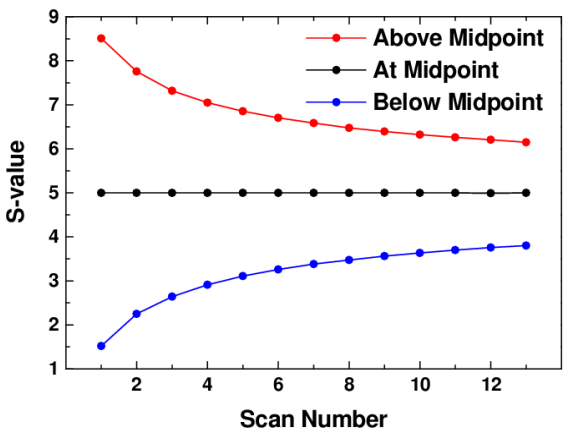
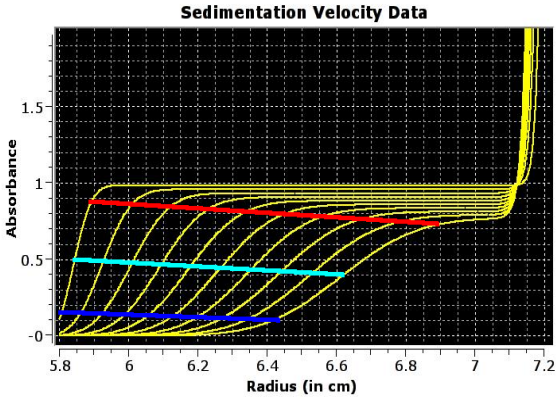
Consider the 2 graphs below:





On the right graph, you see a simulated sedimentation velocity experiment with three colored lines (blue, cyan, red) that intersect the experimental data at different radial positions. For each intersection, an *apparent* sedimentation can be determined by considering how far $(r_b - r_m)$ a particular component in the mixture has moved since the beginning of the experiment $(t - t_0)$, where r_m is the position of the meniscus (top of the solution column), t_0 is the time when the rotor started spinning (you can assume that the rotor started at full speed, which is of course not possible, but it simplifies things now). At some time t later in the experiment, after the experiment has proceeded for $(t - t_0)$ seconds, the particle has moved to the position r_b, a radius somewhere in the boundary. Using the formula below, it is possible to calculate an apparent sedimentation coefficient, s_b, for that point in the boundary, using the time of the scan and the radial distance moved as observed in the experiment.

$$\hat{s}_b = \ln\left(\frac{r_b(t)}{r_m(t_0)}\right)\left(\omega^2 (t - t_0)\right)^{-1}$$

When measuring the radial positions of all the intercepts of the colored lines with the experimental data and calculating and plotting the apparent s-values for those points, you will get the graph on the left. We would expect that a particle sedimenting at a particular point in the boundary has a constant sedimentation speed, but curiously, there is an unexpected result: Apparently, the answer is different dependent on where in the boundary the measurement is made. Furthermore, the measurements above the midpoint are sedimenting slower over time, while the measurements at the midpoint are actually constant, and measurements below the midpoint are actually increasing in speed. Please explain these contradictions:

1. Why is the discrepancy the largest for the early scans? (10 points)
2. What will happen at infinite time, if we had an infinitely large rotor and an infinitely long cell, and an infinite amount of time to wait for the sample to sediment to infinity? (5 points)
3. What would the result look like if there were two components in the mixture with different sedimentation coefficients? (10 points)
4. How should one correct for this observation? (20 bonus points if you figure this one out correctly!)

Note: ignore the fact that there are 13 scans shown in the graph on the left and only 10 in the graph on the right, the principle still holds. You do not need to make any calculations to answer this question. Please no collaboration, and please type your response.

Don't forget to send me your RSA public key and your IP4 address if you want to connect from home. (no points, but you will need it for future homework assignments).