

5. Question 1: Luminol and Fluorescein to Detect Blood

Bloodstains are the most common and useful type of physical evidence in crime investigation. The detection and examination of bloodstains are of great value in reconstruction of crime scenes and linking a person to the scene. There are a variety of chemicals that can be used to detect blood such as luminol and fluorescein. These substances make the bloodstains glow when excited with longwave UV light.



Disclaimer about the scenario below: The scenario described is entirely fictitious and for the purposes of this assignment, the reactions have been simplified. The data provided was generated randomly and is not necessarily an accurate representation of chemical reactions. The data and calculated results should not be used for any purpose aside from this assignment.

Figure 1: A solution of luminol and hydrogen peroxide being used by a forensic scientist to identify blood at a crime scene [1].

5.1 Problem scenario

In this fictitious scenario, the chemistry department is investigating methods to detect blood using chemiluminescence. You have been tasked with analyzing experimental data from the lab and determining the rates of the reactions and how long each reaction lasts.

You mix a solution of luminol, hydrogen peroxide and blood and measure the concentration of luminol remaining over time. The experimental data you collect is in the first two columns of Table 1. You repeat the experiment with fluorescein, hydrogen peroxide and blood. The experimental data is placed in the first two columns of Table 2.

Reminder: concentration of chemical = [chemical]

Table 1: Experimental data you collect showing the consumption of luminol with time in a solution of hydrogen peroxide, luminol, and blood.

| Time (s) | [Luminol] (mol/L) | Uncertainty (\pm mol/L) |
|----------|-------------------|----------------------------|
| 0 | 20.00 | |
| 5 | 18.43 | |
| 10 | 14.05 | |
| 15 | 12.79 | |
| 20 | 8.60 | |
| 25 | 7.07 | |
| 30 | 4.11 | |
| 35 | 2.16 | |
| 40 | 1.04 | |
| 45 | 0.42 | |

Table 2: Experimental data you collect showing the consumption of fluorescein with time in a solution of hydrogen peroxide, fluorescein, and blood.

| <u>Time (s)</u> | <u>[Fluorescein] (mol/L)</u> | <u>Uncertainty (\pmmol/L)</u> |
|-----------------|------------------------------|--|
| 0 | 20.00 | |
| 5 | 19.78 | |
| 10 | 19.03 | |
| 15 | 18.45 | |
| 20 | 16.39 | |
| 25 | 15.21 | |
| 30 | 13.01 | |
| 35 | 10.26 | |
| 40 | 8.99 | |
| 45 | 8.01 | |

The uncertainty of the concentration can be found by Equation 1, shown below.

$$\text{Uncertainty (Concentration)} = \pm\sqrt{\text{Concentration}} \quad (1)$$

5.2 Steps to Follow

1. Transfer **Table 1** and

2. **Table 2** into an Excel spreadsheet. Calculate the natural logarithm (LN) of the luminol and fluorescein concentrations.
3. Construct a scatter plot with **Time** on the x-axis and **Concentration** on the y-axis. Include **two** series in this plot: luminol concentration and fluorescein concentration. Label the plot **Figure 1**. Add appropriate axis ranges, axis titles (with units), **a legend** with appropriate names, and professional formatting. Be sure to use **different colours** for each data series.
4. Add trendlines to **both** of the series in Figure 1 and display both equations on the graph using the form shown in Equation 2 where **m** is the slope and **b** is the y-intercept. Place each **trendline equation** beside the data they represent. Add appropriate **variable names** to each trendline equation.

$$\text{concentration} = mt + b \quad (2)$$

5. Add Error Bars to **both** of the series in Figure 1, calculated using Equation 1.
6. Based on the trendline equations, determine the degradation rates for each of the two samples.
7. Using the equations from Figure 1, calculate the time in seconds where each concentration is equal to zero. In your report, show the steps for **one** of the calculations, using the **Equation** option under Word **Symbols**. In your steps, display the numbers to **two decimal places**.

5.3 To Hand In

5.3.1 Introduction

1. A short paragraph outlining the sets of data and describing the tables, graphs, and equations you are including. Be sure to use Word **Captions** to add captions and cross-references when referring to the graphs and tables in your report. Also, ensure that equations are numbered and referred to by number in your report.

5.3.2 Results and Analysis

1. The filled in copies of Table 1 & Table 2 from *Steps to Follow 1*
2. Figure 1 from *Steps to Follow 2*
3. Equations of **both** the trendlines from Figure 1, presented using Word Equations
4. The degradation rates over **45** seconds for both chemicals from *Steps to Follow 5*. Include units, but not error.
5. The sample calculation from *Steps to Follow 6*

5.3.3 Conclusion

1. A short paragraph, outlining whether the reaction rate of luminol in the presence of blood differs from the reaction rate of fluorescein in the presence of blood. Why would it be beneficial to use one over the other? **Hint: Consider the reaction rates**
2. Citing at least one source, what is one other chemical method of detecting blood. Discuss the benefits and drawbacks of using this method. Remember to put the source you use in the **references** section. Be sure to use the IEEE format for your references.

6. Question 2: Climate Change in Kingston

Queen’s Environmental Engineering Solutions (QEES) is a recently formed, fictitious design team which specializes in tackling environmental issues related to climate change. QEES’s newest project is with the City of Kingston. Cities across the world are in desperate need to find out how climate change will affect their day-to-day operations. Changes such as higher water levels, more severe storms, fluctuations in temperature, and changes in amounts of precipitation and snowfall could significantly affect a city’s infrastructure. An example of an ill-equipped road being washed out by a lake with high water levels can be seen in Figure 2.



Figure 2: High water levels of a lake washing out a road [2].

