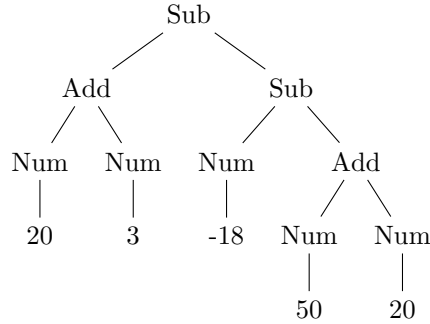# Evaluación semanal 3

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Ejercicio 1

$(-\ (+\ 20\ 3)(-\ -18\ (+\ 50\ 20)))$

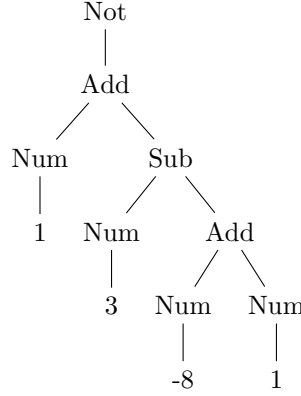1. **Sintaxix abstracta**

2. **Semántica natural**

$$\cfrac{\cfrac{N(20) \Rightarrow N(20) \qquad N(3) \Rightarrow N(3)}{Add(N(20),\ N(3)) \Rightarrow N(23)} \qquad \cfrac{N(-18) \Rightarrow N(-18) \qquad \cfrac{N(50) \Rightarrow N(50) \qquad N(20) \Rightarrow N(20)}{Add(N(50),\ N(20)) \Rightarrow N(70)}}{Sub(N\ (-18),\ Add(N(50),\ N(20)) \Rightarrow N(70))}}{Sub(Add(N(20),\ N(3)),\ Sub(N(-18),\ Add(N(50),\ N(20)))) \Rightarrow N(111)}$$

3. **Semántica estructural**

$Sub(Add(Num(20), Num(3)), Sub(Num(-18), Add(Num(50), Num(20))))$
$\rightarrow Sub(Num(23), Sub(Num(-18), Add(Num(50), Num(20))))$
$\rightarrow Sub(Num(23), Sub(Num(-18), Num(70)))$
$\rightarrow Sub(Num(23), Num(-88))$
$\rightarrow Num(111)$

$(not(+\ \ 1(-\ \ 3(+\ \ -8\ \ 1))))$

1. **Sintaxix abstracta**

```
                    Not
                     |
                    Add
                   /    \
               Num        Sub
                |        /    \
                1     Num      Add
                       |      /    \
                       3   Num      Num
                            |        |
                           -8        1
```
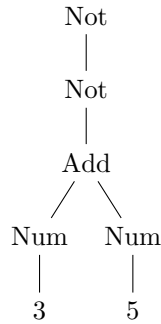
2. **Semántica natural**

$$
\cfrac{
  Num(1) \Rightarrow Num(1) \quad
  \cfrac{
    Num(3) \Rightarrow Num(3) \quad
    \cfrac{
      \cfrac{Num(-8) \Rightarrow Num(-8) \quad Num(1) \Rightarrow Num(1)}{Add(Num(-8), Num(1)) \Rightarrow Num(-7)}
    }{Sub(Num(3), Add(Num(-8), Num(1))) \Rightarrow Num(10)}
  }{Add(Num(1), Sub(Num(3), Add(Num(-8), Num(1)))) \Rightarrow Num(11)}
}{Not(Add(Num(1), Sub(Num(3), Add(Num(-8), Num(1))))) \Rightarrow Boolean(false)}
$$

3. **Semántica estructural**

$Not(Add(Num(1), Sub(Num(3), Add(Num(-8), Num(1)))))$
$\rightarrow Not(Add(Num(1), Sub(Num(3)Num(-7))))$
$\rightarrow Not(Add((Num(1), Num(10))))$
$\rightarrow Not(11)$
$\rightarrow Boolean(false)$

$(not(not(+\ \ 3\ \ 5)))$

1. **Sintaxix abstracta**

```
            Not
             |
            Not
             |
            Add
           /    \
       Num        Num
        |          |
        3          5
```

2. **Semántica natural**

$$
\cfrac{
  \cfrac{
    \cfrac{Num(3) \Rightarrow Num(3) \quad Num(5) \Rightarrow Num(5)}{Add(Num(3), Num(5)) \Rightarrow Num(8)}
  }{Not(Add(Num(3), Num(5))) \Rightarrow Boolean(false)}
}{Not(Not(Add(Num(3), Num(5)))) \Rightarrow Boolean(true)}
$$

3. **Semántica estructural**

$Not(Not(Add(Num(3), Num(5))))$
$\rightarrow Not(Not(Num(8)))$
$\rightarrow Not(Boolean(false))$
$\rightarrow Boolean(true)$

