

1 Title

Addition Via Recursion

2 Abstract

Recursion is an effective way to add numbers. Using recursion, a more complicated addition is reduced to simpler additions. Hence, through a recursive procedure, it turns into several steps of addition by 1, where $a + 1$ denotes the next number.

3 Procedure

$$\begin{aligned} & a + b \\ & \Downarrow \\ & (a + (b - 1)) + 1 \\ & \Downarrow \\ & ((a + (b - 2)) + 1) + 1 \\ & \Downarrow \\ & \vdots \\ & \Downarrow \\ & (\cdots ((a + 0) + 1) + \cdots + 1) \end{aligned}$$

4 Examples

4.1 Example 1

4.1.1 Question

Calculate this $3 + 2$:

4.1.2 Answer

$$\begin{aligned} 3 + 2 &= (3 + 1) + 1 && \text{(First decomposition)} \\ &= ((3 + 0) + 1) + 1 && \text{(Second decomposition)} \\ &= (3 + 1) + 1 && \text{(Base case applied)} \\ &= 4 + 1 && \text{(First increment)} \\ &= 5 && \text{(Final result)} \end{aligned}$$

4.2 Example 2

4.2.1 Question

Calculate the result of $a + b$:

4.2.2 Answer

$$\begin{aligned}a + b &= (a + (b - 1)) + 1 \\&= ((a + (b - 2)) + 1) + 1 \\&\vdots \\&= (\cdots ((a + 0) + 1) + \cdots + 1) \\&= a + \underbrace{1 + 1 + \cdots + 1}_{b \text{ times}} \\&= a + b\end{aligned}$$