Examination 1

CSC315 Programming Language Concepts

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Contents

Chapter 1

Eric Andow

1. 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 the 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) Ada is one example that uses parentheses to reference array elements.
   (b) In the case of Ada, the designers chose to use a uniform style for function calls and array references because, ultimately, both represent a mapping to a specific point in memory.

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

   A lexeme is an association that the compiler uses to understand your code. So, a number is understood as an integer literal and an equal sign is understood as an equivalence operator. The lexemes are then grouped into categories, called tokens. While a lexeme appears verbatim in your code, a token is a name that only the compiler uses, like 'equal_sign' or 'mult_op'.

3. 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?

(a) The internal nodes of a parse tree are non-terminal symbols, which branch out into other symbols.

(b) At the leaves of the tree lie terminal symbols, each of which represents an atom of the original code.

4. 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 heralded the first use of the BNF formalism. BNF stands for Backus-Naur form, one of the primary ways of describing the syntax of programming languages. Unfortunately, when it was introduced, BNF was seen as too complicated. The slow shift towards accepting BNF would come too late for ALGOL 60 to ever gain a foothold among users.

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

As the Reagan era commenced, Americans were facing tougher problems than they knew how to deal with. Namely, they had too many dialects of Lisp. Like having too many dialects of any language, this caused widespread strife and factionalism among those who were left with no way to communicate. To bring their colleagues back to the table of brotherhood, a few brave developers created Common Lisp, a language which included features of several popular Lisp dialects. In this way, the developers gave the many dialects a unified way to communicate.

6. 6. What is an ambiguous context free grammar?

Grammar?? But seriously, an ambiguous grammar is a sort of context-free grammar (one for which a parse tree can be generated) which can produce more than one valid parse tree for some input.

7. 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?

The most general kinds of context-free grammar require parsers that are of complexity O(n cubed), because they often make mistakes and must rebuild parts of the parse tree. Any commercially viable algorithm (the kind used to parse programming languages for compilers) will only operate on a subset of the grammars, but it will be of complexity O(n).

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

Most languages support ASCII, a character set which only includes the english alphabet, plus special characters. UCS-2 is a standard developed by the Unicode Consortium which supports most character and number systems from around the world. This means that programmers in Thailand don't have to write custom Java to interpret their input; it just works.

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

A binary coded decimal represents a set of decimal digits to store a decimal number precisely. In contrast, a floating-point number stores a less-precise value and an exponent. This means that floating-point numbers have a much wider range, and take up less memory, but they are less precise (1.0 - 1) might give you something like (0.000000001).

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

In 2004, Java added enumeration types, which map a set of discrete values onto a subset of the integers. The user can match any set of labels invisibly to a set of distinct integers.

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

For some reason, C-based languages give the AND operator precedence over the OR operator. However, mathematicians will remind you over and over again that the two operators should have equal precedence. They invented Boolean algebra, for crying out loud!

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

In JavaScript, == means test whether the two sides evaluate to the same thing. So, (5+1) == (9-3) returns true. However, this isn't very useful if we want to match the exact expression, for example we want to find a difference between '7' and 7. For those purposes, we use ===, which does not affect the operands before comparing them.

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

Short-circuited evaluations can evaluate only the left-hand side, so if there are side-effects on the right-hand side (as in 'latest ¿ bestSoFar —— index++ ¿ size), they might not happen in some cases. When the program decides on side effects at runtime, this can be really difficult to track.

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

Only run this when you are out of available memory. 1. Mark everything to look like garbage. 2. For each pointer, mark what it points to as not-garbage. 3. All cells that are still marked as garbage are reclaimed.

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

Matz was unhappy with the neat languages that everyone liked, like Perl and Python. While they allowed you to use objects if you wanted, Matz thought that this was too weak. He wanted a language that would scale without the inelegance of primitive types or functions. Therefore, he built Ruby in the model of Smalltalk: a purely object-oriented language, where even primitive operators were methods and could be re-written.

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

Microsoft wanted all the cool cats to use their .Net framework, so that they could obtain the power of huge market share. To achieve their dreams, they forged `C#` a weapon meant to combine the power of Java and C++ into a new general purpose programming language. They intended this great power to attract the greedy race of men, who would swarm in countless legions under the banner of .Net.

