Lab 3

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

Note: You will need the deal.II Documentation available at `https://www.dealii.org/current/doxygen/deal.II/index.html`.

1. Make yourself familiar with step-2 (I added a copy of step-2 to the class github repository) and looking up help about deal.II. The step-2 documentation is at `https://www.dealii.org/current/doxygen/deal.II/step_2.html`. Go read it. There are also video lectures linked that are created by a colleague of mine.

2. How does the pattern change if you use a globally refined (say 3 times) unit square?

3. How does the pattern change if you increase the polynomial degree from 1 to 2 or to 3? Does that make sense?

4. How many entries per row do you expect for a Q1 element (assuming four cells are around each vertex)? Check that this is true for the mesh in the question above (look for `row_length(i)` and output them for each row). How does that change with a different mesh? Can you construct a mesh (without hanging nodes) that has a row with more entries?

5. Print all entries for row 42 for the original sparsity pattern from the c++ code (figure out how to access sparsity pattern entries).

6. Are these patterns symmetric? Why/why not?

7. Compute and output statistics like the the number of unknowns, bandwidth of the sparsity pattern, average number of entries per row, and fill ratio.