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

$$a + b$$
$$\Downarrow$$
$$(a + (b - 1)) + 1$$
$$\Downarrow$$
$$((a + (b - 2)) + 1) + 1$$
$$\Downarrow$$
$$\vdots$$
$$\Downarrow$$
$$(\cdots((a + 0) + 1) + \cdots + 1)$$

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

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