NE 155 - Introduction to Numerical Simulations in Radiation Transport
Final Project
Due May 12, 2015

Below is a list of possible term projects (there are Monte Carlo and deterministic options). If you intend to share a project among a team of students (maximum three students per team), check to ensure that the project has sufficient scope. The project is 30% of your grade and is due on May 12. The following schedule will be imposed:

April 8: Decide which project to work on; turn in list of team members (if applicable) and a one- or two-page abstract of project, including:

- what you plan to do
- major steps to execute the project
- deadlines associated with each step
- what you need to do to accomplish each step (laying out a path to success)
- if in a team, the division of work

April 20 : Submit written report (4, 6, or 8 pages maximum for 1, 2, or 3 people, respectively) explaining your project. See the code project or analysis project rubrics for details of what to include.

May 12: Presentations (between 5 and 15 minutes, depending on project and team size). See the code project or analysis project rubrics for details of what to include.

May 12: Final written reports (about 6-7 pages/team member as a rule of thumb) are due. See the code project or analysis project rubrics for details of what to include.

Potential project topics:

There are two main project types: **code** and **analysis**. They have different scoring criteria for the reports and presentations.

Code topics:

If you are comfortable writing your project in Python, I encourage you to consider using PyNE (http://pyne.io) to facilitate your project. Depending on what you do, we might be able to contribute your project back to the PyNE code base over the summer.

1. Write a 2D diffusion solver that has vacuum boundaries on the bottom and left faces and reflecting boundaries on the top and right boundaries. I have more detailed specifications and some helpful tasks to facilitate completion if you choose this project.

2. Write a 2D transport solver that has vacuum boundaries on the bottom and left faces and reflecting boundaries on the top and right boundaries. I have more detailed specifications and some helpful tasks to facilitate completion if you choose this project.

3. Propose your own project to write a method for deterministic or Monte Carlo code.

Analysis topics:

You may need software that requires a license (MCNP, Serpent, SCALE). If you do not have the appropriate license already, it may not be a good idea to do one of those projects - though Serpent is pretty easy to obtain quickly.

1. Propose your own project for doing analysis with an existing deterministic or Monte Carlo code.

2. There was a reactor in Baghdad that was used to measure a some nuclear data. We would like to model this experiment in MCNP to try to reproduce the inelastic neutron scattering data. This project involves creating a model based on two publications with information about the experiment, running the model, and comparing to the results. I can give you some source materials, and Lee Bernstein and I will help you get started. This one has no guarantee of success.

3. Some interesting problems in computational radiation dosimetry were posed by the European Commission; they can be modeled with MCNP A full description of the problems can be found at: http://www.nea.fr/download/quados/quados.html

   The eight problems are:

   - Brachytherapy (photons)
   - Endovascular (electrons)
   - proton eye treatment (protons)
   - TLD-albedo dosimeter response function (neutrons)
   - ISO phantom backscatter (photons)
   - Environmental scatter (neutrons)
   - Simulation of response of germanium detector (photons)
   - detection sensitivity to the position of an Am-Be source (neutrons)