

# The Draft of MrHeer

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July 27, 2019

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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  $\leq F$  and hence number of searches  $< \sim \lg F$ )  $\rightarrow$  exponential search.

$$2^{\lfloor \lg F \rfloor} \leq F \leq 2^{\lceil \lg F \rceil}$$

$$range = 2^{\lceil \lg F \rceil} - 2^{\lfloor \lg F \rfloor} = \{0, 2^{\lfloor \lg F \rfloor}\} \leq 2^{\lg F} = F$$

$$range \leq F$$

## 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