Supplementary problems: 13.5 # 1-4, 9; 13.6 # 1, 2, 7
Quiz: 13.5 and 13.6

Compulsory problems:

(1) Consider the 2-D heat conduction problem

\[
\frac{\partial u}{\partial t} = K \left[ \frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} \right]; \quad u(0, y) = u(\pi, y) = 0; \quad u(x, 0) = 1, \quad u(x, 1) = 2; \quad u(x, y, t = 0) = f(x, y). \tag{1}
\]

(a) [40 pts.] Solve for the steady-state (also known as the equilibrium) solution; i.e. Laplace’s equation

\[
\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} = 0; \quad u(0, y) = u(\pi, y) = 0; \quad u(x, 0) = 1, \quad u(x, 1) = 2; \tag{2}
\]

(b) [10 pts.] Notice that this solution can be used in a change of variables to solve the corresponding homogeneous heat equation. Don’t do any work, but rather intuitively write down the corresponding homogeneous 2-D heat equation. Do not solve.

(2) [10 pts.] Convert the following nonhomogeneous heat problem to its corresponding homogeneous problem. Do not solve!

\[
\frac{\partial u}{\partial t} = K \left( \frac{\partial^2 u}{\partial x^2} + 1 \right); \quad u(0, t) = 1, \quad u(1, t) = 2; \quad u(x, 0) = f(x) \tag{3}
\]

Your homework raw score is: \( \frac{n}{2m} \cdot M + \left( 1 - \frac{n}{2m} \right) \cdot N = N + \frac{n}{2m} (M - N) \). For this homework, \( M = 60, \ m = 8 \), \( N \) is the number of compulsory problems you get correct, and \( n \) is the number of supplementary problems you complete. It should be noted that for the supplementary problems I will be looking for full completion, but I won’t take off points for mistakes.