From last time: Find ten (m) numbers that sum to 100 (N) whose product is maximum.

MAXIMIZE: $n_0 \cdot n_1 \cdot n_2 \cdots n_9$

MINIMIZING: $-n_0 \cdot n_1 \cdot n_2 \cdots n_9$

OR: $-\ln(n_0 \cdot n_1 \cdot n_2 \cdots n_9)$

$f(n_0, \ldots n_9) = -\ln(n_0 \cdot n_1 \cdot n_2 \cdots n_9 + 1)$

prevent taking log(0)

df = change in func. value

compute $e^{-df/k}$

MAGIC SQUARES:

Take an $n \times n$ grid, and place the numbers $1, 2, 3, \ldots, n^2$ in the grid cells. We want the rows, colums, and diagonals to have all the same sums.

			sums
8	2	9	19
1	5	4	10
7	6	3	16
21	16	13	16	16

If the sums are equal, what are the equal to?

sum of all entries: $1 + 2 + 3 + \cdots + n^2 = \frac{1}{2} n^2 (n^2 + 1)$

$n^2 + (n^2 - 1) + (n^2 - 2) + \cdots + 1$

n^2 terms, each $n^2 + 1$ $\longrightarrow$ $(n^2+1) + (n^2+1) + (n^2+1) + \cdots + (n^2+1) = n^2(n^2+1)$

Since there are n row sums, each of them must be $\frac{1}{n} \cdot \frac{1}{2} n^2(n^2+1) = \frac{1}{2} n(n^2+1)$ if they are all the same.

We want row, column, and diagonal sums to be this.

Convert to an optimization problem:

- What are the states?
- What function do we minimize?
- How do we move from one state to another?