2.3 Interacting Systems

(HW 2.8)
Examples 2.9 and 2.10)

N_A, q_A $\qquad\qquad$ N_B, q_B

N_A = # of oscillators in solid A
N_B = # " " " " B.

q = total # of energy units $= q_A + q_B$.

Problem 2.9
$N_A = 3 \qquad N_B = 3 \qquad q = 6$

List all the macrostates and their multiplicity.

q_A	Ω_A	q_B	Ω_B	$\Omega_A \cdot \Omega_B$

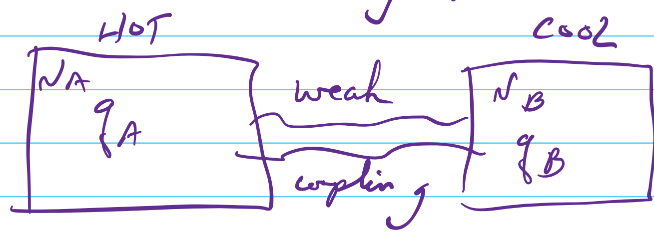
all states have same total q.

Assume: In an isolated system in thermal equilibrium, all accessible microstates are equally probable.

Corollary: we are most likely to observe the macrostate with the largest multiplicity.

Application:

If we start off with most of the energy in system A, almost any spontaneous flow of



energy will result in q_A decreasing and q_B increasing, i.e. heat will flow from A to B due to their temperature difference.

This is one version of the 2nd Law of Thermodynamics: ~~the system~~ an isolated system tends towards the most probable macrostate. Heat flows from hotter to cooler object. (More precise statements later.)

Problem 2.10. As N & q gets larger, these probability distributions become even sharper.

Though it's tempting to explore these more here, we really need to consider more realistic — very large — N values.