Lab 4

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These are just exercises, do not hand them in as homework.

1. For tutorial step-7:

   (a) Switch to vtk output. Compare the differences of `build_patches(k)` for Q2 output for a fixed mesh (not too fine) where $k = 1$, $k = 2$, and $k = 4$.

   (b) Check convergence order for global refinement for Q3 and Q4. Does it work as expected? What changes do you need to make to make it work? Any suggestions on how to make a program "order independent"?

   (c) Create a plot (use gnuplot or open office) with number of unknowns on the x axis and l2-error on the y axis (both log scale) and plot lines for Q1 adaptive refinement, Q1 global refinement, Q2 adaptive refinement, and Q2 global refinement (or more if you want).

   (d) Bonus: switch to release mode and find the best order Q_k (accuracy vs. time).

2. For tutorial step-20:

   (a) Test the two different permeability fields given in "Possibilities for extensions". Plot the solution also as a vector field and using streamlines.

   (b) Create a SparsityPattern for all DoFs (not a BlockSparsityPattern as in `make_grid_and_dofs()`) and compare with and without `DoFRenumbering::component_wise(dof_handler)`. Use a coarse mesh.