

Write Up for Part One

Executive Summary

Part one of my project is a program that will calculate the heat balance on a piece of squared metal. The upper and lower edges of the metal will have a constant temperature of 0, while the left and right edges of the metal stays at the temperature of 100. User will give the width and the length of the metal, while my VBA code will compute the steady state temperature distribution.

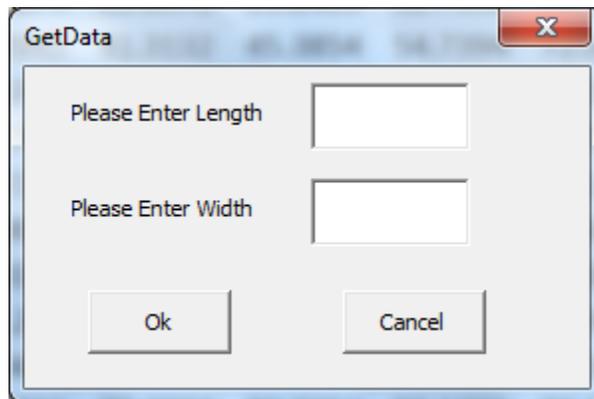
A steady state means every slot on the metal, excluding the edges, should have a temperature that's the average of the four slots around it. As shown in the picture, 51.16 equal the average of 0, 100, 71.98 and 32.7.

	A	B	C
1	0	0	0
2	100	51.1632	32.703
3	100	71.9797	54.6783
4	100	82.1267	68.7698

Implementation Documentation

User Form

When the user clicks on the project button from ribbon, a user form will pop up, looking like the picture below.



If the user leave either one of the text box empty and click okay, the caption of this user form will change, asking user to enter both values (as show below).

If the user enters non numerical characters in either one of the text box, the caption will change as well. It will request the user to enter numbers, as shown below.

If the user clicks cancel, the user form will clear up the text boxes and hide.

If the user clicks OK after entering two numbers for length and width, my program will calculate the heat balance stage and print each slot out. Below is an example of printed steady state.

	A	B	C	D	E
1	0	0	0	0	0
2	100	55.155	44.543	55.183	100
3	100	76.1889	67.9303	76.227	100
4	100	81.7946	74.8624	81.8291	100
5	100	76.227	67.9726	76.2505	100
6	100	55.2003	44.5933	55.2109	100
7	0	0	0	0	0

Calculation

Once length and width of the metal is successfully captured by user form, the sub procedure connected with the OK button will call another sub named “heatbalance”. This new sub takes two arguments, which is the length and the width of the metal.

Once heatbalance is called, a two dimensional array will be created based on the length and width given. Three loops will fill the array with initial temperatures: 0 and 100 for the edges, while 50 for the middle parts.

A while loop then will start running. Within this loop, each slot in the array, except for the edges, is calculated by averaging the four slots around it. Each slot's temperature change is compared with the largest change so far. By the end of the loop, if the biggest change in temperature is less than 0.1, the state is considered steady, and the loop will stop running. In short, the loop will keep running and calculate the averages until temperatures are stable.

Once the heat balance is reached, a nested loop will print out the two dimensional array in excel, so that the user can see the end result.

Learning and Difficulties

There are two difficulties I met in this project. The first one is related to two dimensional arrays. Although I have learned about it during class, I didn't get to implement features like "Redim" in actual programming for this class, neither was I familiar enough with the syntax. I solved this part of the problem by going online and check whether my codes are correct.

The second difficulty is more of a learning experience. I initially used input box, and was having trouble with handling the error message if user does not make an input. Professor suggested that I use user form instead, which helped me write codes to handle different potential actions from the user. I also found out that the user form project we did earlier was very helpful. The syntax I learned from it is applicable when writing this project.

Assistance

I did not receive substantial help from another person one this project.