DIGITAL SCHOOLHOUSE

POWERED BY PlayStation.

Digital Schoolhouse Puzzle Page

“If I had an hour to solve a problem I'd spend 55 minutes thinking about the problem and 5 minutes thinking about solutions”

Albert Einstein

Welcome to the Digital Schoolhouse Puzzle Page

On this paper, we will investigate a series of puzzles that can be used to promote Computational Thinking. This month we will investigate Santa’s Glove Selection conundrum.

Super-Egg Test

Digital Schoolhouse (DSH) has invested a super-strong egg. For publicity purposes, it wants to determine the highest floor in a 100-story building from which such an egg can fall without breaking. DSH has given a tester two identical eggs to experiment with. Of course, the same egg can be dropped multiple times unless it breaks.

What is the minimum number of droppings that is guaranteed to determine the highest safe floor in all cases.

Answer: 14

Let $H(k)$ be the maximum number of floors for which the problem can be solved in k drops. The first drop has to be made from floor k because if the egg breaks, each of the lower $k—1$ floors will need to be tested sequentially starting with the first floor.

If the first drop does not break the egg, the second drop has to be made from floor $k + (k - 1)$ to be prepared for the possibility that if the egg breaks, each of the $k—2$ floors from floor $k + 1$ to floor $2k—2$ need to tested sequentially.

Repeating this argument for the remaining $k– 2$ drops, gives us the following formula for $H(k)$:

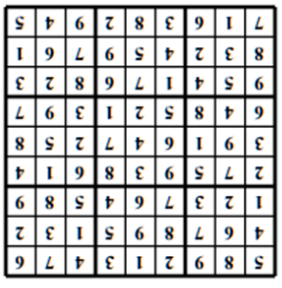
$$H(k) = k + (k—1) + ... + 1 = k(k + 1)/ 2$$

What remains to be done to answer the puzzle question is to find the smallest value of k such that $k(k + 1)/2 \geq 100$. This value is 14. The first egg can be dropped from floors 14, 27, 39, 50, 60, 69, 77, 84, 90, 95, 99 and 100 until it breaks. If this happens then the second egg is to be dropped from each consecutive floor starting with the next floor after the last successfully tested one.

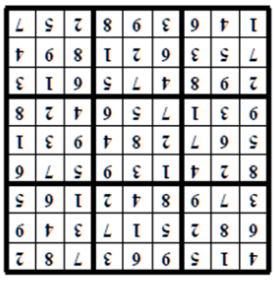
Linkage to Computer Science

This algorithm is based on the Greedy Algorithm. It is rather unusual in analysing the worst case backwards: it finds the largest size of the problem for a given number of times its basic operation (the egg drop) is executed.

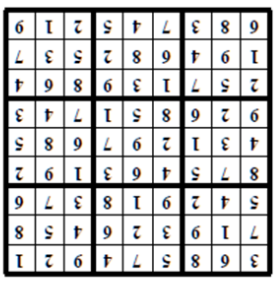
Solutions



Puzzle 39: (Hard, difficulty rating 0.63)



Puzzle 38: (Medium, difficulty rating 0.55)



Puzzle 37: (Easy, difficulty rating 0.41)

Puzzle 37: Easy

3		8		7				
7	1	9			6			
		2			8	3		6
					3	1		
	3	1				6	8	
		6	8					
2		7	1			8		
			6			5	3	7
				4		2		9

Puzzle 38: Medium

	1	5		6				
6		2		1		3		
3	7			4				5
8							7	
		7	2	8	4	9		
	3							8
2				7			1	3
		3		2		8		4
				9		2	5	

Puzzle 39: Hard

5					3	4		6
	6		8					
1		3	7				8	
2					8	6		
	9	1				2	5	
		8	5					7
	5				6	8		3
					9		6	
7		6	3					5