Report: Programming Project Part 2

How to get the perfect cake!

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1 Problem

The theoretical problem we want to solve is the heat equation, which is given by:

$$\frac{\partial u}{\partial t} = \nabla(\alpha \nabla u) \tag{1}$$

$$u(\vec{x}, t)|_{\partial\Omega^D} = u^D \tag{2}$$

$$\left(\frac{\partial u(\vec{x}, t)}{\partial \nu}\right)\Bigg|_{\partial\Omega^N} = g \tag{3}$$

$$u(\vec{x}, t)|_{t=0} = u_0(\vec{x}) \tag{4}$$

Where:

- $u(\vec{x}, t)$ is the heat function.
- α is a constant denoting the thermal diffusivitie.
- Ω is the domain of the problem.
- $\partial\Omega^D$ is the part of the boundary with Dirichlet boundary-conditions.
- $\partial\Omega^N$ is the part of the boundary with Neumann boundary-conditions.
- ν is the normal vector on the Neumann-boundary.

2 Setting up the System

In this section we find a relaxation of the problem stated in section 1. To do so we introduce a triangulation of the area Ω, which we will call Ω^d.