CSC 301 Assignment 13
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1.)

<exp>* ::= <exp> + <mulexp> | <exp> - <mulexp> | <mulexp>
<mulexp> ::= <mulexp> * <rootexp> | <rootexp>
<rootexp> ::= (<exp>) | <constant>
<constant> ::= all valid integer constants

2.)

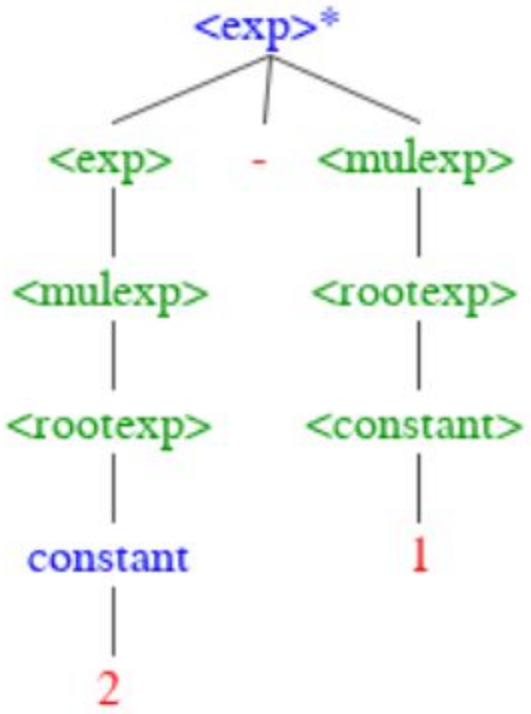
```
val1(plus(X,Y),Value) :-
   val1(X, XValue),
   val1(Y, YValue),
   Value is XValue + YValue.

val1(minus(X,Y),Value) :-
   val1(X, XValue),
   val1(Y, YValue),
   Value is XValue - YValue.

val1(times(X,Y),Value) :-
   val1(X,XValue),
   val1(Y,YValue),
   Value is XValue * YValue.

val1(const(X),Value) :- Value is X.
```

3.)

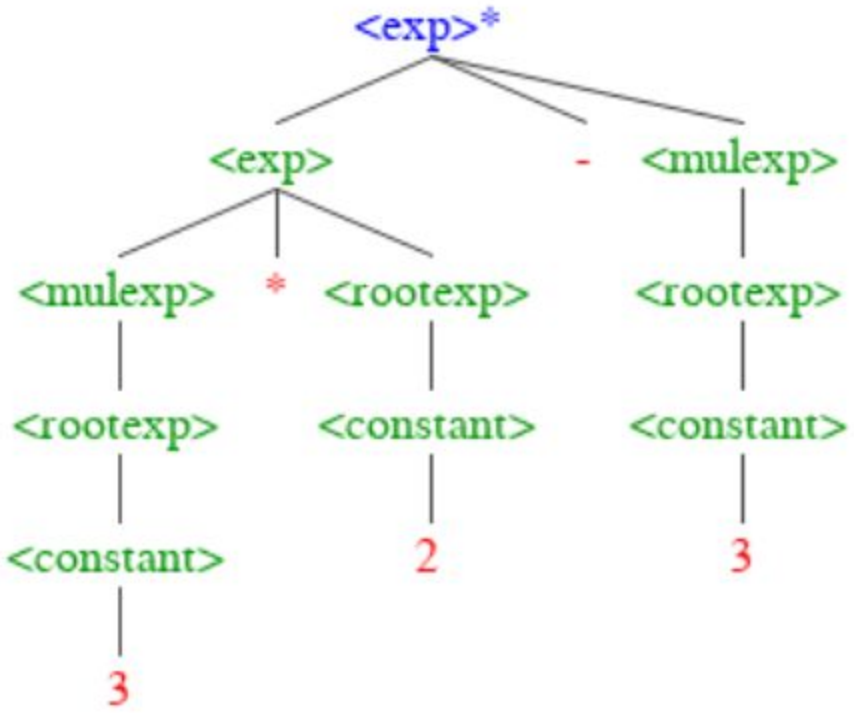
$$\frac{E_1 \rightarrow v_1 \quad E_2 \rightarrow v_2}{\text{minus}(E_1,E_2) \rightarrow v_1 - v_2}$$

4.)