Chapter 2

Emily Andrulis

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 the 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) Ada uses parentheses to enclose the index in a reference to an element of an array.

   (b) Ada was designed this way so that array references and function calls in expressions would both use the same syntax. They wanted this uniformity because they are both mappings, and should therefore have the same syntax.

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

   A token is a category of its lexemes. An identifier is a token that can have many lexemes (or instances), such as index or count, but some tokens only have a single possible lexeme, i.e. = is the only lexeme for equalSign token.

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?

(a) Internal nodes of a parse tree have a nonterminal symbol, such as id in angle brackets.

(b) Leaves of a parse tree have terminal symbols, such as A.

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 programming language to use BNF, or even to formally describe the syntax of the langauge at all. Even though nowadays BNF is widely used and recognized as an acceptable way to document programming language syntax, at the time BNF was not easily accepted since most viewed it as strange and complicated.

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

Mainly, the creaters of LISP were trying to create a language that could do list processing. In particular, they needed a language that could support recursion, conditional expressions, and dynamic storage allocation or implicit deallocation. The creaters were John McCarthy and Marvin Minsky from MIT.

6. What is an ambiguous context free grammar?

An ambiguous context free grammar is one where there are two or more distinct parse trees possible for a single statement. This commonly occurs when a grammar allows parse trees to grow both from the left and the right, instead of restricting it to one side.

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?

Attribute grammars are used to describe more of the structure of a programming language than can be described with a context-free grammar. Rules of static semantics are described in attribute grammars, whereas context free grammars do not take these into consideration. Therefore, algorithms that parses strings for the grammars of programming languages are more complicated because they must also account for static and dynamic semantics. However, parsing algorithms for context-free grammars must account for a large general set of grammars, and their complexity is usually measured as $O(n^3)$. Even though programming languages are complicated, they can use parsing alogirthms that are less general and do not fit all grammars, so long as they do fit the grammar for that language. Therefore, commercial compliers have complexity of O(n) typically, which makes them less complex algorithms than those of the general context-free grammar parsing algorithms.

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

This feature is significant because as opposed to its predeccessor, ASCII, the Unicode character set includes characters from most of the world's natural languages. Therefore, Unicode is needed to faciliate international communication with code. Also, Unicode encapsulates ASCII, and the first 128 characters of Unicode are the same as those from ASCII.

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

Decimal types are able to precisely store decimal numbers, within a restricted range, which cannot be done with floating point types. Although this allows more accuracy in arithmatic operations, it is also mildy wasteful with memory since they are stored one or two digits per byte.

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

Enum is the class of user-defined ordinal types in Java.

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

In mathematics the OR and AND operators must have equal precedence, but in programming languages, specifically those that are C-based, a higher precedence is assigned to the AND operator over OR.

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

A double equals allows coercion first, whereas the triple equals does not.

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

If a language allows short-circuited evaluation and side effects of an expression at the same time, then it is possible for a piece of the expression to not be evaluated, and therefore not have it's side effect come into play. This can be a serious problem if the evaluation of the side effect was neccessary for the program's correctness.

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

Mark-sweep starts with all cells in the heap having their indicators set to indicate that they are garbage. Next, each point in the program is traced into the heap, and all reachable cells are marked instead as not being

garbage. Finally, all cells in the heap that were not marked as still being in use are returned to the list of available space.

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

He was unsatisfied with the Perl and Python languages, and wanted another language that was purely object oriented in that it did not support non-object primitive types nor functions instead of method calls.

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

Microsoft wanted to create a language for component-based software development, specifically for such development in the .NET framework that they had already established.

Chapter 3

Sam Caldwell

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 the 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) Ada
   (b) The designers of Ada specifically chose parentheses to enclose subscripts so there would be uniformity between array references and function calls in expressions, in spite of potential readability problems

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

   A token represents functional groups of lexemes, which are representations of the lowest level of syntactic units

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?

(a) internal nodes have non-terminal symbols

(b) leaf nodes have terminal symbols

4. One of the most significant contributions from the developers of ALGOL 60 also limited the success of that language. What was that contribution?

"Ironically, one of the most important contributions to computer science associated with ALGOL 60, BNF, was also a factor in its lack of acceptance. Although BNF is now considered a simple and elegant means of syntax descrip- tion, in 1960 it seemed strange and complicated." pg. 57 (10th edition)

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

The developers of Common LISP were trying to solve issues with portability among programs written in various dialects.

