Universidad del Istmo de Guatemala
Facultad de Ingenieria
Ing. en Telecomunicaciones
Informatica 1
Estuardo Valenzuela

Hoja de trabajo #3

Fecha de entrega: 16 de Agosto, 2018 - 11:59pm

Ejercicio #1 (10%)

Utilizando la definicion de suma ($\oplus$) para los numeros naturales unarios, llevar a cabo la suma entre tres $[s(s(s(0)))]$ y cuatro $[s(s(s(s(0))))]$. Debe elaborar todos los pasos de forma explicita. Como referencia, se presenta nuevamente la definición de suma para numeros natruales unarios:

$$n \oplus m := \begin{cases} m & \text{si } n = o \\ n & \text{si } m = o \\ s(i \oplus m) & \text{si } n = s(i) \end{cases}$$

Resolucion al ejercicio 1

$$s(s(s(0))) \oplus s(s(s(s(0))))$$
$$s(sss(0) \oplus sss(0))$$
$$s(s(ssss(0) \oplus ss(0)))$$
$$s(s(s(ssss(0))) \oplus s(0))$$
$$s(s(s(s(s(s(s(0)))))) \oplus 0)$$
$$s(s(s(s(s(s(s(0))))))))$$

Ejercicio #2 (30%)

Definir inductivamente una función para multiplicar ($\otimes$) numeros naturales unarios. **Consejo:** Puede apoyarse de la definición de suma estudiada durante la clase.

Resolución ejercicio 2
$[U - U] \oplus [U \oplus U \oplus ...] \rightarrow$ donde U es el primer número unitario y u es el segundo número unitario que multiplica al primero, la cantidad de U's dentro del parentesis esta limitada por el valor de u

Ejercicio #3 (20%)

Verifique que su definición de multiplicación es correcta multiplicando los siguientes valores:

- $s(s(s(0))) \otimes 0$
  $\rightarrow [s(s(s(0))) - s(s(s(0))))] \oplus [0]$
  $\rightarrow [0] \oplus [0]$
  $\rightarrow 0$

- $s(s(s(0))) \otimes s(0)$
  $\rightarrow [s(s(s(0))) - s(s(s(0)))] \oplus [s(s(s(0)))]$
  $\rightarrow [0] \oplus s(s(s(0)))$
  $\rightarrow [0] \oplus s((0) \oplus ss(0))$
  $\rightarrow [0] \oplus s(s(0) \oplus s(0))$
  $\rightarrow [0] \oplus s(s(s(0))) \oplus 0$
  $\rightarrow s(s(s(0)))$

- $s(s(s(0))) \otimes s(s(0))$
  $\rightarrow [s(s(s(0))) - s(s(s(0)))] \oplus [s(s(s(0))) \oplus s(s(0)))]$
  $\rightarrow [0] \oplus [s(sss(0) \oplus s(0))]$
  $\rightarrow [0] \oplus [s(s(s(sss(0))) \oplus (0))]$
  $\rightarrow [0] \oplus [s(s(s(s(sss(0)))))]$
  $\rightarrow [s(s(s(sss(0))))]$

Ejercicio #4 (40%)

Demostrar utilizando inducción:

- $a \oplus s(s(0)) = s(s(a))$
  Siendo a $= s(0) \rightarrow s(0) \oplus s(s(0)) = s(s(s(0)))$
  $s(s(s(0))) = s(s(s(0)))$

- $a \otimes b = b \otimes a$
  $a > 0 \quad b > 0$
  $s(0) \otimes s(s(0)) = s(s(0)) \otimes s(0)$
  $[s(0) - s(0)] \oplus [s(0) \oplus s(0)] = [s(s(0)) - s(s(0))] \oplus [s(s(0))]$
  $[0] \oplus [s(0) \oplus s(0)] = [0] \oplus [s(s(0))]$
  $s(s(0)) = s(s(0))$

- $a \otimes (b \otimes c) = (a \otimes b) \otimes c$

  $a > 0\ b > 0\ c > 0$
  $a = s(s(0))$
  $b = s(0))$
  $c = s(s(s(0)))$
  $\rightarrow s(s(0)) \otimes ([s(0) - s(0)] \oplus [s(s(s(0)))]) = ([s(s(0)) - s(s(0))] \oplus [(s(0)) \oplus s(0))] \otimes s(s(s(0)))$
  $\rightarrow s(s(0)) \otimes s(s(s(0))) = s(s(0)) \otimes s(s(s(0)))$
  $\rightarrow [s(s(0) - s(s(0)] \oplus [s(s(s(0))) \oplus s(s(s(0)))] = [s(s(0)) - s(s(0))] \oplus [s(s(s(0))) \oplus s(s(s(0)))]$
  $\rightarrow ssssss(0) = ssssss(0)$

- $(a \oplus b) \otimes c = (a \otimes b) \oplus (b \otimes c)$
  $a = 0$
  $b = s(0)$
  $c = s(s(0))$
  $\rightarrow (a \oplus b) \otimes c = (a \otimes b) \oplus (b \otimes c)$

$\rightarrow (0 + s(0)) \otimes s(s(0)) = (0 \otimes s(0)) \oplus (s(0) \otimes s(s(0))$
$\rightarrow s(0) \otimes s(s(0)) = [s(0) - s(0)] \oplus [0] \oplus [s(s(0)) - s(s(0))] \oplus [s(s(0))]$
$\rightarrow s(s(0)) = 0 + 0 + s(s(0))$
$\rightarrow s(s(0)) = s(s(0))$
$\rightarrow ss(0) = ss(0)$