

The Dinosaur Eggs

Solution

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Yes, 20 drops are more than enough. The minimum worst-case number is 14.

Assume both eggs have the same threshold: below the first breaking floor they never break, and at or above it they always break. An unbroken egg is unchanged by a drop. If every floor is safe, the answer is “the eggs do not break from this building.”

A 14-drop plan

Drop the first egg from floors

14, 27, 39, 50, 60, 69, 77, 84, 90, 95, 99, 100,

stopping this sequence as soon as it breaks. The gaps are designed to shrink as you use up drops.

When it breaks, use the second egg to test the untested floors in order, beginning just above the highest floor already known to be safe. Stop when the second egg breaks, or when only the already-tested breaking floor remains possible.

For example, if the first egg breaks at 14, test floors 1 through 13 with the other egg. That is at most $1 + 13 = 14$ drops. If it survives 14 but breaks at 27, test 15 through 26, using at most $2 + 12 = 14$ drops. The same accounting works at every later stage. If it never breaks, the final test at 100 establishes that all floors are safe.

Why 13 drops are not enough

Suppose you have k drops and two eggs. Your first test can be at most k floors above the highest known-safe floor. Otherwise, if the egg breaks, one remaining egg and $k - 1$ drops cannot check the longer interval one floor at a time.

If the first egg survives, there are $k - 1$ drops left, so the next gap can be at most $k - 1$. The following gaps can be at most $k - 2, k - 3, \dots, 1$. Therefore the maximum number of floors is

$$k + (k - 1) + \dots + 1 = \frac{k(k + 1)}{2}.$$

Thirteen drops cover at most 91 floors, while fourteen cover at most 105. Thus 14 is necessary and sufficient for 100 floors.

The follow-up questions. With $k = 14$, both 104 and 105 floors can be handled, but 106 cannot; 106 needs 15 drops. For the full 105-floor plan, the first-egg floors are

14, 27, 39, 50, 60, 69, 77, 84, 90, 95, 99, 102, 104, 105.

History and sources: [companion history PDF](#).