Ejercicio 2

Gramática libre de contexto modificada

```
<S>  ::=  <E>
<E>  ::=  <Int> | <Bool> | <Float>
          | (+ <E> <E>) | (- <E> <E>)
          | (* <E> <E>) | (/ <E> <E>)
          | (Not <E>) | (add1 <E>) | (sub1 <E>)
          | (sqrt <E>)
<Int>  ::=  <N> | -<M>
<Bool>  ::=  #t | #f
<Float>  ::=  <Int>.<N>
<D>  ::=  1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9
<N>  ::=  0 | <D>{<N>}
<M>  ::=  <D>{<N>}
```

Reglas de sintaxis abstracta

Números

$$\frac{n \in \mathbb{R}}{\text{Num}(n) \text{ ASA}}$$

Multiplicación

$$\frac{i \text{ ASA} \qquad d \text{ ASA}}{Mult(i,d) \text{ ASA}}$$

División

$$\frac{i \text{ ASA} \qquad d \text{ ASA}}{Div(i,d) \text{ ASA}}$$

Sumar uno

$$\frac{i \text{ ASA}}{Add1(i) \text{ ASA}}$$

Restar uno

$$\frac{i \text{ ASA}}{Sub1(i) \text{ ASA}}$$

Raíz cuadrada

$$\frac{i \text{ ASA}}{Sqrt(i) \text{ ASA}}$$

Reglas de semántica natural y estructural

Natural

Multiplicación

$$\frac{\text{i} \Rightarrow \text{Num}(n_1) \qquad \text{d} \Rightarrow \text{Num}(n_2)}{\text{Mult(i,d)} \Rightarrow \text{Num}(n_1 * n_2)}$$

División

$$\frac{\text{i} \Rightarrow \text{Num}(n_1) \qquad \text{d} \Rightarrow \text{Num}(0)}{\text{Div(i,d)} \Rightarrow \text{'error: División entre cero'}}$$

$$\frac{\text{i} \Rightarrow \text{Num}(n_1) \qquad \text{d} \Rightarrow \text{Num}(n_2)}{\text{Div(i,d)} \Rightarrow \text{Num}(n_1/n_2)}$$

Sumar uno

$$\frac{\text{i} \Rightarrow \text{Num}(n_1)}{\text{Add1(i)} \Rightarrow \text{Num}(n_1 + 1)}$$

Restar uno

$$\frac{\text{i} \Rightarrow \text{Num}(n_1)}{\text{Sub1(i,d)} \Rightarrow \text{Num}(n_1 - 1)}$$

Raíz Cuadrada

$$\frac{\text{i} \Rightarrow \text{Num}(n) \qquad n \in \mathbb{R}^-}{\text{Sqrt(i)} \Rightarrow \text{'error: Raíz negativa'}}$$

$$\frac{\text{i} \Rightarrow \text{Num}(n_1)}{\text{Sqrt(i)} \Rightarrow \text{Num}(\sqrt{n_1})}$$

Estructural

Multiplicación

- Caso 1

$$\frac{i \to i'}{Mult(i,d) \to Mult(i',d)}$$

- Caso 2

$$\frac{d \to d'}{Mult(Num(n),d) \to Mult(Num(n),d')}$$

- Caso 3

$$\frac{}{Mult(Num(n_1),Num(n_2)) \to Num(n_1 * n_2)}$$

División

- Caso 1

$$\frac{\text{i} \to \text{i'}}{\text{Div(i,d)} \to \text{Div(i',d)}}$$

- Caso 2

$$\frac{\text{d} \rightarrow \text{d'}}{\text{Div(Num}(n_1)\text{,d)} \rightarrow \text{Div(Num}(n_1)\text{,d')}}$$

- Caso 3

$$\frac{}{\text{Div(Num(n), Num(0))} \Rightarrow \text{'error: División entre cero'}}$$

- Caso 4

$$\frac{n_2 \in \mathbb{R} - \{0\}}{\text{Div(Num}(n_1)\text{), Num}(n_2)) \rightarrow \text{Num}(n_1/n_2)}$$

Sumar uno

- Caso 1

$$\frac{i \rightarrow i'}{Add1(i) \rightarrow Add1(i')}$$

- Caso 2

$$\frac{}{Add1(Num(n_1)) \rightarrow Num(n_1 + 1)}$$

Restar uno

- Caso 1

$$\frac{i \rightarrow i'}{Sub1(i) \rightarrow Sub1(i')}$$

- Caso 2

$$\frac{}{Sub1(Num(n_1)) \rightarrow Num(n_1 - 1)}$$

Raíz cuadrada

- Caso 1

$$\frac{i \rightarrow i'}{Sqrt(i) \rightarrow Sqrt(i')}$$

- caso 2

$$\frac{n_1 \in \mathbb{R}^-}{Sqrt(Num(n_1)) \rightarrow \text{'error: Raíz negativa'}}$$

- Caso 3

$$\frac{n_1 \in \mathbb{R}^+ \cup \{0\}}{Sqrt(Num(n_1)) \rightarrow Num(\sqrt{n_1})}$$