# MIT NSE Ph.D. Qualifying Exam:
# Reactor Physics Oral Question, Feb. 2015

The NRC is developing a new 2D deterministic lattice code to generate homogenized fuel assembly data to be used in a new multi-group homogenized-assembly 3D core simulator code.

**Reactor Modeling**:

1. What neutronics parameters will the core simulator need from the lattice code?
2. When 2D lattice data is used in 3D core models, which neutronic effects might be poorly approximated?

**2D Lattice Methods**:

3. If you were to use 100 energy-group cross section library, how would different isotopes influence your recommendation for a distribution of energy groups?
4. What self-shielding method would you recommend for treating resolved resonances?
5. What transport solution method would you recommend for computing scalar fluxes?

**3D Core Methods**:

6. If the 3D core model uses a diffusion theory model, what approximation would you recommend to compute homogenized-assembly diffusion coefficients?
7. What are the advantages and disadvantages of using FE (Finite-Element) vs. Nodal methods to solve homogenized diffusion equations?
8. What thermal-hydraulic approximations would you recommend for treating the core's fuel and coolant temperature distributions?

**Uncertainty Factors**:

9. If the first application of the new methods will be for the yet un-built AP1000 reactors, what plan would you recommend for determining 95/95 uncertainty factors to be applied to code predictions?