6. What is an ambiguous context free grammar?

"A grammar that generates a sentential form for which there are two or more distinct parse trees is said to be ambiguous"

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?

Parsing algorithms for unambiguous grammars are complicated and inneficient. In fact, " the complexity of such algorithms is $O(n^3)$"(pg. 180). On the other hand, the algorithms used for context free grammars are closer to the level of $O(n)$, which means the time they take is linearly related to the length of the string to be parsed. This is vastly more efficient than $O(n^3)$ algorithms.

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

The previously used ASCII was becoming obsolete with the globalization of business and the need for computers to communicate around the world. Java quickly becomes a global coding language based on it's acceptance of unicode - which includes (among other things) the Cryllic alphabet.

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

"Decimal types have the advantage of being able to precisely store decimal values, at least those within a restricted range, which cannot be done with floating-point"

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

"There are two user-defined ordinal types that have been supported by programming languages: enumeration and subrange."

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

Because in programming, arithmetic expressions can be the operands of relational expressions, and relational expressions can be the operands of Boolean expressions. For example the '=' sign - in mathmatics is signifies that two sides of an equation are the same value, wheras in programming it signifies the changing of value of a variable (or other things).

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

Because the '==' operator uses coercions to achieve equality, '===' is testing for it.

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

"Suppose that short-circuit evaluation is used on an expression and part of the expres- sion that contains a side effect is not evaluated; then the side effect will occur only in complete evaluations of the whole expression."

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

First, all cells in the heap have their indicators set to indicate they are garbage. Second, Every pointer in the program is traced into the heap, and all reachable cells are marked as not being garbage Third, All cells in the heap that have not been specifically marked as still being used are returned to the list of available space

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

"The motivation for Ruby was dissatisfaction of its designer with Perl and Python. Although both Perl and Python support object-oriented programming,14 nei- ther is a pure object-oriented language, at least in the sense that each has primi- tive (nonobject) types and each supports functions."(pg. 100)

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

"The purpose of `C#` is to provide a language for component-based software development, specifically for such development in the .NET Framework.

In this environment, components from a variety of languages can be easily com- bined to form systems”

Chapter 4

Dot Carmichael

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 the 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) Ada uses parentheses to enclose the index.
   (b) The programmers used parentheses instead of brackets to provide uniformity between arrays and functions, since they both use mapping.

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

   A token is a category of one or more lexemes within a language.

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?

   (a) Non-terminal symbols.

(b) Terminal symbols.

4. One of the most significant contributions from the developers of ALGOL 60 also limited the success of that language. What was that contribution?

Backus-Naur Form syntax description

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

The problem was a lack of portability between programs written in different dialects of LISP.

6. What is an ambiguous context free grammar?

An ambiguous context free grammar can generate sentences with more than one leftmost and rightmost derivation.

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 for parsing any unambiguous grammars are highly inefficient, with a complexity of O(n**3), whereas algorithms for programming languages are complexity O(n).

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 allows programs to be written which can communicate with other

countries whose languages cannot be represented by the basic english alphabet.

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

Floating point numbers are an approximation of the number using fractions and exponents, stored in binary which can make them even less accurate. Binary coded decimals precisely store decimal values at the cost of taking up more storage than floating point numbers.

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

Enumeration

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

When Boolean operators evaluate to 0 and 1, they can be used in equations with multiple relational operators to produce unexpected results. (1 ¡ 2 ¡= 1) -¿ ((true/1) ¡= 1) -¿ true

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

With +==+, strings can be coerced into numbers to check for equality. With +===+, no coercion will take place, so strings and numbers will not resolve as equal.

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

If there is a side effect in the right hand side of the expression and it

short-circuits on the left, then the side effect will not occur.

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

1- all cells in heap set indicators to 'garbage' 2- all pointers in the program are traced, and anything which is pointed to is changed to 'not garbage' 3- all cells still marked 'garbage' are reverted to available space

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

Matsumoto was dissatisfied with Perl and Python; specifically, that they were not pure object-oriented languages because they had primitive types and functions.

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

Microsoft aimed to provide a language for development of component-based software in the .NET framework.

Chapter 5

Sam Chalkley

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 the 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) the language that requires the use of parentheses to enclose an index is ada.

