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Recursion Challenge Exam

Imagine you want to build a wall out of Legos. The length of your wall is 15 studs long. You want to build the wall out of repeating patterns of blocks. Using recursion allows you to break this task into smaller and smaller elements.

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Block position | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 |
| COLOR | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X |

F(x) = 1 IF (x <= 2)

= F(x-2) + 2 IF (x>2)

Using this piecewise function we can create a Lego wall with a recursive pattern! A beautiful display of math!

F(x) = 1 IF (x <= 2) AND add red block.

= F(x-2) + 2 IF (x>2) AND add two blocks, change color

Every time we add 2 in our recursive function, we add two blue blocks. Every time we get the result 1, we add one red block.

We must divide and conquer the construction of this wall by working our way up to block 15.

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Block position | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 |
| COLOR | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X |

F(15) = F(15-2) + 2 = F(13) + 2 ADD TWO RED & change - Start at block 15

= F(13-2) + 4 = F(11) + 4 ADD TWO BLUE & change - Work until you get a starting color

= F(11-2) + 6 = F(9) + 6 ADD TWO RED & change

= F(9-2) + 8 = F(7) + 8 ADD TWO BLUE & change

= F(7-2) + 10 = F(5) + 10 ADD TWO RED & change

= F(5-2) + 12 = F(3) + 12 ADD TWO BLUE & change

= F(3-2) + 14 = F(1) + 14 ADD TWO RED & change

**=** F(1) + 14 = 1 + 14 = 15 ADD ONE RED - Once you get RED as a starting color you can finally finish building your Lego wall!

Work back up the set of instructions you have written yourself. Notice how you are repeating the basic step “Add two blocks, change color” until your wall is finished. This is the basic principle of recursion. It allows us to break down our complex world into easily understandable chunks.

By diving the wall building process into simple, repetitive steps, we demonstrate the intuitive nature of recursion. Every child has played with Legos and made patterns like this, but many have never heard of the concept of recursion. I hope that my project has demonstrated how recursion is present everywhere in life even if you do not notice it happening.