

Homework Assignment #1

Note

This assignment is due 2:10PM Wednesday, September 26, 2012. Please write or type your answers on A4 (or similar size) paper. Drop your homework by the due time in Yih-Kuen Tsay's mail box on the first floor of Management College Building 2. Late submission will be penalized by 20% for each working day overdue. You may discuss the problems with others, but copying answers is strictly forbidden.

Problems

There are five problems in this assignment, each accounting for 20 points.

1. Consider the following RAM (Random-Access Machine) program:

```
1: read(M[1])
2: read(M[2])
3: M[1] := M[1] - M[2]
4: if M[1] ≥ 0 then goto 3
5: M[1] := M[1] + M[2]
6: write(M[1])
7: halt
```

- (a) Under what condition will the program terminate?
- (b) For the cases where the program terminate, what does it compute?

2. Consider the following RAM program segment:

```
l - 1: ...
l: if M[1] = M[2] then goto m
l + 1: ...
...
m: ...
```

Suppose now the only conditional allowed is of the form “if $M[j] \geq 0$ then goto i ”.

- (a) How will you translate the program segment into one complying with the restriction?
 - (b) What assumptions do you need to make about the other parts of the program?
3. Consider the expression $(-b + \text{sqrt}(b*b - 4*a*c))/(2*a)$, where `sqrt` is a function taking the square root of its argument.
 - (a) Rewrite the expression in prefix notation.
 - (b) Rewrite the expression in postfix notation.
 - (c) Draw an abstract syntax tree for the expression.

4. Consider the following grammar (that has been discussed in class) for real numbers:

$$\begin{aligned}\langle \text{real-number} \rangle &::= \langle \text{integer-part} \rangle . \langle \text{fraction} \rangle \\ \langle \text{integer-part} \rangle &::= \langle \text{digit} \rangle \mid \langle \text{integer-part} \rangle \langle \text{digit} \rangle \\ \langle \text{fraction} \rangle &::= \langle \text{digit} \rangle \mid \langle \text{digit} \rangle \langle \text{fraction} \rangle \\ \langle \text{digit} \rangle &::= 0 \mid 1 \mid 2 \mid 3 \mid 4 \mid 5 \mid 6 \mid 7 \mid 8 \mid 9\end{aligned}$$

- (a) Give a left-most derivation of the string “31.4”.
- (b) Draw tree snapshots corresponding to the derivation in Problem 4a.
5. Consider the following grammar (that has been discussed in class) for arithmetic expressions:

$$\begin{aligned}E &::= E + T \mid E - T \mid T \\ T &::= T * F \mid T / F \mid F \\ F &::= \mathbf{number} \mid \mathbf{name} \mid (E)\end{aligned}$$

For each of the following strings, draw a parse tree with respect to the grammar.

- (a) $2 + 3 * 4$.
- (b) $(2 + 3) * 4$.