   (b) the designers chose parentheses to enclose subscripts so there would be uniformity between array references and function calls in expressions.

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

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   the lexemes of a programming language include numeric literals operators and special words. these are partitioned into groups. the token is the name that represents each lexeme group. (a token of a language is a category of its lexemes.)

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?

(a) nonterminal symbols are at every internal node

(b) leaves of the parse tree is labeled with a terminal symbol

4. One of the most significant contributions from the developers of ALGOL 60 also limited the success of that language. What was that contribution?

This is what is called static scopping it is a method of binding names to nonlocal variables. the scope of the variable can be statically determined prior to execution.

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

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it was created to solve lack of portability among programs written in the various dialects

6. What is an ambiguous context free grammar?

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a grammarthat generates a sentential form where there are two or more distinct parse trees.

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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the conplexity for parsing strings that conform to general kinds of context free grammers is $O(n^3)$ which is alot and takes awhile. while parsing strings that conform to grammars have a complexity of $O(n)$ which is much faster. this indicates that it is linear. and much more efficient

********** Write your answer here.

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 is standard for character incoding. this allowed computers to communicate with comuters around the world. this helped with globalization of business because of the demand of computers talking to comuters around the world.

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

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uses binary codefor the decimal digits (much like strings.) this allows precision storing of decimal values. supports business proccessing etc. on the other hand floating points are only approximations for many real values. has some problems like loss of accuracy throug arithmetic operations

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

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this is an enumeration.

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

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in math booleans or/ and must have equal precedence. however with computer science, specifically in c we establish a higher precedence in and than or.

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

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because this === prevents operands from being coerced.in this case === with a string and number would turn out false.

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

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short circut evaluation can be hazardus when used on and expression and part of an expression that contains a side effect is not evaluated. for example $(a > b)||((b++/3)$ if the programmer assumed b would change every time and a was not greater than b the program would fail.

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

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1) all cells in the heap have their indicators set to indicate they are garbage 2) marking phase, every pointer is traced into the heap and all reachable cells are marked as not being garbage 3)sweep phase, all cells in the heap that have not been specifically marked as still being used are returned to the list of available space.

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

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the motivation for ruby was dissatisfaction of its designer with perl and python. niether was a pure object-oriented language in the sense that each hase primitive types and each supports functions.

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

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the C# designers obviously disagreed with this wholesale removal of featurs that java did not include. it included all but the multiple inheritance. they wanted to have a language for component based software development (looking alot at .NET)

Chapter 6

Nicci Geiger

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 the 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?

   (a) Write your answer here.

   (b) Write your answer here.

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?

Write your answer here.

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.

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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.

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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?

Write your answer here.

Chapter 7

Brian Hixson-Simeral

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 the 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) Ada uses parentheses to enclose the index to an element of an array.
   (b) The reason that brackets are used, rather than parentheses, is that parentheses are also used to denote subprogram calls.

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

   Tokens are the catagorey of the lexeme. Eg. 2 and int_literal (lexeme and token).

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?

   (a) Nonterminal

(b) Terminal

4. One of the most significant contributions from the developers of ALGOL 60 also limited the success of that language. What was that contribution?

BNF (Backus-Naur Form)

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

They were trying to create one version of LISP, so that there wouldn't be so many dialects being used. With the large amount of dialects came a lack of potability.

6. What is an ambiguous context free grammar?

A context-free grammar is a generative device for defining languages. Context-free gramars are ambiguous when they generate a sentential form that could have two or more distinct parse trees.

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?

A parsing algorithm for an unambiguous grammar is ridiculously inefficient ($O(n^3)$). More specifc alogorithms can be made for programming languages that have a complexity of $O(n)$. It is much more efficient to use specific algorithms.

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

feature?

It was a 16-bit character set that included characters from most natural languages and ASCII.

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

Floating-point are represented as fractions and exponents while Decimal are stored with a fixed number of decimal digits with the decimal point at a fixed position in the value. The value 0.1 can be represented exactly in decimal, but in floating-point it would come with some uncertainty.

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

The two user-defined ordinal types in Java are enumeration and subrange.

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

In math, AND and OR have equal precedence, but in most programming languages AND has a higher precedence than OR.

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

Programmers should use === instead of == because when you use == a string such as "7" will be coerced to the number 7, but when you use === it remains a string.

