

Homework 8

1. Please read the following two pieces carefully to learn more about the notion of interpreters and virtual machines.

- (a) *The Lean, Mean, Java Virtual Machine*, by Bill Venners, Artima Software. This is a somewhat long article (1500 words), but is nicely written and includes an illustrative applet.

<http://www.artima.com/underthehood/leanmean.html>

Bring a (typed) report on your reading to the next class, Tuesday, November 19. Reports must be very brief, with one sentence on each of the following items:

1. A brief description of the article.
2. Something in the reading that you found interesting; e.g., a fact or an opinion that the author expressed.
3. A response to the reading: a comment or question about the article or your opinion on the subject.

- (b) The second piece is from Chapter 4 of the textbook *Structure and Interpretation of Computer Programs*, by Abelson, Sussman, and Sussman, MIT Press/McGraw Hill. This piece reinforces the notion of interpreters as discussed in the article handed out in the previous class. Please read the first five paragraphs of the chapter. (The fifth paragraph ends with “appropriate descriptive languages.”.)

http://mitpress.mit.edu/sicp/full-text/book/book-Z-H-25.html#%_chap_4

2. (Due November 26) Consider the language for arithmetic expressions that we discussed in class. The production rules for valid statements in the language are:

$$\begin{aligned} R0 : \langle e \rangle &\rightarrow \text{num} & V(\langle e \rangle) &= \text{num} \\ R1 : \langle e \rangle &\rightarrow \text{op } \langle e \rangle_1 \langle e \rangle_2 & V(\langle e \rangle) &= \text{op}(V(\langle e \rangle_1), V(\langle e \rangle_2)), \end{aligned}$$

where num represents a number, op represents an arithmetic binary operation and $V()$ represents the value function.

- (a) Determine, for each of the expressions below, whether it is a valid expression. In each case, either show the parse tree or explain why the expression is not valid.

(i) * * * / 7 9 - 9 8 11 + 7 - + 5 6 17

(ii) - + 53.1 6 - + 15 19.6 -5 * - 7 8 9

- (b) Write an interpreter, in any programming language, for the language. Your interpreter must accept an input statement (on a single line) and then do one of the following: (i) if the statement is not valid within the language, return “NOT A VALID EXPRESSION”; (ii) if the statement is valid, then evaluate the expression and return the value.

For extra credit, your program may check for errors such as divide-by-zero and number overflow, and introduce other features.

Please email your source code, with documentation and instructions for compiling, to me (rraj@ccs.neu.edu). Also, turn in a hard-copy of the source code in class.