Hoja de trabajo # 3

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1 Ejercicio # 1

$Sumar : s(s(s(0))) \oplus s(s(s(s(0))))$

$s(s(s(0))) \oplus s(s(s(s(0))))$
$s(s(s(s(0))) \oplus s(s(s(0))))$
$s(s(s(s(s(0))) \oplus s(s(0))))$
$s(s(s(s(s(s(0))) \oplus (s(0))))$
$s(s(s(s(s(s(0 \oplus 0))))$
$s(s(s(s(s(s(s(0)))))))$

2 Ejercicio #2

Definir la multiplicación para numeros naturales unarios:

$$n \otimes m := \begin{cases} 0 & \text{si } n = 0 \\ 0 & \text{si } m = 0 \\ 0 & \text{si } m = 0, n = 0 \\ m & \text{si } n = 1 \\ n & \text{si } m = 1 \\ s(i) \oplus (s(i) \otimes j) & \text{si } n = s(i) \end{cases}$$

3 Ejercicio #3

1. $s(s(s(0))) \otimes 0$
   $s(s(s(0))) \otimes 0 = 0$

2. $s(s(s(0))) \otimes s(0)$
   $s(s(s(0))) \otimes s(0) = s(s(s(0))) \oplus (s(s(s(0))) \otimes 0) = s(s(s(0)))$

3. $s(s(s(0))) \otimes s(s(0))$
   $s(s(s(0))) \oplus (s(s(s(0))) \otimes s(0))$
   $s(s(s(0))) \oplus s(s(s(0)))$
   $s(s(s(s(0))) \oplus s(s(0)))$
   $s(s(s(s(s(0))) \oplus s(0)))$
   $s(s(s(s(s(s(0)) \oplus 0)))$
   $s(s(s(s(s(s(0 \oplus 0))))))$
   $s(s(s(s(s(s(0))))))$

4 Ejercicio #4

1. $a \oplus s(s(0)) = s(s(a))$

   Caso base a=0
   $0 \oplus s(s(0)) = s(s(0))$
   $(s(0 \oplus 0)) = s(s(0))$
   $s(s(0)) = s(s(0))$

   Caso inductivo a= s(i)
   $s(i) \oplus s(s(0)) = s(s(s(i)))$
   $s(s(i)) \oplus s(0) = s(s(s(i)))$
   $s(s(s(i \oplus 0))) = s(s(s(i)))$
   $s(s(s(i))) = s(s(s(i)))$

2. $a \otimes b = b \otimes a$

   Caso base a = 0
   $0 \otimes b = b \otimes 0$
   $0 = 0$

   Caso Inductivo a = s(i)
   $s(i) \otimes b = b \otimes s(i)$
   $s(i) \oplus (s(i) \otimes b) = (b \otimes s(i)) \oplus s(i)$
   $s(i) \oplus (s(i) \otimes b) = s(i) \oplus (s(i) \otimes b)$

3. $a \otimes (b \otimes c) = (a \otimes b) \otimes c$

   Caso Base c= 0
   $a \otimes (b \otimes 0) = (a \otimes b) \otimes 0$

$a \otimes 0 = (ab) \otimes 0$
$0 = 0$

Caso Inductivo a= s(i)
$s(i) \otimes (b \otimes c) = (s(i) \otimes b) \otimes c$
$s(i) \oplus (s(i) \otimes (b \otimes c)) = (s(i) \oplus (s(i) \otimes b)) \otimes c$
$s(i) \oplus (s(i) \otimes (b \otimes c)) = s(i) \oplus (s(i) \otimes (b \otimes c))$

4. $(a \otimes b) \otimes c = (a \otimes c) \oplus (b \otimes c)$

Caso base: $c = 0$
$(a \otimes b) \otimes 0 = (a \otimes 0) \oplus (b \otimes 0)$
$(ab) \otimes 0 = (0) \oplus (0)$
$0 = 0$

Método inductivo: $c = n \oplus 1$
$(a \otimes b) \otimes (n \oplus 1) = (a \otimes (n + 1)) \oplus (b \otimes (n \oplus 1))$
$(a \otimes (n \oplus 1) \oplus (b \otimes (n \oplus 1)) = (an \oplus a) \oplus (bn \oplus b)$
$(an \oplus a) \oplus (bn \oplus b) = (an \oplus a) \oplus (bn \oplus b)$
$an \ominus an \oplus bn \ominus bn \oplus a \ominus a \oplus b \ominus b = 0$
$0 = 0$