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

This allows subtle errors to occur. "If the short-circuit evaluation is used on an expression and part od the expression that contains a side effect is not evaluated; the the side effect will occur only in complete evaluations of the wole expression. If program correctness depends on the side effect, short-circuit evaluation can result in a serious error."

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

All cells in the heap have their indicators set to indicate that they are garbage. Every pointer in the program is traced into the heap, and all reachable cells are marked as not being garbage. All cells in the heap that are marked as garbage are returned to the list of available space.

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

He was dissatisfied with Perl and Python. He wanted a purely object-oriented language and neither of them lived up to it.

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

C# was meant to provide a language for component-based software development. It was geared towards development in the .NET Framework.

Chapter 8

Tuli Leota

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 the 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?

   (a) Write your answer here.

   (b) Write your answer here.

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?

Write your answer here.

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

Write your answer here.

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?

Write your answer here.

Chapter 9

Ally Lien

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 the 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) pre-90 FORTRAN or PL/I

   (b) No other suitable characters were available

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

   A token is a category of a language's lexemes, and a lexeme is the lowest-level syntactic units. Lexemes include identifiers, literals, operators, and special words.

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?

(a) Nonterminal symbols are found at the internal nodes of the parse tree.

(b) Terminal symbols are found at the leaves of the parse tree

4. One of the most significant contributions from the developers of ALGOL 60 also limited the success of that language. What was that contribution?

BNF (Backus-Naur form) became the way to describe programming languages

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

They were trying to solve the problem of the lack of portability of programs written in different dialects.

6. What is an ambiguous context free grammar?

It is a grammmar that generates more than one distinct parse tree, because it specifies less syntactic structure.

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?

Parsing algorithms that parse strings of the most general grammars have a complexity of $O(n^3)$, while algorithms that parse the grammmars of programming languages have a complexity of $O(n)$. Algorithms for general grammars take much longer than those used for grammars of programming languages. It takes on order of the cube of the length of string to be parsed using a general grammar algorithm, while it only takes a linear relation of the string to be parsed in the algorithms for programming languages.

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

The language now had a way to encode all of the world's languages using a global standard.This limited the confusion between computers

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

Decimal types can precisely store decimal values, but floating-points cannot. It also takes more memory to store decimals than it does to store numbers in binary.

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

Java has enumeration types, where all the possible values are provided in the definition.

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

Mathematicians have a hierarchy of boolean operations, just like most programming languages. In some programming languages, boolean operators have a higher precedence than relational operators, so programmers will have a different order doing things.

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

If a (===) is used, then no type conversion is done, so the types must be the same to be considered equal. The (==) allows for type conversion. If

two values are not the same type, (==) and (===) may return different answers.

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

Short-circuted evaluation allows for an expression to be evaluated without evaluating all of the operands and/or operators. If side effects occur, the type of a parameter or global variable may be changed. This could change the value of the answer to a part of the expression, changing the value of the whole expression, creating an error in the program if it short circuits the expression.

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

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1. Alls the cells in the heap have their indicators set to indicate they are garbage. 2. Every pointer in the program is traced to the heap. All reachable cells are marked as 'not garbage.' 3. The sweep phase is when all the cells in the heap that have not been specifically marked as being used are returned to the list of available space.

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

He was dissatisfied with Perl and Python, because neither of them were purely object-oriented languages.

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

They wanted to create a language for development in the .NET Framework, and other component-based software.They aimed to improve C++ and Java.

Chapter 10

Aeint Thet Ngon

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 the 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) Ada
   (b) Because the designers wanted uniformity between array references and function calls in expressions in spite of potential readability problems.

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

   A lexeme is a formal descriptions of a syntax of progamming languages and most of the times do not include descriptions of the lowest-level syntactic units. Each lexeme group is represented by a name or a token. So a token of a language is a category of its lexemes.

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?

(a) Non-terminal cateogires of the grammar are found at the internal nodes of a parse tree.

(b) Leaf nodes are labelled by terminal categories.

4. One of the most significant contributions from the developers of ALGOL 60 also limited the success of that language. What was that contribution?

BNF, one of the most important contributions to computer science, is considered a simple and elegant means of syntax description but in 1960 it seemed strange and complicated and was a factor in its lack of acceptance.

