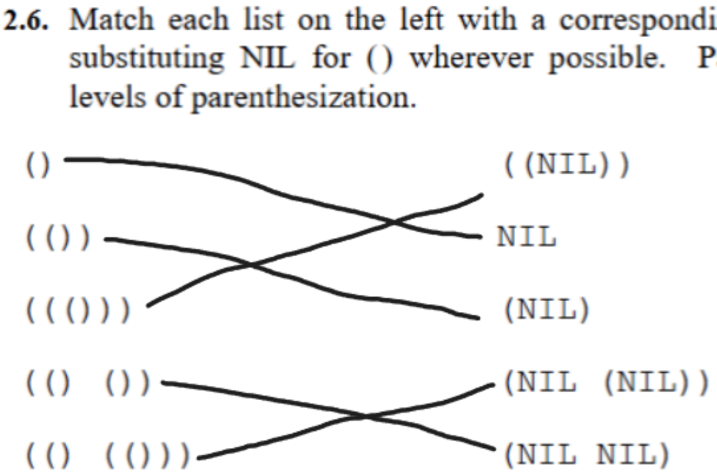
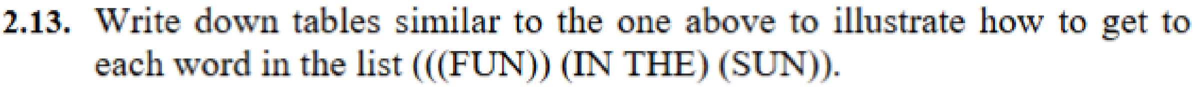
1. Which of these are well-formed lists? That is, which ones have properly balanced parentheses?
    a. ((A)(B))
    b. (A(B(C)))
    c. (((A)(B))(C))
2. What is the parenthesis notation for this cons cell structure?
    a. ((BOWS (ARROWS (NIL))) ((FLOWERS (CHOCOLATES (NIL))) (NIL)))



2.6. Match each list on the left with a corresponding list on the right by substituting NIL for () wherever possible. Pay careful attention to levels of parenthesization.

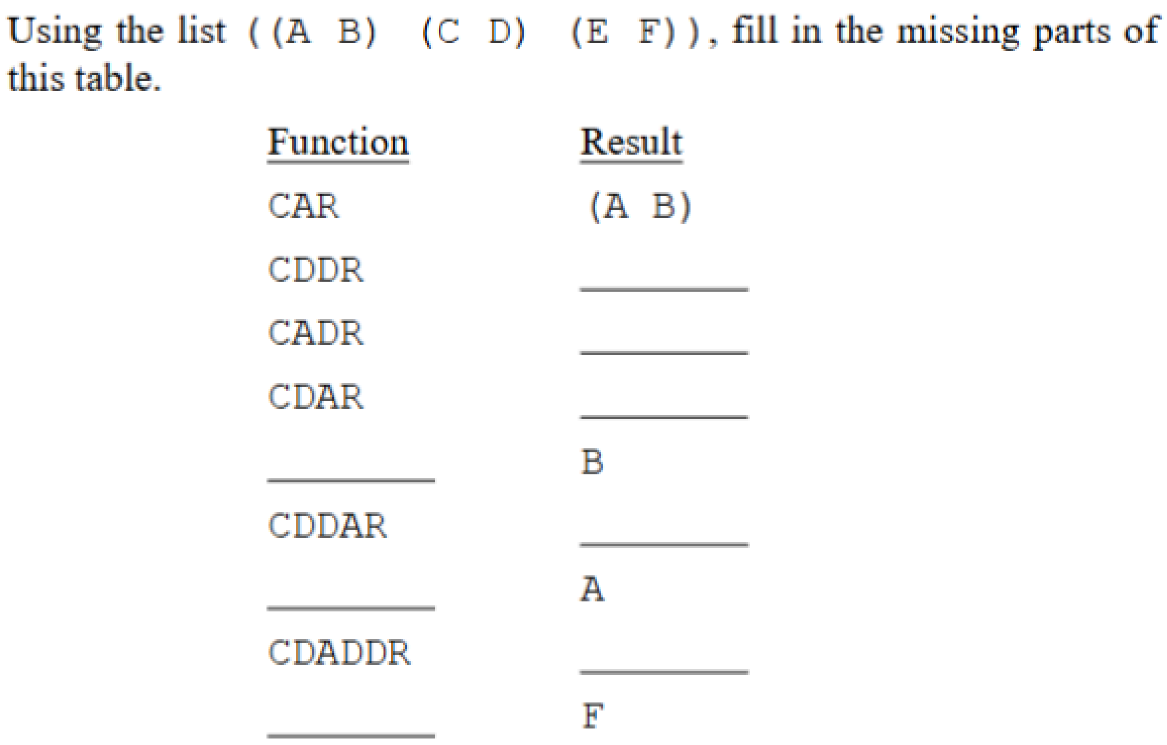
```
()                 ((NIL))
(())               NIL
((()))             (NIL)
(() ())            (NIL (NIL))
(() (()))          (NIL NIL)
```

3.



2.13. Write down tables similar to the one above to illustrate how to get to each word in the list (((FUN)) (IN THE) (SUN)).

