QUIZ 1 – EXCEL

Directions:

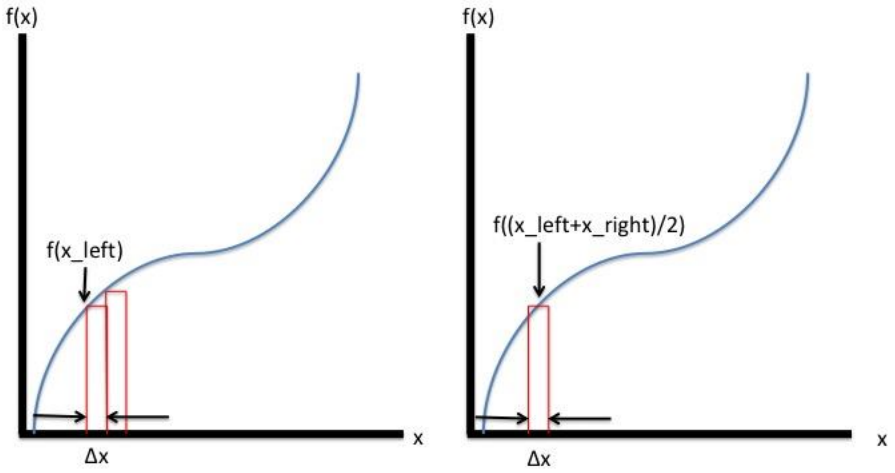
1. This is a limited open book quiz, meaning that the ***only*** sources of information allowed are the *lecture notes, tutorial problems, textbook and your handwritten notes* reiterating/reinforcing the material presented in class. This information can be accessed either in a soft or hard copy form.
2. Please note that the access of files, documents or information ***other than*** that explicitly listed at Point 1 will be treated as cheating and will be dealt with accordingly.
3. The access of social media, text messages, email or any other form of electronic communication will be treated as cheating and will be dealt with accordingly.
4. "Teamwork" and/or discussions are not permitted during the quiz.
5. If any evidence of cheating is noted, the appropriate penalties will be applied as listed in the course outline.
6. The use of cell phones during the quiz is prohibited.
7. Download the excel file from OWL and rename it using the following convention: 'Quiz [#] - [STUDENT NUMBER] – [EMAIL PREFIX].xlsx', where your 'EMAIL PREFIX' is your UWO email address minus the '@uwo.ca' part. This is what you will upload to OWL when you are done.
8. Only your owl submission will be marked.
9. **Quiz duration: 90 minutes (9:30 am – 11:00 am) + 10 minutes upload time**
10. **Total duration: 100 minutes (9:30 am – 11:10 am)**

Note: While performing problems you can use the help function built into excel to help you with syntax, and the proper use of commands.

Problem 1 [10 marks]

Integrals can be estimated numerically by using various discretization methods in Excel. Two of these methods are shown below. The left method calculates the area under the curve by multiplying the function value at the left data point by the width, all these areas are then summed. The right method is the same except it utilizes the function value at the average x value of the section.

$$\int f(x) \approx \sum f(x_{left}) * \Delta x \qquad \int f(x) \approx \sum f((x_{left} + x_{right})/2) * \Delta x$$



Given the function:

$$f(x) = -x^4 + 30x^2 + 25x - 100$$

Where $-6 \leq x \leq 6$

a) Using the template provided in the 'Question 1' worksheet, calculate the function values and plot the given function between the specified bounds with appropriate chart axis labels. Place your graph within the green border provided. **[3 marks]**

b) Using either numerical integration method described above, compute the definite integral within the bounds given using a discretization width of x = 0.5. Put the resulting calculated value in cell B32 in the worksheet in excel. **[4 marks]**

c) Using Excel Solver find all the roots of f(x). Suitable bounds of each root have been provided for you in cells A37:B40 to use as constraints in the solver. Place your answers in cells D36:D39. **[2 marks]**

d) If you were to decrease the discretization width to x=0.1 do you think the error of the numerical integration method would increase or decrease? Put your answer in cell B43. **[1 mark]**

Problem 2 [10 marks]

You have a sneaking suspicion that the US government is spying on you with surveillance planes. To help investigate this, you find an open-source dataset that scrapes FlightRadar24.com and the FAA's aircraft registration database.

a) You notice a suspicious aircraft has been following you on your way home from work in a small town outside Montreal. The last time this happened you managed to jot down the coordinates of your location as **[73.2804, 45.2384]** (longitude, latitude). Use VLOOKUP to search Column C in the dataset provided in the 'Question 2ab' tab and return the manufacturer and the model of the aircraft using the given coordinates and the corresponding aircraft data stored in columns G and H. Return you answers in Cells N11 and O11. **[3 marks]**

b) Certainly, there are other people in your region who have experienced the same thing you have! Using the COUNTIFS function in excel and the data in columns A and B in the 'Question 2ab' tab, determine how many surveillance aircraft have been spotted around the Greater Montreal Area between the longitude -73 to -74 and the latitude 45 to 46 as shown in *Figure 1*. Put your answer in Cell N17. **[4 marks]**

