Q/A

1. Are there any ambiguities in your technique and how did you address them?

There were a few ambiguities in our solution technique to this problem. First, Maple gave two answers for the solution to the system of nonlinear equations. However, the first solution was immediately thrown out because its radial component was much greater than the radius of the earth. The second ambiguity lies in the solutions themselves. Our solution does not exactly satisfy all four of the pseudo range equations; instead, it is a least squares solution. The least squares solution is an inherent resort that Maple takes if it cannot exactly solve a system of equations. It provides a best guess solution, and in this case the best guess solution was good enough to correctly predict the location of the restaurant

2. Can you place a confidence interval on your position estimate?

Assuming Selective Availability (SA) is turned off, the standard deviation of the error in GPS position estimate due to common errors is $\sigma = 9.5$ meters.

In our case, we calculated the latitude and the longitude to be $33.7728°$ and $-84.3799°$, respectively, while the actual coordinates of Mary Mac's Tea Room are $33.772698°$ and $-84.379927°$. That results to a GPS error of

$$\sin \frac{33.772698° - 33.77286°}{6378.1} = 0.0116 \text{ km}.$$

Therefore the approximate distance location error is about 11.6 meters, which is close to the standard deviation of common GPS errors.

3. What factors we did not consider might affect a realistic GPS ranging estimate?

A realistic GPS ranging estimate is affected by satellite clock, Ephemeris error, selective availability, Ionospheric delay, Tropospheric delay, receiver noise and errors due to multipath propagation.

The latter factor plays a major role in degrading the GPS estimate, since the decoded location is in Midtown Atlanta, where high-rise buildings increase the multipath effects drastically.