# Report project superpercomuters

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## Theory

In this project we are studying the two-dimensional Poisson problem

$$\begin{aligned} -\nabla^2 u &= f \qquad \text{in } \Omega = (0,1) \times (0,1) \\ u &= 0 \qquad \text{on } \partial\Omega, \end{aligned} \tag{1}$$

where $f$ is given load function and $u$ is the solution. We have been using two different load functions

$$f(x,y) = 1$$

and

$$\begin{aligned} &f(x,y) = 5\pi^2 \sin(2\pi x)\sin(\pi y) \quad \text{with exact solution} \\ &u(x,y) = \sin(2\pi x)\sin(\pi y). \end{aligned} \tag{2}$$

We discretize the Laplace operator with the five-point stencil and use regular finite difference grid with $(n+1)$ points in each direction. To solve the resulting algebraic system, we apply a diagonalization method using Discrete sine transforms.