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

During the 1970s and early 198s, due to the usage of diverse dialects of LISP, there was a problem of lack of portability among the programs writting using different dialects. To solve the problem, Common Lisp was created by combining the features of different dialects of LISP.

6. What is an ambiguous context free grammar?

A grammar that genereates a sentential form for which there are two or more distinct parse trees is said to be ambiguous.

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?

Parsing algorithms that work for any unambiguous grammar are complicated and inefficient, the amount of time they take is on the order of the cube of the lenght of the string to be parsed. So generality is traded for efficiency. Faster alogrithms have been found that work only for a subset of the set of all possible grammars and the time they take is linearly related to the length of the string to be parsed.

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

This feature includes the characters from most of the world's natural languages. It was developed because of globalization of business and the need for computers to communicate with other computers around the world.

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

Floating point data types model real numbers but the representation are only apprximations for many real values. Decimal types have the advantage of being able to precisely store decimal values, which cannot be done with floating point.

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

Enumeration Types

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

In mathematics, Boolean algebras have equal precedence, however, C-based languages assign higher precedence to AND than OR. This might have resulted from the baseless correlation of mulitplcation with AND and of additon with OR, which would then naturally assign higher precedence to AND.

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

Because whena string and a number are the operands of a relational oper-

ator, the string is coerced to a number but when `===` is used no coercion is done on the operands of this operator.

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

A language that provides short-circuit evaluations of Boolean expressions and also has side effects in expressions allows subltel errors to occr. Suppose that short-circuit evaluation is used on an expression and part of the expression that contains a side effect is not evaluated; then the side effect will occur only in complete evaluations of the whole expression. If a program correctness depends on the side effect, short-circuit evaluation can result in a serious error.

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

- All cells in the heap have their indicators set to indicate they are garbage
- Marking phase-Every pointer in the program is traced into the heap and all reachable cells are marked as not being garbage
- Sweep phase-all cells in the heap that have not been specifially marked as still being used are returned to the list of available space

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

Yukihiro Matsumoto's motivation was due to his dissatisfaction with Perl and Python, which support object-oriented programming but neither is puer object oriented langauge.

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

The purose of C# is to provide a language for componenet based software

development. In this environment, components from a variety of languages can be easily combined to form systems.

Chapter 11

Huong Nguyen

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 the 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) The languages are pre-90 Fortrans and PL/I
   (b) Because there were no other suitable characters available at the time. Card punches did not include bracket characters.

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

   Lexemes are the lowest-level syntactic units. A token of a language is a category of its lexemes.

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?

   (a) Nonterminal symbols are found at the internal nodes of a parse trees.

(b) Terminal symbols are found at the leaves of a parse trees.

4. One of the most significant contributions from the developers of ALGOL 60 also limited the success of that language. What was that contribution?

It was the use of BNF as the formal means of describing syntax. In 1960 it seemed strange and complicated.

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

During the 1970s and early 1980s, a large number of different dialects of LISP were developed and used. This led to the familiar problem of lack of portability among programs written in the various dialects. Common LIPS was created to rectify the situation by combining the features of several dialects of LISP, including Scheme, into a single language.

6. What is an ambiguous context free grammar?

An ambiguous grammar is a grammar that generates a sentential form for which there are two or more distinct parse trees. Context-free grammars were developed by Noam Chomsky as a class of natural languages, but became the primary method through which the syntax of programming languages are described.

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 that can parse general kinds of context-free grammars have a cubic time complexity. But the grammars of programming languages are far less general and only a subset of general context-free grammars. Algorithms to parse them have O(n), or linear time complexity, which is more efficient.

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 includes the characters from most of the world's natural languages. Before Unicode was created, the 8-bit code ASCII was used to code character data and became inadequate for communication with computers around the world.

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

Floating-points store only approximations for many real values, while decimals store precise decimal values up to a specific range. Floating-point values are represented as fractions and exponents, typically taking 32 bits. Binary-coded decimals store one to two digits per byte, since a digit takes at least 4 bits, so they take up a lot of storage.

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

The java user-defined ordinal type is Enum. All enumeration types in Java are implicitly subclasses of the predefined class Enum.

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

In the mathematics of Boolean algebras, the OR and AND operators must have equal precedence. However, the C-base languages assign a higher precedence to AND than OR.

