PHY303 – Statistical Thermodynamics – Fall 2012 – Prof. D. Garanin

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Assignment 4

1 Microstates and macrostates

3 distinguishable particles can occupy 4 states. Find all macrostates and the numbers of microstates realizing each macrostate. Put results into the 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?

Macrostates			Numbers of microstates
3	0	0	1
?	?	?	?

2 Method of lagrange multipliers

Find the area of the largest rectangle that can be inscribed into the ellipse

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

Use the method of Lagrange multipliers: to minimize a function $F(x, y)$ with a constraint $\phi(x, y = 0$, minimize

$$\Phi(x, y) \equiv F(x, y) - \lambda\phi(x, y)$$

with respect to x, y, and λ.

3 Density of states of particles in the rigid box in 1d and 2d

The density of states of quantum particles in a rigid $3d$ box has been calculated in the lectures. Generalize these results for one and two dimensions.

4 Density of states of phonons in $1d$ and $2d$

The density of states of phonons in $3d$ has been calculated in the lectures. Generalize these results for one and two dimensions.