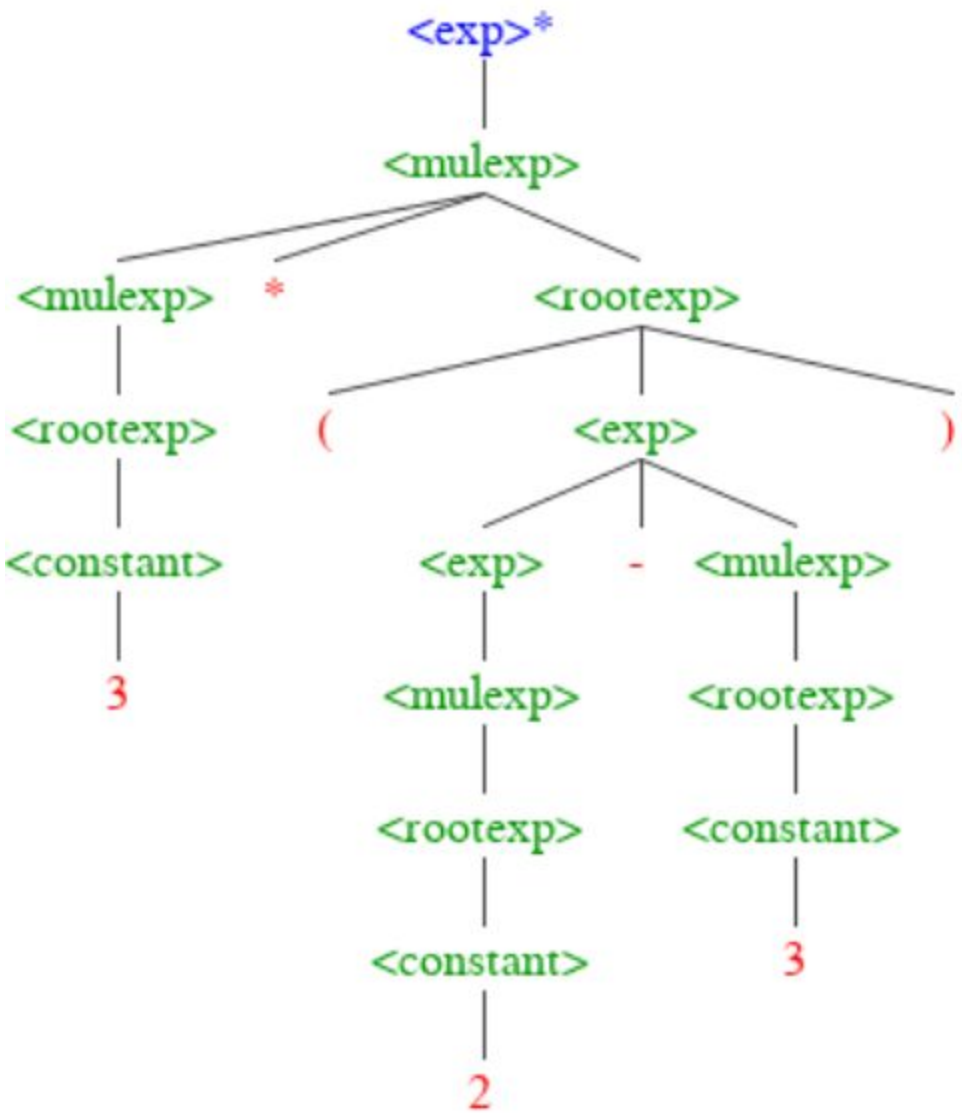
Parse tree for “2-1”



Parse tree for “3*2-3”



Parse tree for “3*(2-3)”



5.)

```
?- consult('reverse_list.pl').
true.

?- myflip([a,b,c,d,e,f],X).
X = [f, e, d, c, b, a].

?- myflip([a1,a2,a3,a4],X).
X = [a4, a3, a2, a1].
```

6.)

Natural semantic proof for “2-1”

$$\frac{\text{const}(2)\rightarrow 2 \quad \text{const}(1)\rightarrow 1}{\text{minus}(\text{const}(2),\text{const}(1)) \rightarrow 2 - 1 = 1}$$

Natural semantic proof for “3*2-3”

$$\frac{\dfrac{\text{const}(3)\rightarrow 3 \quad \text{const}(2)\rightarrow 2}{\text{times}(\text{const}(3),\text{const}(2)) \rightarrow 3 \times 2 = 6} \quad \text{const}(3)\rightarrow 3}{\text{minus}(\text{times}(\text{const}(3),\text{const}(2)),\text{const}(3)) \rightarrow 6 - 3 = 3}$$

Natural semantic proof for “3*(2-3)”

$$\frac{\text{const}(3)\rightarrow 3 \quad \dfrac{\text{const}(2)\rightarrow 2 \quad \text{const}(3)\rightarrow 3}{\text{minus}(\text{const}(2),\text{const}(3)) \rightarrow 2 - 3 = -1}}{\text{times}(\text{const}(3),\text{minus}(\text{const}(2),\text{const}(3))) \rightarrow 3 \times (-1) = -3}$$