Hint: Check the Excel Help Entry for the COUNTIFS function for a description of its syntax as well as examples of its use.

c) You now wish to format the data as a table. A copy of the raw data used in parts (a) and (b) can be found in the 'Question 2c' tab – convert this raw data to a table. You predict that most surveillance aircraft are single engine fixed-wing aircraft like the drawing in *Figure 2*. Using the table filtering tools, display only **single engine fixed-wing aircraft** (type 4) **used by the FBI**, and record the different manufacturers (mfr) of planes used for these conditions. This can be done manually and does not need to auto update with new data. Put your answers in Cells B4:I4 (more cells are provided than needed). **[3 marks]**

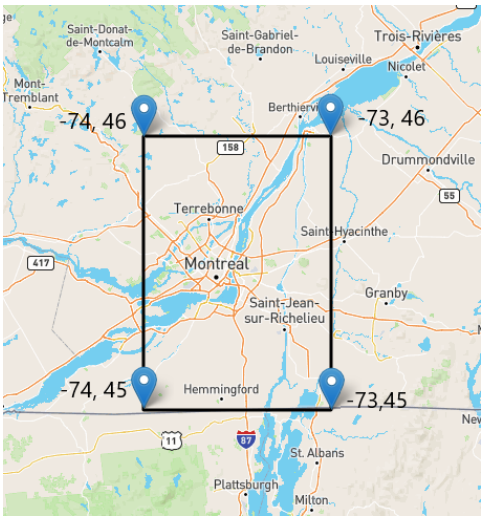


Figure 1. Search area

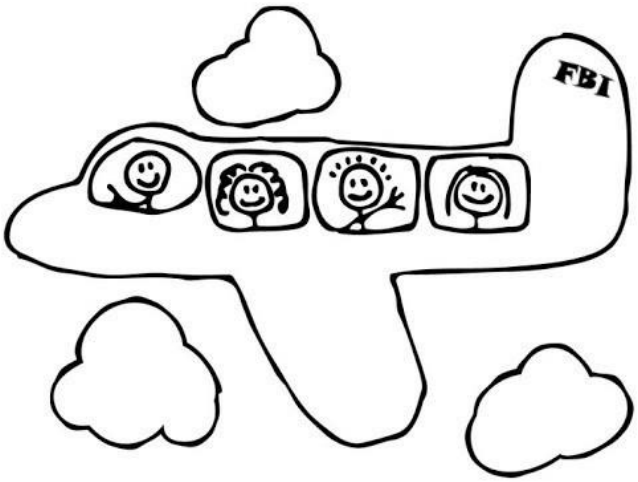


Figure 2. Suspected surveillance plane

Problem 3 [10 marks]

You have just graduated and landed a job as a process engineer at a steel plate manufacturer. Your first task is to analyze the steel plates produced on one of the production lines. Most of the plates produced from this line have surface imperfections and management wants to know why. The production line data for this problem is provided in the 'Question 3' tab.

a) Using the steel plate dimensions provided in columns A and B, determine the area of each steel plate, and put this value in column C. Next, using the resulting area and the thickness given in column D, determine the volume of each steel plate and put this value in column E. Finally, calculate the mass of each plate if A300 steel has a density of 7.75 g/cm^3 and A400 steel has a density of 8.05 g/cm^3. **[2 marks]**

Hint: you will need to use an if() statement to assign the correct density to each plate using the steel type flags given in columns G and H.

b) Using any method, determine the total number of each type of surface imperfection for the two types of steel. The presence of imperfections are given by the flags stored in columns I through L, where 1 means present and 0 means not present. If the plate has no defects, count it in the last column called entitled 'no defects'. Whatever method you use must auto update if you paste new data into the spreadsheet, so this cannot be done 'manually'. Put your results in the table in cells P10:T11. **[3 marks]**

Hint: a COUNTIF() or COUNTIFS() statement will likely be most effective here, but it is also possible using extra flag columns if so desired.

c) Given your results from part b), which steel would you recommend the line switch to if management wants to reduce the number of surface imperfections? Is there a tradeoff to changing to this type of steel? Place your response in the text box provided. **[1 mark]**

d) Use the Analysis Toolpak to generate descriptive statistics for the mass of all the steel plates including the A300 and A400 plates (no need to separate them, just analyze all plates together in one group). Put your results in the space provided. **[2 marks]**

e) Create a histogram of all the steel plate masses, again including both A300 and A400 plates in the same group (no need to separate steel types). The bins have been provided in cells O44:O73 for you to use. You may produce the histogram manually or using the Analysis Toolpak. **[2 marks]**