The generating function for the states of a system of three magnets is

$$(\uparrow_1 + \downarrow_1)(\uparrow_2 + \downarrow_2)(\uparrow_3 + \downarrow_3).$$

This expression on multiplication generates $2^3 = 8$ different states:

Three magnets up:		$\uparrow_1\uparrow_2\uparrow_3$	
Two magnets up:	$\uparrow_1\uparrow_2\downarrow_3$	$\uparrow_1\downarrow_2\uparrow_3$	$\downarrow_1\uparrow_2\uparrow_3$
One magnet up:	$\uparrow_1\downarrow_2\downarrow_3$	$\downarrow_1\uparrow_2\downarrow_3$	$\downarrow_1\downarrow_2\uparrow_3$
None up:		$\downarrow_1\downarrow_2\downarrow_3.$	

fisika : magnetismoa

The total magnetic moment of our model system of N magnets each of magnetic moment m will be denoted by $\boxed{M}$, which we will relate to the energy in a magnetic field. The value of M varies from Nm to $-Nm$. The set of possible values is given by

N PARTIKULAK

2^N EGOERAK

$N+1$ BANAKETAK

$g(N,s)$ BANAKETETAKO EGOERAK

$$M = Nm, \quad (N-2)m, \quad (N-4)m, \quad (N-6)m, \quad \cdots, \quad -Nm. \tag{7}$$

The set of possible values of M is obtained if we start with the state for which all magnets are up ($M = Nm$) and reverse one at a time. We may reverse N magnets to obtain the ultimate state for which all magnets are down ($M = -Nm$).

There are $N + 1$ possible values of the total moment, whereas there are 2^N states. When $N \gg 1$, we have $2^N \gg N + 1$. There are many more states than values of the total moment. If $N = 10$, there are $2^{10} = 1024$ states distributed -- edo energia among 11 different values of the total magnetic moment. For large N many different states of the system may have the same value of the total moment M. We will calculate in the next section how many states have a given value of M.

Only one state of a system has the moment $M = Nm$; that state is

$$\uparrow\uparrow\uparrow\uparrow\cdots\uparrow\uparrow\uparrow\uparrow. \tag{8}$$

There are N ways to form a state with one magnet down:

$$\downarrow\uparrow\uparrow\uparrow\cdots\uparrow\uparrow\uparrow\uparrow \tag{9}$$

is one such state; another is

$$\uparrow\downarrow\uparrow\uparrow\cdots\uparrow\uparrow\uparrow\uparrow, \tag{10}$$