Lab 7

Math 9830 Timo Heister, heister@clemson.edu

Note: Unless specifically asked to submit a solution, just work on the exercises and keep track of your progress in your journal.

1. Make yourself familiar with step-6 (I added a copy of step-6 to the class github repository). The step-6 documentation is at `https://www.dealii.org/current/doxygen/deal.II/step_6.html`. Go read it.

2. Visualize the solution once with the `constraints.distribute()` call in the code and once without (just comment this line out). **In your journal, describe in your own words what this call does.**

3. Create a new function that creates the simple mesh with 7 cells and two hanging nodes as shown in class (refine a 2d hypercube once and then refine the first cell one more time). Create the `AffineConstraints` object with the hanging node constraints for a Q1 and a Q2 finite element and print to the screen (it should be 2 constraints for Q1).

4. Use the code

```
   std::map<types::global_dof_index, Point<dim> > support_points;
DoFTools::map_dofs_to_support_points (MappingQ1<dim>(),
                                      dof_handler,
                                      support_points);
```

   to create a map from DoF index to coordinates and confirm that the constrained DoFs are indeed the ones you expect them to be.

5. Now do the same for Q2 and **write down in your journal** what constraints you are seeing (as mathematical notation, not just the deal.II format). Can you create a simple sketch how the constraints look like? Can you explain the different kind of constraints?