Disclaimer: The climate data provided in this question is real and was gathered using Historical Climate Data from the Government of Canada. The City of Kingston data was randomly generated and is not an accurate representation of reality. For the purposes of this question, climate change and the effects of temperature, precipitation, and snowfall has been greatly simplified. The calculated results should not be used for any purpose aside for this assignment.

6.1 Problem Scenario

You recently joined QEES and have been tasked with a project. You must analyze environmental data provided to you to give your team a better understanding of Kingston’s climate. The data that you have been provided with has annual temperature averages, total annual precipitation, and total annual snowfall for a period from 1873 – 2006 (there are some years missing). Using this data, you will find the trends relating to the change in temperature and in amounts of precipitation and snowfall.

The City of Kingston does many tasks with the climate in mind. In the winter months, the city covers the roads and sidewalks with sand and salt. In the fall and spring months, rain and melting of snow utilize the City’s extensive storm drain system. You will be determining if the City of Kingston needs to invest in upgrading this infrastructure in order to prepare for climate change.

While rising global temperatures increasing, the necessity of an air conditioner becomes higher and higher. Often those renting homes may not be allowed to install such a device, or they may lack the funds to do so. The City of Kingston needs to stay up to date with its bylaws to ensure that citizens are able to stay cool during the hottest months.

The data has been assigned to you in a separate Excel document on the assignment website.

6.2 Steps to Follow

1. Copy the data provided in the Excel file named “Practice Data.xlsx” to another Excel spreadsheet. Be sure to include units in the column headers. There are some years missing due to unreported climate data, **do not attempt to guess what it would have been in those years.**
2. Construct scatter plots of the **temperature, precipitation, and snowfall** data. These should all be in separate plots (you will have three separate graphs). Your graphs should have **Time (years)** on

the x-axis and either **Temperature (°C)**, **Annual Precipitation (mm)**, or **Annual Snowfall (cm)** on the y-axis. Select appropriate axis ranges, and axis titles (with units) and professional formatting.

3. Add a **trendline** to each of the three data series and display the equations on the graph using appropriate variable names. Note that the Excel trendline is the result of a linear regression, which places a line of best fit to the data.
4. Use Excel Analysis to complete a **regression analysis** of the **temperature** data with a 68% confidence level. Produce both residuals and a residual plot for the data series. Do not force the regression through the origin.

Reminder: You cannot access Excel Analysis unless you have enabled the “Analysis ToolPak” plug-in.

Do not worry if you do not understand the meaning of the confidence level. Confidence levels are related to standard error and will be explored in APSC 100 Module 2.

5. Add Table 3 (below) to your Excel spreadsheet. Complete the table using the values you found in step 4. Refer to the written Excel tutorial for which numbers to include in Table 3.

Table 3: The format of the table, which you should create in your Excel spreadsheet to summarize the results of your regression analysis.

| Temperature Change Per Year [°C/year] | Standard Error [±°C/year] | Intercept [°C] | Intercept Standard Error [±°C] |
|--|----------------------------------|-----------------------|---------------------------------------|
| | | | |

6. Repeat steps 4 & 5 for the **precipitation** and **snowfall** data.

6.3 To Hand In

6.3.1 Introduction

1. A short paragraph outlining the **three** sets of data and describing the tables, graphs, and equations you are including. Be sure to use Word **Captions** to add captions and cross-references when referring to the graphs and tables in your report. Ensure that equations are numbered and referred to by number in your report.

6.3.2 Results and Analysis

This results and analysis section has fewer physical results, but more analysis. For the results, your report must include all the following, in any order that keeps the flow of the report intact.

1. The **three (3) Figures** from *Steps to Follow 2*
2. The **three (3) Tables** from *Steps to Follow 5-7*
3. The Equations showing the relationship of **Temperature, Precipitation** and **Snowfall** to time, taken from the Regression Analyses in the Tables from *Steps to Follow 5-7*
4. The **three (3) residual plots** from *Steps to Follow 5-7*

In terms of analysis, there are a few questions that may be interspersed throughout this section at your discretion, or simply placed at the end of the section; whichever choice makes the report flow best is the choice you should make. These analyses include:

1. Based off the residual plots for each series how well does the regression fit the data?
2. Given that the average temperature in 1992 was 6°C, in what year will the average temperature have increased by a significant amount? An increase in average temperature of 1.5°C or more is considered significant.
3. The City of Kingston buys sand and salt in order to melt the snow but will need to change the quantity of sand and salt if there is a significant change in the snowfall from when they made their purchasing plan in 2002. Assume that a significant change is required if the snowfall changes by more than 20% of the amount in 2002. For the current year, will they have to adjust their spending habits?

6.3.3 Conclusion

1. A short paragraph outlining whether the City of Kingston should update the bylaws written in 1992 to make air conditioning a requirement in rental homes. Consider whether the **average temperature has increased significantly**. Also consider the data points between now and 1992 to determine whether the calculation is accurate enough.
2. Kingston's drainage system can withstand **1200 mm** of precipitation a year. By what year should the City of Kingston have upgraded the drainage systems? The calculations may be shown in the results section.
3. A short analysis of whether the equations (generated above) are good fits for the data. Use the residual plots to demonstrate. Refer to the written Excel tutorial or the Excel Videos to understand how to interpret the residual plots.

7. References

- [1] G. Miller, "Infrared-Based Imaging in Forensics," March 2017. [Online]. Available: <https://possibility.teledyneimaging.com/infrared-based-imaging-forensics/>.
- [2] K. Reardon, "Erie Island flooding caused by rain, large seiche. What is it?," January 2019. [Online]. Available: https://www.cleveland.com/weather/blog/2018/04/put-in-bay_flooding_caused_not.html.