



EASTERN MEDITERRANEAN UNIVERSITY

Department of Computer Engineering

CMPE410 Principles of Programming Languages

Problem Set for Chapters 1-4

1. What programming language has dominated scientific computing over the past 50 years?
2. What is the disadvantage of having too many features in a language?
3. How can user-defined operator overloading harm the readability of a program?
4. What is one example of a lack of orthogonality in the design of C?
5. What does it mean for a program to be reliable?
6. Why is readability important to writability?
7. How is the cost of compilers for a given language related to the design of that language?
8. What role does the symbol table play in a compiler?
9. In what year was the Fortran design project begun?
10. What missing language element of ALGOL 60 damaged its chances for widespread use?
11. What is a nonprocedural language?
12. What three concepts are the basis for object-oriented programming?
13. What language was designed to describe the syntax of ALGOL 60?
14. Compute the weakest precondition for the following assignment statements and postconditions:
$$a = 2 * (b - 1) - 1 \{a > 0\}$$
15. Modify the grammar below to add a unary minus operator that has higher precedence than either + or *.

$$\begin{aligned} \langle \text{assign} \rangle &\rightarrow \langle \text{id} \rangle = \langle \text{expr} \rangle \\ \langle \text{id} \rangle &\rightarrow A \mid B \mid C \\ \langle \text{expr} \rangle &\rightarrow \langle \text{expr} \rangle + \langle \text{term} \rangle \\ &\quad \mid \langle \text{term} \rangle \\ \langle \text{term} \rangle &\rightarrow \langle \text{term} \rangle * \langle \text{factor} \rangle \\ &\quad \mid \langle \text{factor} \rangle \\ \langle \text{factor} \rangle &\rightarrow (\langle \text{expr} \rangle) \\ &\quad \mid \langle \text{id} \rangle \end{aligned}$$

16. Convert the BNF below to EBNF

$$\begin{aligned} \langle \text{assign} \rangle &\rightarrow \langle \text{id} \rangle = \langle \text{expr} \rangle \\ \langle \text{id} \rangle &\rightarrow A \mid B \mid C \\ \langle \text{expr} \rangle &\rightarrow \langle \text{expr} \rangle + \langle \text{expr} \rangle \\ &\quad \mid \langle \text{expr} \rangle * \langle \text{expr} \rangle \\ &\quad \mid (\langle \text{expr} \rangle) \\ &\quad \mid \langle \text{id} \rangle \end{aligned}$$

17. Perform the pairwise disjointness test for the following grammar rule;

$$A \rightarrow aB \mid b \mid cBB$$

18. Using the LL parsing approach and the rules below, parse the following input string (efghi) and announce a syntax error if it occurs. Show intermediate stack changes and the resulting parse tree.

$$\begin{aligned} S &\rightarrow T Y \\ T &\rightarrow A B \mid e S \\ Y &\rightarrow C D \mid j T \\ A &\rightarrow f \mid k A \\ B &\rightarrow g \mid h \\ C &\rightarrow c \mid i \\ D &\rightarrow d \end{aligned}$$