1.a. What are the three main blocks in an MCNP input deck?

Cell Cards, Surface Cards, and Data Cards

1.b. How are each of the three main blocks in the input deck separated?

By an empty line with no characters on it

1.c. How many columns of input can you specify in a MCNP input deck?

Input lines have a maximum of 80 columns

1.d. What are the two methods of commenting a MCNP input deck?

1. Starting a line with the letter C (uppercase or lowercase)
2. Starting a line with the “$” sign

1.e. Describe the role of the ":" union operator.

Logical "or" operator that combines 2 surfaces

1.f. Describe the role of the "#" complement operator.

Logical "not" operator (excludes the conditions of another logic statement)

1.g. Describe the role of the intersection operator.

Logical "and" operator that can represent where 2 surfaces overlap – different from “:” which totals both surfaces

2.a. Create the surfaces (without using macrobodies) to build a box that is 5cm on a side centered on the origin.

1 PX 2.5 2 PX -2.5 3 PY 2.5 4 PY -2.5 5 PZ 2.5 6 PZ -2.5

2.b. Create the same surface using a macrobody.

1 BOX -2.5 -2.5 -2.5 0 0 5 0 5 0 5 0 0 $Box format: vx vy vz ax ay az bx by bz cx cy cz

2.c. Create a cell filled with water (material #1) that resides entirely inside the box specified in either part a) or b). In this cell, we want to transport neutrons and not photons.

1 M1 1000 2 8000 1 $water

2 BOX -2.5 -2.5 -2.5 0 0 5 0 5 0 5 0 0

3 M1 2 IMP N=1 IMP P=0

3.a. Create the a material card for HEU (93.15 wt% U-235, 6.85 wt% U-238) for neutron transport.

M1 92235 -0.9315 92238 -0.0685

3.b. Create surfaces to define a 10cm tall half-cylinder (ie the cross-sectional area looks like "D") of radius 1 inch parallel to the z-axis with the base centered on the origin. The half-cylinder is defined in the positive x direction (ie all the "--" of the "D" is the y axis.

1 RCC 0 0 0 0 0 10 1

3.c. Create a cell for photon and neutron transport made of HEU defined in part a) and contained within the surfaces defined in part b).

c \*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\* BLOCK 1: SURFACE CARDS \*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

1 RCC 0 0 0 0 0 10 1

c \*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\* BLOCK 2: MATERIAL CARDS \*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

M1 92235 -0.9315 92238 -0.0685

4 - Create the isotropic source of 14.1 MeV neutrons located at the coordinates (0,3,10).

SDEF POS 0 3 10 PAR=1 ERG=14.1 Energy in MeV

5.a. What tally is used to get the surface current in units of particles?

F1 (for surface content)

5.b. What tally is used to get the surface energy flux in units of MeV/cm^2?

\*F2 (the \* is used for units of MeV/cm^2)

5.c. What tally is used to get the volume flux in a cell in units of particles/cm^2?

F4 (particles/cm^2 is the default units)

5.d. What tally is used to get the detector pulse height distribution in a (detector) cell?

F8

5.e. What is the card that would be used to specify the energy structure for the volume flux tally F14?

The energy bin structure is 0-100 keV, 100 keV - 1 MeV, 1-14.1 MeV.

E14 0.1 1 14.1 $energies in MeV

6. What concept did you find difficult in the reading?

Following their syntax was difficult, and getting used to the rhythm of each card to ensure everything was in the right place. The reading did a poor job of helping really put everything together in one coherent package for me, integrating cells and materials.

Project Preferences:

1. 2D Diffusion Model
2. Neutron-RSM Material Study
3. Neutron-RSM scatter contribution study

Collaboration: I worked with CPT Owens on this one, who helped me particularly with problems 3-4.