

Student name: **Enter your name here**

## Homework 6: Heat Equation in 1D and 2D

This homework set is very much based on the computer lab #6. Before we start let us make an individual problem for everyone of you using on your *student ID number*. Let us say  $s_1$  is the first digit of your student ID,  $s_2$  the second, and so on. We will use these values  $s_i$  in the following exercises. (If you do not have a student ID, use the numbers in you driver license number or passport. If you do not have either then please use the annual salary of your favorite Hollywood actor.)

### Stationary State of the 1D heat equation

We want find the stationary state for a 1D problem that is only slightly different from the computer lab. Please read the lab handout again. We use the same interval  $x=[0,L]$  but use different boundary conditions. Please set the boundary value on the left ( $x=0$ ) equal to  $s_1$  and the boundary value on the right ( $x=L$ ) to  $s_2$ . Please modify your code and make sure it converges to a straight line as expected.

Now we want to add one more modification. In the addition to fixing the value at both interval end points, we also demand that the temperature at the mid point,  $x=L/2$ , is kept fixed at  $s_3$  for all times. To realize this constraint, please think about whether  $N$  needs to be odd or even.

Please run your code until it has converged reasonable well to the new stationary state. Please cut and paste your code in here and include a graph of your final temperature distribution. Please list the value of  $s_i$  in the figure caption.

### Stationary State of the Heat Equation in 2D

For this part, we will again use the  $L \times L$  geometry with  $51 \times 51$  points but we change the boundary conditions. We now require that the temperature in the 4 corners of your domain is  $s_4$ ,  $s_5$ ,  $s_6$ , and  $s_7$ . The other values on each side are allowed to adjust in order to obtain any value so that the 1D heat equation is satisfied. Please submit a figure of your final temperature distribution as well as your final Matlab code.

For the final part of this homework, we want again specify the temperature at every point on the boundary but we want to change the geometry to  $101 \times 51$  points. Set the temperatures as shown in the following diagram using the first six digits of your CalID. Set the temperatures at the interval boundaries (yellow points) to the average of the adjacent points. Please submit your Matlab code as well as a 3D figure showing the final temperature distribution. Again please list the value of  $s_i$  in the figure caption.

