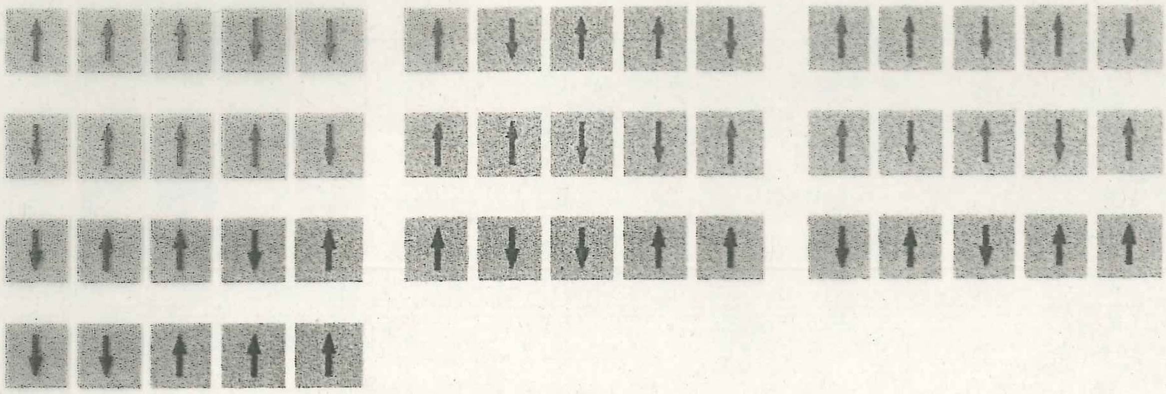

Figure 2.3 The ensemble represents a system with $N = 5$ spins and spin excess $2s = 1$.

Figure 2.4 With $N = 5$ and $2s = 5$, a single system may represent the ensemble. This is not a typical situation.

quantum states at this energy. The number of such states is given by the multiplicity function (1.15):

$$g(5,\tfrac{1}{2}) = \frac{5!}{3!\,2!} = 10.$$

The 10 systems shown in Figure 2.3 make up the ensemble.

If the energy in the magnetic field were such that $2s = 5$, then a single system comprises the ensemble, as in Figure 2.4. In zero magnetic field, all energies of all $2^N = 2^5 = 32$ states are equal, and the new ensemble must represent 32 systems, of which 1 system has $2s = 5$; 5 systems have $2s = 3$; 10 systems have $2s = 1$; 10 systems have $2s = -1$; 5 systems have $2s = -3$; and 1 system has $2s = -5$.

Most Probable Configuration

Let two systems $\mathcal{S}_1$ and $\mathcal{S}_2$ be brought into contact so that energy can be transferred freely from one to the other. This is called **thermal contact** (Figure 2.5). The two systems in contact form a larger closed system $\mathcal{S} = \mathcal{S}_1 + \mathcal{S}_2$ with constant energy $U = U_1 + U_2$. What determines whether there will be a net flow of energy from one system to another? The answer leads to the concept of temperature. The direction of energy flow is not simply a matter of whether the energy of one system is greater than the energy of the other, because the