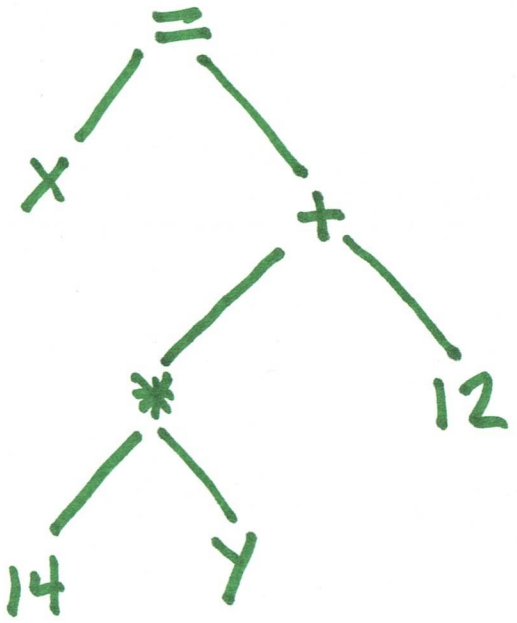
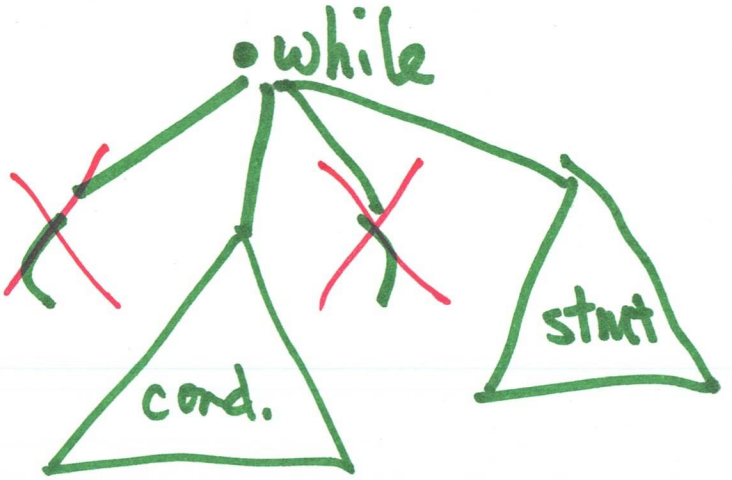
x = 14*y+12



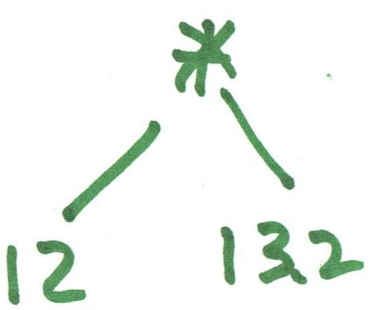
while (cond) stmt

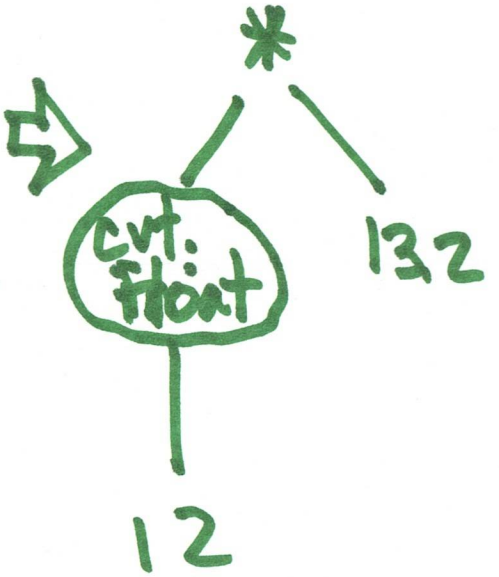


parse tree

AST

12 * 13.2






```
LOADI   12, r1
CVTF    r1
LOADI   13.2, r2
~~ADD~~   r1, r2, r3
MUL
```

x = true + 31.2

bool float

y = true

z = 31.2

x = y + z

```
switch(c) {
  case 'a':
  case 'b':
  case 'a': x
}
```

regular expressions

alphabet Σ = set.

elements of an alphabet are **characters** or **symbols** or **letters**

$\Sigma = \{0,1\}$ $\Sigma' = \{1\}$

string sequence of symbols (with possible repeats) from an alphabet

010010 string on $\Sigma = \{0,1\}$

11111 string on $\Sigma = \{1\}$ or $\Sigma = \{0,1\}$

Σ^* = set of all strings on Σ

ε (epsilon) = string of 0 characters

$\varepsilon \in \Sigma^*$ for any Σ

language is a set of strings on Σ. $L \subseteq \Sigma^*$

$L = \{01, 001, 0001, \ldots\}$ on $\Sigma = \{0, 1\}$

$L = \{a, b, ab\}$ on $\Sigma = \{a, b, c\}$

$L_a = \{a\}$ for any $a \in \Sigma$

$L_0 = \{0\}$ $L_1 = \{1\}$

$L_\varepsilon = \{\varepsilon\}$

$L_a \overset{L \cup M}{\cup} L_b = \{a, b\} = \{a\} \cup \{b\}$

$L_a L_b = \{\alpha\beta \mid \alpha \in L_a, b \in L_b\}$ concatenation

$L \quad M$

$L \cdot M$

$L = \{a, ab\}$

$M = \{c, cd\}$

$LM = \{ac, acd, abc, abcd\}$

$L^k = \underbrace{LLL\ldots L}_{k \text{ times}}$

$L^1 = L_1 = L$

$L^0 = L_0 = \{\varepsilon\}$

$L^2 = L_2 = LL$

$L^3 = L_3 = LLL$

$L_k = LL_{k-1}$

$L^* = L_0 \cup L_1 \cup L_2 \cup L_3 \cup \ldots\ldots$

$\Sigma = \{0, 1\}$

$L_{\{0,1\}} = \{0, 1\}$

$L^*_{\{0,1\}} = \{\varepsilon, 0, 1, 00, 01, 10, 11, 000, 001, 010, \ldots\}$

any string of 1's and zeroes.

regular expression

ε		L_ε
a		L_a $\quad \forall a \in \Sigma$
$\alpha \mid \beta$	$\alpha + \beta$	$L_\alpha \cup L_\beta$
$\alpha\beta$		$L_\alpha L_\beta$
α^k		L_α^k
α^*		L_α^*

() for grouping.

reg. exp. — languages.

$a(b|c)d^* = L = \{ab, ac, abd, acd, abdd, acdd, \ldots\}$

while(tom)

to^*m $\quad \{tm, tom, toom, tooom, \ldots\}$

expressivity extensions

$\alpha?$ or $\alpha?$ $\quad (\alpha|\varepsilon)$

$\alpha^+ \quad (\alpha\alpha^*)$

$\alpha^k \quad L_\alpha^k$

→ cannot use k twice as variable

$\alpha \bowtie \beta \quad (\varepsilon + \alpha(\beta\alpha)^*)$

β-separated list of α's.

L^*L^k order of precedence

LM

$L|M$

$(L|M)^*$ $\quad \{lml, l, m, \ldots\}$

$\{l\}\ \{m\}$ any string of l's & m's.

$\alpha^k\beta^k$

$\alpha^2\beta^2$

$X \bowtie 2$

$\varepsilon \; X \; X,X \; X,X,X$

X,X,X,X