CS 330

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HW 1

Questions 1 and 2

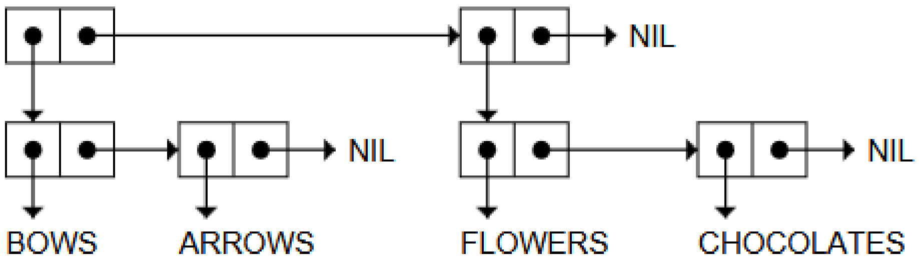
Q1) From Lisp text: Questions 2.2, 2.4 (page 34), 2.6 (page 38), 2.13. 2.15, 2.16 (Page 49)

2.2: Which of these are well-formed lists? That is, which one's have properly balanced parentheses?

(A B (C)	**NOT BALANCED**
((A) (B))	**BALANCED**
A B)(C D)	**NOT BALANCED**
(A (B (C))	**NOT BALANCED**
(A (B (C)))	**BALANCED**
(((A) (B)) (C))	**BALANCED**

Answers are next to the examples

2.4. What is the parenthesis notation for this cons cell structure?



ANSWER: ((BOWS ARROWS) (FLOWERS CHOCOLATES))

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)

ANSWER:

() = NIL

(()) = (NIL)
((())) = ((NIL))

(() ()) = (NIL NIL)

(() (())) = (NIL (NIL))

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)).

ANSWER:

1) Getting to word: FUN

<u>STEP</u>	<u>RESULT</u>
start	(((FUN)) (IN THE) (SUN))
C..AR	((FUN))
C.AAR	(FUN)
CAAAR	FUN

2) Getting to word: IN

<u>STEP</u>	<u>RESULT</u>

start	(((FUN)) (IN THE) (SUN))
C..DR	((IN THE) (SUN))
C.ADR	(IN THE)
CAADR	IN

3) Getting to word: THE

STEP	RESULT
start	(((FUN)) (IN THE) (SUN))
C...DR	((IN THE) (SUN))
C..ADR	(IN THE)
C.AADR	(THE)
CAADR	THE

4) Getting to word: SUN

STEP	RESULT
start	(((FUN)) (IN THE) (SUN))
C...DR	((IN THE) (SUN))
C..DDR	((SUN))
C.ADDR	(SUN)
CAADDR	SUN

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

Answers are in bold.

Function Result	
CAR	(A B)

CDDR	**((E F))**
CADR	**(C D)**
CDAR	**(B)**
CADAR	B
CDDAR	**NIL**
CAAR	A
CDADDR	**(F)**
CADADDR	F

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

ANSWER:

It causes an error; the first car returns a pointer to the symbol FRED. The second car causes an error as FRED is a symbol and not a con cell. Here is the debugger output:

```
debugger invoked on a TYPE-ERROR in thread

#<THREAD "main thread" RUNNING {9461061}>:

 The value

   FRED

 is not of type

   LIST

 when binding LIST
```

Q2) From Sebesta Chapter 1 review questions: Questions 6 through 16, 20 through 25, and 29.

6. In what language is most of UNIX written?

Most of UNIX is written in the C programming language.

7. What is the disadvantage of having too many features in a language.

Having too many features in a language can harm readability and simplicity. Having too many features can make a language harder to read as a person may not know all the features. More features also make the language more complex, which could increase the cost it takes to train programmers in that language.

The more features a language has leads to it being more complex, increasing the cost it takes to write and maintain code in that language.

8. How can user-defined operator overloading harm the readability of a program?

User-defined operator overloading can result in a user changing the behavior of an operator. For example, if a user overloaded the '+' symbol to do division. The different behavior from the expected standard behavior can cause confusion. Overloading operators can cause operators to do unexpected behavior, make a program more complex, and make a program harder to maintain since the programmer must keep track of what each operator does.

9. What is one example of lack of orthogonality in the design of C?

An example of a lack of orthogonality in the design of C is the implementation of arrays and records. records or structs can be returned by functions, while arrays cannot. Arrays can have any data type except void and functions, while structures can have any data type besides void and a struct of the same type.

These differences show how not all features of the C language follow the same rules.

10. What language uses orthogonality as a primary design criterion?

ALGOL 68 used orthogonality as a primary design criterion. There is a language construct for every type in ALGOL 68, and there are no restrictions on those types.

11. What primitive control statement is used to build more complicated control statements in languages that lack then?

The primitive control statement GOTO can help build more complicated control statements like loops.

12. What does it mean for a program to be reliable?

A program is reliable if it performs its specifications under all conditions. Some aspects of a reliable program are correctness in logic, ability to handle unexpected inputs, and that the program can be easily tested.

13. Why is type checking the parameters of a subprogram important?

Type checking is important as the earlier errors are caught, the less expensive any corrections and repairs will be. Failure to type check can create bugs that are hard to diagnose. Type checking helps keep the program reliable, as the type checking prevents errors and makes the program easier to maintain.

14. What is aliasing?

Aliasing is where more than one name can access the same memory cell. For example, multiple pointers pointing to the same address in memory.

15. What is exception handling?

Exception handling is the program's ability to intercept run-time errors, take corrective measures, and then continue to run the program. For example, if a user Entered a string of letters when the program expected an integer, The program can intercept this error and properly deal with it without crashing.

16. Why is readability important to writability?

Programs that are more difficult to read will be harder to understand and maintain. A programmer may have to spend more time reading to understand the code of a program before they can make changes.

20. What two programming language deficiencies were discovered as a result of research in software development in the 1970s?

The two deficiencies are the incompleteness of type checking and the inadequacy of control statements.

21.What are the three fundamental features of an object-oriented programming language?

The three fundamental features of an object-oriented programming language are data abstraction, Inheritance, and Dynamic or run-time method binding.

22. What language was the first to support the three fundamental features of object-oriented programming?

The language to first support the three fundamental features of object-oriented programming is Smalltalk.

23. What is an example of two language design criteria that are in direct conflict with each other?

An example is the conflict between reliability and cost of execution. The more preprocessing a language has, for example doing type checking, increases the cost it takes to execute and compile the program. While doing less preprocessing makes the language cheaper to compile, it reduces reliability.

24. What are the three general methods of implementing a programming language?

The three methods are compilations, pure interpretation, and hybrid implementation systems.

25. Which produces faster program execution, a complier or a pure interpreter?

A compiler produces faster program execution.

29. What are the advantages in implementing a language with a pure interpreter?

Pure interpretation has the advantage of allowing the easy implementation of source-level units. So, if an error is found during run time, the line of code that caused the error can be identified easily.