Graduate Assignment: Due in December at the final exam.

The objective of this project is to construct a model solar atmosphere by computing the total gas pressure (P), temperature (T), opacity (κ), electron pressure (P_e), and density (ρ) versus optical depth (τ) and comparing the results with tabulated data from a solar model. In addition, the emergent specific intensity, $I_\lambda(\tau = 0, \theta)$, should be calculated for a range of wavelengths and angles, and compared with observed intensities of the sun's disk.

In order to construct the model the atmosphere may be assumed to be: 1) plane parallel, 2) in hydrostatic equilibrium, 3) in LTE, 4) a grey atmosphere (assume $\kappa = \kappa_{5000\mathring{A}}$), 5) composed of 10% Helium by number, 0.01% metal by number (with ionization potential of 7.9 eV), and 6) $T_{eff} = 5770\,\mathrm{K}$.

To solve you will need to determine the opacity as a function of electron pressure and temperature. You may use the equations in the textbook by Mihalas (1978) to determine κ from these two physical inputs. The electron pressure can be written in terms of the gas pressure and the temperature through use of the Saha equation (although these are non-linear equations which will need to be solved numerically).

I suggest you work together at the beginning. However, as you become comfortable with the details of the calculation you should work individually to produce a final project.

I suggest for starting references: Astrophysical Quantities: Allen (1964), Numerical Recipes: Press et al., Stellar Atmospheres: Mihalas (1978).