

Examination 1

CSC315 Programming Language Concepts

09 October 2015

Contents

Chapter 1

Eric Andow

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Spencer Rudnick

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- (a) Ada is an example of a programming language that uses parentheses to enclose indices to reference elements of arrays.
 - (b) The designers of Ada chose to use parentheses for enclosing indices, in spite of the fact that it makes code more difficult to read, because both array references and function calls map to an address in memory. An understanding of how a program runs on the hardware of computer reveals that this seemingly strange choice actually makes a lot of sense.

2. What is the relationship between a lexeme and a token?
-

A token describes a category of lexemes. For example, all variable names, *i*, *index*, *currentNode*, etc., are *lexemes* within the token *Identifiers*. It has its own token, *equalsign*. And soon, all down the line of reserved words, characters, and user-defined variables.

3. (a) What kind of symbols are found at the internal nodes of a parse tree?
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- (a) Nonterminal symbols are found at the internal nodes of a parse tree. Nonterminals include *if()* statements and other function calls.
 - (b) Terminal symbols are found at the leaves of a parse tree. Terminals include lexemes and tokens, such as integer literals and variable names.
4. One of the most significant contributions from the developers of ALGOL 60 also limited the success of that language. What was that contribution?
-

ALGOL 60 was the first language to be defined using what is now known as Backus-Naur Form, or BNF for short. BNF was a very significant contribution to the field of computer science. However, it did not catch on very quickly at the time of ALGOL 60's release, so few people adopted the language.

5. What problem were the creators of Common LISP trying to solve?
-

The creators of Common LISP were trying to solve the problem of fragmentation in the LISP family, which made code portability very difficult. Common LISP combined elements of many other versions of LISP, creating a language which was portable, yet very complex.

6. What is an ambiguous context free grammar?
-

A grammar for which sentences can have more than one valid parse tree.

7. Contrast the complexity of algorithms that can parse strings that conform to the most general kinds of context free grammars and the complexity

of the algorithms that can parse strings that conform to the grammars of programming languages?

Algorithms which parse strings conforming to general kinds of context free grammars function on $O(n)$.

Algorithms which parse strings conforming to the grammars of a modern programming language usually function on the order of $O(n^3)$.

8. Java represents characters with Unicode. It is the first widely used programming language with this feature. What is the significance of this feature?
-

Unicode represents characters from almost every natural language and number system. This allows information encoded in Unicode to be read on almost any machine (especially those running Java).

9. How does the binary coded decimal type differ from the floating point type?
-

Decimals are precise definitions of a value, though they are usually only allowed to be in a range specified by the language and hardware. They contain a fixed decimal point with exact numbers defined on both sides.

Floating points are approximations of a value. They are not precise, but they are able to represent a vastly greater span of values. Floating points are made up of a sign bit, an exponent byte (or two), and between three and eight bytes defining a fraction.

10. Identify a user-defined ordinal type in the Java programming language.
-

integer is a user-defined ordinal type in Java.

11. Mathematicians and programmers might have different ideas about the precedence of Boolean operators. Explain.

In boolean algebra, the AND and OR operators have the same precedence. However, C-based languages assign a higher precedence to AND than OR, likely because of an erroneous associations between arithmetic multiplication with the AND function, and arithmetic addition with the OR function.

12. Programmers should use `===` rather than `==` to test the equality of the values of two expressions in JavaScript. Why?

In JavaScript, `=="` allows the operands to be coerced (one is converted into the same type as the other for easy comparison). `"7" == 7` would return true. `==="` prevents coercion by the interpreter, so `"7" === 7` would return false.

13. Describe a hazard of allowing short-circuited evaluation of expressions and side effects in expressions at the same time.

There is a possibility that the whole expression may not be parsed, and so the side effect which was intended to happen is skipped. This could result in small errors in which an integer which was supposed to be incremented is not! **gasp**

14. Briefly describe the three steps in the mark-sweep algorithm for garbage collection.

Step 1. All cells in the heap are marked as garbage.

Step 2. Each cell is checked to see if it is reachable. If it is, it is marked as still in use (not garbage).

Step 3. All cells still marked as garbage are destroyed (removed from the heap).

15. What led Yukihiro Matsumoto to create the Ruby programming language?

Yukihiro Matsumoto created Ruby out of dissatisfaction with Perl and Python, specifically that they were not pure object-oriented languages.

16. What did Microsoft aim to achieve with its development of the C# language?

The purpose of C# was to create a language which can combine components in any other language within the .NET framework (C#, Visual Basic, .Net, Managed C++, F#, and JScript .Net). Seems like they were trying to incorporate some of the Unix philosophy we learned about on the first day!

Chapter 13

Kat Sayrs

1. Most programming languages require the use of brackets to enclose the index in a reference to an element of an array.
 - (a) Identify a language that requires the use of parentheses to enclose the index in a reference to an element of an array.
 - (b) Why did the designers of the language choose parentheses rather than brackets?

-
- (a) Write your answer here.
 - (b) Write your answer here.

2. What is the relationship between a lexeme and a token?

Write your answer here.

3.
 - (a) What kind of symbols are found at the internal nodes of a parse tree?
 - (b) What kind of symbols are found at the leaves of a parse tree?

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- (a) Write your answer here.
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4. One of the most significant contributions from the developers of ALGOL 60 also limited the success of that language. What was that contribution?

Write your answer here.

5. What problem were the creators of Common LISP trying to solve?

Write your answer here.

6. What is an ambiguous context free grammar?

Write your answer here.

7. Contrast the complexity of algorithms that can parse strings that conform to the most general kinds of context free grammars and the complexity of the algorithms that can parse strings that conform to the grammars of programming languages?

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8. Java represents characters with Unicode. It is the first widely used programming language with this feature. What is the significance of this feature?

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9. How does the binary coded decimal type differ from the floating point type?

Write your answer here.

10. Identify a user-defined ordinal type in the Java programming language.

Write your answer here.

11. Mathematicians and programmers might have different ideas about the precedence of Boolean operators. Explain.

Write your answer here.

12. Programmers should use `===` rather than `==` to test the equality of the values of two expressions in JavaScript. Why?

Write your answer here.

13. Describe a hazard of allowing short-circuited evaluation of expressions and side effects in expressions at the same time.

Write your answer here.

14. Briefly describe the three steps in the mark-sweep algorithm for garbage collection.

Write your answer here.

15. What led Yukihiro Matsumoto to create the Ruby programming language?

Write your answer here.

16. What did Microsoft aim to achieve with its development of the C# language?

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Chapter 14

Cameron Seebach

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Joe Sterchele

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