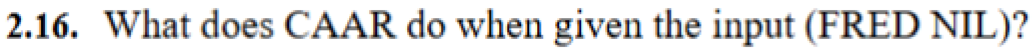
4.
    a. FUN: (car (car (car '(((FUN)) (IN THE) (SUN)))))
    b. IN: (car (car (cdr '(((FUN)) (IN THE) (SUN)))))
    c. THE: (car (cdr (car (cdr '(((FUN)) (IN THE) (SUN))))))
    d. SUN: (car (car (cdr (cdr '(((FUN)) (IN THE) (SUN))))))



Using the list ((A B) (C D) (E F)), fill in the missing parts of this table.

Function	Result
CAR	(A B)
CDDR	________
CADR	________
CDAR	________
________	B
CDDAR	________
________	A
CDADDR	________
________	F

5.
   a.



2.16. What does CAAR do when given the input (FRED NIL)?

6.
   a. caar applied to (FRED NIL) will cause an error because FRED is a symbol, and car expects a list as its argument.
7. In what language is most of UNIX written?
   a. C
8. What is the disadvantage of having too many features in a language?
   a. Complexity, Readability, maintainability, learning curve, and compatibility
9. How can user-defined operator overloading harm the readability of a program?
   a. User-defined operator overloading can harm program readability by making operators behave in unexpected or non-intuitive ways, requiring readers to understand custom implementations to interpret the code correctly.
10. What is one example of a lack of orthogonality in the design of C?
   a. An example of a lack of orthogonality in C is that arrays cannot be returned from functions, while structures can, even though both are structured data types.
11. What language used orthogonality as a primary design criterion?
   a. ALGOL 68
12. What primitive control statement is used to build more complicated control statements in languages that lack them?
   a. The selection statement plus GOTO is the primitive control statement used to build more complicated control statements in languages that lack them
13. what does it mean for a program to be reliable?

    a. For a program to be reliable, it must consistently perform its intended functions without failure under specified conditions and for a specified period of time.

14. why is type checking the parameters of a subprogram important?
    a. Type checking the parameters of a subprogram is important because it ensures that the actual parameters match the expected types of the formal parameters, preventing runtime errors and improving program reliability and correctness
15. What is aliasing?
    a. a situation where a single memory location can be accessed through multiple symbolic names, meaning changes made through one name affect all others, which can lead to unexpected behavior
16. What is exception handling?
    a. Exception handling is the process of responding to anomalous or exceptional conditions (called exceptions) that occur during program execution, allowing the program to manage errors gracefully and maintain its normal flow using mechanisms like try-catch blocks
17. why is readability important to writability
    a. Readability is important to writability because code that is easy to read and understand allows developers to write, modify, and debug programs more efficiently, reducing errors and improving productivity.
18. What two programming language deficiencies were discovered as a result of the research in software development in the 1970s?
    a. Two programming language deficiencies discovered as a result of research in software development in the 1970s were inadequate support for data abstraction and insufficient control over program structure, which led to the development of structured programming and modular design principles.

19. What are the three fundamental features of an object-oriented programming language?
    a. The three fundamental features of an object-oriented programming language are encapsulation, inheritance, and polymorphism, which distinguish OOP from non-OOP languages by enabling modularity, code reuse, and dynamic behavior.
20. What language was the first to support the three fundamental features of object-oriented programming?
    a. The first programming language to support the three fundamental features of object-oriented programming was Simula
21. What is an example of two language design criteria that are in direct conflict with each other?
    a. An example of two language design criteria that are in direct conflict with each other is execution efficiency and reliability.
22. What are the three general methods of implementing a programming language?
    a. The three general methods of implementing a programming language are compilation, where the source code is translated into machine code for direct execution; pure interpretation, where the source code is executed line by line by an interpreter; and hybrid implementation, which combines both approaches by

translating the source code into an intermediate form (e.g., bytecode) that is then interpreted.

23. Which produces faster program execution, a compiler or a pure interpreter?
    a. A compiler produces faster program execution than a pure interpreter because it translates the entire program into machine code once, while an interpreter processes and executes the code line by line during runtime, making it significantly slower
24. What are the advantages in implementing a language with a pure interpreter?
    a. The advantages of implementing a language with a pure interpreter include easier debugging and error detection, as the program is executed line by line, allowing errors to be identified and corrected immediately during runtime Additionally, pure interpreters provide flexibility by enabling dynamic code execution and modification, making them ideal for scripting and interactive environments.
25. Find the sequence of CARs and CDRs that return x when applied to the following expressions:
    a. (a b x d)
        i. (car (cdr (cdr '(a b x d))))
    b. (a (b (x d)))
        i. (car (car (cdr (car (cdr '(a (b (x d))))))))
    c. (((a (b (x) d))))
        i. (car (car (cdr (car (cdr (car (car '(((a (b (x) d)))))))))))
26. Construct the lists in Q 3, using only symbols and calls to cons.
    a. (cons 'a (cons 'b (cons 'x (cons 'd '()))))
    b. (cons 'a (cons (cons 'b (cons (cons 'x (cons 'd '())) '())) '()))
    c. (cons (cons (cons 'a (cons (cons 'b (cons (cons 'x '()) (cons 'd '()))) '())) '()) '())