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| Problems set # 9 | **Physics 303**   November 4, 2014

1. Three distinguishable particles can occupy three states. Find all macrostates and the numbers of microstates realizing each macrostate. Compile your results into a table. Which macrostate has the highest statistical weight? What is the total number of microstates that can be found immediately? Is the sum of the microstates realizing each mucrostate equal to this expected total number?

2. Use the method of Lagrange multipliers to find the area of the largest rectangle that can be inscribed into the ellipse

$$\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1.$$

3. *(i)* Find the density of states for quantum particles in a one-dimensional rigid box. *(ii)* Generalize the result for two and three dimensions.

4. *(i)* Show that the variance of a uniform distribution of width Δ is $\Delta^2/12$. [*Hint:* Center the box at the origin.]