

Combinations and Einstein Solids

Thermodynamics

Spring 2021

College of the Atlantic.

1. There are 21 students in this class.
 - (a) Suppose someday we were able to meet in person, and we decide to arrange ourselves in a straight line. How many different ways could we form this line?
 - (b) Suppose I needed two students to help me with a dangerous thermodynamics demonstration. How many different possible pairs could I choose?
 - (c) Now suppose I needed four students to help with the demonstration. How many different possible groups of four could I choose?
 - (d) Suppose I want to divide the class into two groups: one of ten students and the other of eleven students. How many different ways are there to do this?
2. Suppose there are six people in a room and there are four identical hats. How many different ways are there to distribute the hats among the people? (Assume that each person, having only one head, can wear only one hat.)
3. Consider an Einstein solid with $N = 3$ and $q = 4$.
 - (a) List all possible microstates, using the “dot and line” notation.
 - (b) Count the microstates, and verify the formula for the multiplicity:

$$\Omega(N, q) = \binom{q + N - 1}{q}. \quad (1)$$