The Draft of MrHeer

MrHeer

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1 Throwing eggs from a building

Question

Suppose that you have an N-story building and plenty of eggs. Suppose also that an egg is broken if it is thrown off floor F or higher, and unhurt otherwise. First, devise a strategy to determine the value of F such that the number of broken eggs is $\sim\lg N$ when using $\sim\lg N$ throws, then find a way to reduce the cost to $\sim 2\lg F$.

Answer

$\sim\lg N$: start at the top, always cut search space in half $\rightarrow$ binary search.
$\sim 2\lg F$: start at 1, next 2, 4, 8 (i.e., 2^i), once the egg breaks after ($\sim\lg F$ steps) do binary search in the smaller search space (range $< F$ and hence number of searches $< \sim\lg F$) $\rightarrow$ exponential search.

$$2^{\lceil \lg F \rceil - 1} < F \leqslant 2^{\lceil \lg F \rceil}$$

$$range = 2^{\lceil \lg F \rceil} - 2^{\lceil \lg F \rceil - 1} = 2^{\lceil \lg F \rceil - 1} < 2^{\lg F} = F$$

$$range < F$$

2 Throwing two eggs from a building

Question

Consider the previous question, but now suppose you only have two eggs, and your cost model is the number of throws. Devise a strategy to determine F such that the number of throws is at most $2\sqrt{N}$, then find a way to reduce the cost to $\sim c\sqrt{F}$. This is analogous to a situation where search hits (egg intact) are much cheaper than misses (egg broken).

Answer