CS294 Homework 1
Due 9/26/2017

September 11, 2017

1. Implement `RectMDArrayImplem.H` corresponding to the header `RectMDArray.H`.

   - `RectMDArray()`, `RectMDArray(Box a_box)`: constructors.
   - `void define(Box a_box)`: defines an `RectMDArray` that has been default-constructed.
   - `RectMDArray(const RectMDArray<T,NC>& a_srcArray)`: copy constructor
   - `~RectMDArray()`: destructor.
   - `void setVal(const T& a_val)`: set all the elements of the `RectMDArray` to the constant value `a_val`.
   - `const T& operator[](const Point& a_pt) const`: indexing operator - return a reference to $A_{\boldsymbol{p}}$ for the input Point $\boldsymbol{p}$=`a_pt`(both const and non-const versions).
   - `const T& operator()(const Point& a_pt, int a_ic = 0) const`: indexing operator - return a reference to $A_{\boldsymbol{p}}$ for the input Point $\boldsymbol{p}$=`a_pt` for component `a_ic` (both const and non-const versions).

   Note that `const Box RectMDArray<T,NC>::getBox() const` is already defined in `RectMDArray.H`.

   You will put this file in the directory `resources/homework1/src` (the other files required to build your application are already there). To test your implementation, build `mdArrayTest` in the directory tt homework1/exec1 (the makefile and main are there) for both `DIM = 2` and `DIM = 3`, and run for inputs 64 64 and 64 64 64, respectively.If your program is correct, the output convergence rate for the eigenvalue condition will be $2.0\ldots$.

2. In the directory `homework1/exec2` create a new main program that uses Point Jacobi iteration to compute an approximation to the solution to Poisson's equation, imitating the style in the example in `homework1/exec1` (also, modify a copy of the makefile from that directory as appropriate). Test it for `DIM = 2`, and, when you think it is correct, build and run it for `DIM = 3`. Final runs should be for 64x64 in the 2D case (2000 iterations), and 32x32x32 in the 3D case (1000 iterations). The output should be the max norm of the residual written to stdout after the final iteration, as well as a plotfile suitable for viewing using Visit.

   To turn in your homework, check into your repo a `homework1` directory with `src/ exec1/ exec2/ and /utilities` populated with the necessary `.cpp and .H files` as well as the makefiles, but *only* those files. Do not check in `.o, .exe, .d,` or `.vtk` files.