# Project: Estimation of temperature in a plate.
Due Date: May 10th - 5PM

The purpose of this project is to see how linear systems appears in simple applications such as temperature estimation. You will be required to provide the analytic set-up, a set of instructions (similar to a pseudo code) that can easily be implemented. You should be able to provide a MAPLE or MATLAB routine (or in a different language, after consultation with the instructor). The instructor of the course will be available to help with programming provided you give the instructor detailed explanations of the formulas you are trying to code and the process you expect the computer to do. You should not expect the instructor to solve the problem for you. You are allowed and encouraged to work with a group of cardinality one, two or three. This project is worth 50 points and it will be turned in via T-Learn.

The application: Consider a square plate of dimension L where the edges are held at constant temperature as indicated below. One can estimate the temperature at various locations of the plate by using thermocouples at various grid locations. However, drilling so many holes can be expensive or damage the material. We can then estimate the temperature of each internal point in the grid by assuming it is the average temperature of the four points surrounding it.
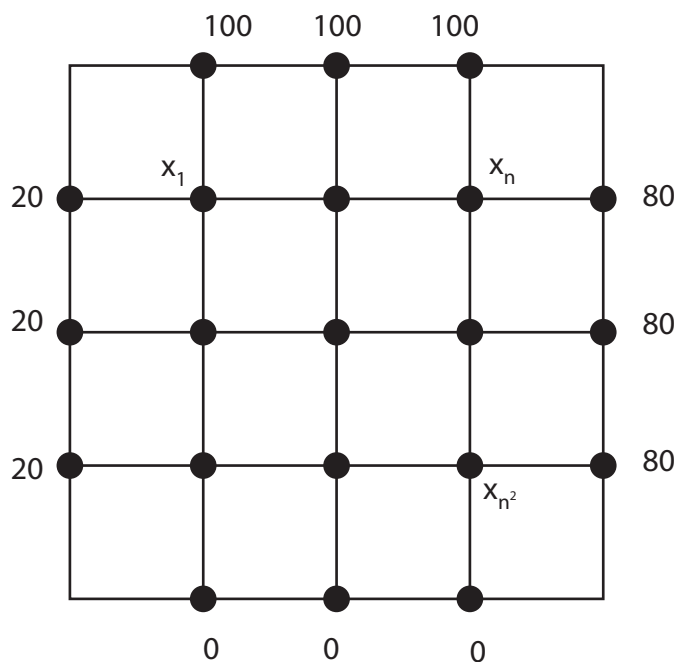
Problems:

(a) (25 points) Provide a complete and detailed solution of the problem if one decides to use a $n \times n$ grid. Formally introduced the variables you will use, set up the corresponding linear system and give a formal description of the matrix (or matrices) you will use.

(b) (15 points) Find the temperature at the center of the plate using a 1×1 grid, a 5×5 grid, and a 23×23 grid.

(c) (10 points) As the value of n increases, the corresponding estimates for the temperature will be more accurate. Develop your own analysis and justification of the optimal size of n, that is, the grid size so that measurements are acceptable. Here, you will need to come up with your own interpretation of acceptable.

(d) (Extra points) Create a MAPLE or MATLAB routine to solve this problem in general. This means, create a routine that can display or provide the solution after accepting different inputs for n, T_{top}, T_{bot}, T_{left}, and T_{right}.

Submission Instructions: Follow these simple guidelines to submit your project.

1. Submit parts a PDF containing the solution for part (a), (b), and (c).

2. Submit a MAPLE or MATLAB file for each of the items above, that is, if you solve all four above, you include four different files.

3. Submission is only allowed via T-Learn and automatically will stop accepting submissions at 11:59:59PM Central Time on May 10th.

4. The deadline is a hard deadline, no work shall be expected from a student during reading days. Please plan accordingly.