

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 the Sock Selection question which has been used by Amazon in interviewing applicants.

Cash Boxes

You have a thousand £1 coins. How can you distribute them among 10 boxes so that any amount between £1 and £1000, inclusive, can be given as some combination of these boxes? No change is allowed of course.

Answer:

The solution to this puzzle takes advantages of the binary system.

Let us put 1, 2, 4, 8, 16, 32, 64, 128, 256 £1 coin in the first nine boxes and $1000 - (1 + 2 + 4 + 8 + 16 + 32 + 64 + 128 + 256) = 489$ £1 coins in the tenth box. Any amount, A, smaller than 489 can be obtained as a combination of these powers of 2, i.e $2^0 \dots 2^8$.

The largest integer a nine digit binary number can be represented is $2^9 - 1 = 511$.

Therefore, any amount between 489 and 1000, inclusive, can be represented as $489 + A'$ where $0 \leq A' \leq 511$. Hence, it can be obtained as the contents of the tenth envelope and a combination of the first nine, the latter given by the binary representation of A' .

Linkage to Computer Science

This solution uses binary to represent the problem's input. i.e. the number of £1 coins in each of the cash boxes. Every decimal integer has a unique representation in the binary number system. The binary number system is important because it has proved to be the most convenient for computer implementation.

Puzzle 16: Easy

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

Puzzle 17: Medium

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

Puzzle 18: Hard

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

Solutions

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

Puzzle 18: (Hard, difficulty rating 0.65)

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

Puzzle 17 (Medium, difficulty rating 0.54)

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

Puzzle 16: (Easy, difficulty rating 0.44)