ME 290-R, Prof. Sara McMains
Homework # 6
Due 5pm, Friday May 3

Feel free to discuss these problems with other students currently taking the class, but give them credit and describe their contribution (e.g. "Fred had the insight that all cats are mortal and Sue pointed out that Socrates was mortal, but from there I figured out that Socrates was a cat on my own") and write up your own work. You may use class readings and links, but no other reference materials.

to be distributed Monday (or pick up @ office hours)

1) Download the Solidworks part "HW6part" from the class website. Draw the V-map of the green "surface" on the Gaussian sphere provided with the wet-erase pen provided (be sure to indicate the interior). Orient the sphere so that the hanging tab is centered on the Gaussian map point corresponding to a face whose normal is in the positive z direction (along the z axis), and so that points where the two halves meet correspond to Gaussian map points of faces whose normals have zero x-components. Write your initials on the hanging tab, or attach a label with your name. Do not use permanent markers on the sphere. Turn in both the sphere and the wet-erase pen.

2) Give the 32 bit value corresponding to the IEEE floating point for the base 10 value 2/3 (1 sign bit, followed by 8 bit exponent, followed by 23 bit "fraction").

3) Run your polygon area calculation program from the last assignment (or debugged version if original was buggy) on the following two polygons:

a) v1 = (.2,.2), v2 = (.1, .2), v3 = (.1, .1), v4 = (.2,.1) (& v5=v1)

to be revealed Monday

[redacted]

[redacted]

4) Lozano-Perez's Spatial Planning paper states that in general, $A \oplus A \neq \{2a | a \in A\}$ and $A \ominus A \neq \emptyset$.

For 2D sets in a 2D configuration space representing 2D translation but without rotation:

a) Find an example of a set A_1 such that $A_1 \oplus A_1 \neq \{2a | a \in A_1\}$, or prove that no such set exists for the 2D case. If such a set exists, draw the relevant set A_1, the set $A_1 \oplus A_1$, and all vectors required to graphically show that the inequality holds.

b) Find an example of a set A_2 such that $A_2 \ominus A_2 \neq \emptyset$, or prove that no such set exists for the 2D case. If such a set exists, draw the relevant sets A_2 and $A_2 \ominus A_2$.