Homework No.2 Due Day: Oct.9, Thursday, 2014.

Problem 1:
A conducting thin wire has a total length of 8 cm and its diameter is 0.2 cm. It is bent into a right angle at its center point as shown in the figure and the potential is one volt on this wire.

(1) Use moment method with two unknowns (just like what we did in the class) to find the charge distribution, the total charges on this wire (this is the capacitance between this wire and the infinite), and the potential at the location $P(0.04, 0.04, 0)$. You may assume the charges are at the locations $(0.01, 0, 0)$, $(0.03, 0, 0)$, $(0, 0.01, 0)$, and $(0, 0.03, 0)$, and test the potentials at the $(0, 0, 0.001)$ and $(0.02, 0, 0.001)$.

(2) Use moment method with enough unknowns to find the charge distribution, the total charges on this wire, and the potential at the location $P(0.04, 0.04, 0)$ accurately to the second digit of decimal. Send your codes to the TAs (apna0403@gmail.com), so they can be checked.

Problem 2:
The vector $r$ is directed from $P'$ $(x', y', z')$, the source point, to $P$ $(x, y, z)$, the observation point. (a) Show that the gradient of $(1/r)$ under these conditions is $\nabla'(1/r) = \hat{r}/r^2$. The symbol $\nabla'$ means to take the gradient with respect to the variable $x'$, $y'$ and $z'$. (b) Show similarly that $\nabla(1/r) = -\hat{r}/r^2$. The symbol $\nabla$ means
to take the gradient with respect to the variable \(x, y\) and \(z\). (c) Why are the results different by a minus sign? (d) \(E(x, y, z, x', y', z')\) means electric field created by the source at \(P'\) and observed at \(P\). We know that \(E(x, y, z, x', y', z') = -\) gradient of \(V(x, y, z, x', y', z')\). Do we take the gradient with respect to the source, \(x', y'\) and \(z'\), or the observation point, \(x, y\) and \(z\)? Why?