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

=== prevents Javascript operands from being coerced, and in effect checks for type equivalence. For example, "7" == 7 evaluates to true in Javascript, while "7" === 7 evaluates to false.

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

Allowing both at the same time may lead to errors where the side effect is part of the second boolean expression, and is not evaluated due to the expression having been short-circuited after the first.

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

First, all cells in the heap are marked as garbage. Second, every pointer is traced into the heap, and mark all cells they reach as not-garbage. Finally, all cells still marked as garbage are returned to the list of available space.

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

Matsumoto was dissatisfied with Perl and Python, which were not pure object-oriented languages.

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

As the flagship language of .NET and Microsoft, C# was meant to allow .NET to combine components written in all other .NET languages, such as Visual Basic and C++.

Chapter 12

Spencer Rudnick

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 the 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) 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*. $\doteq$has its own token, *equal_sign*. And so on, 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?
   (b) What kind of symbols are found at the leaves of a parse tree?

   (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 the 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) Ada
   (b) They chose parenthasees so that there would be uniformity between array refences and function calls in expressions, regardless of potential readability issues.

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

   A lexeme is the lowest-level syntactc unit. They are partitioned into groups. Each lexeme group is represented by a token. So, a token is a category of its lexemes.

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?

(a) nonterminal symbols

(b) terminal symbols

4. One of the most significant contributions from the developers of ALGOL 60 also limited the success of that language. What was that contribution?

Backus-Naur Form, or BNF, a way of describing sntax.

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

The lack of portability among programs written in various dialects.

6. What is an ambiguous context free grammar?

A grammar that generates a sentential form for which there are two or more distinct parse trees.

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?

Parsing algorithms that work for any unambiguous grammar are complicated and inefficient. The complexity of such algorithms is O(n3). This relatively large amount of time is required because these algorithms frequently must back up and reparse part of the sentence being analyzed.Backing up the parser also requires that part of the parsemtree being constructed must be dismantled and rebuilt. In terms of parsing, faster algorithms have been found that work for only a subset of the set of all possible grammars. These algorithms are acceptable as long as the subset includes grammars that describe programming languages.

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 includes characters from most of the world's natural languages, allowing for communication among computers worldwide.

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

Decimal types are able to precisely store decimal values within a restricted range, which cannot be don with a floating-point. However, their storage in memory is somewhat wasteful. Floating-points are approximations, but take up less storage space in memory.

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

An enumeration type.

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

In mathematics, OR and AND have equal precedence, and this is the case with Ada. However, C-based languages assign AND a higher prescedence than OR, possibly resulting from a correlation between multiplication and the AND operator, and addition and OR.

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

With ==, the expressions are coerced into the same type before evaluation, but with ===, no coercion is done.

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

The side effect will only occur in complete evaluations of the whole expression, so if the program depends upon that side effect for correctness and the part of the expression with the side effect is not evaluated, the program will result in a serious error and fail.

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

---

1. All cells in the heap are indeicated as garbage. 2. Every pointer in the program is traced to the heap, and all reachable cells are marked as not garbage anymore. 3. sweep phase: all cells not marked as still being used are returned to the list of available space.

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

He was dissatisfied with Perl and Python, since neither of them are pure object-oriented languages in that they have primitive types and support functions.

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

The designers wanted to provide a language for component-based software development, specifically for such development in the .NET framework. In this environment, components from a variety of languages can be easily combined to form systems.

Chapter 14

Cameron Seebach

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 the 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?

   (a) Write your answer here.

   (b) Write your answer here.

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?

Write your answer here.

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

Write your answer here.

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?

Write your answer here.

Chapter 15

Joe Sterchele

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 the 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?

   (a) Write your answer here.

   (b) Write your answer here.

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?

Write your answer here.

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

Write your answer here.

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?

Write your answer here.

Chapter 16

Htut Khine Win

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 the 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) Ada

   (b) The architects of Ada chose parentheses to enclose the index in a reference to an element of an array so that it is consistent between array references and function calls in expressions. Moreover, the choice is in part influenced by the notion that both array element references and function calls are mappings.

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

   A lexeme is the lowest-level syntatic unit in the programming languages. Lexemes are grouped and each lexeme group is represented by a token. Therefore, a token is a category of its lexemes. For example, an identifier is a token that can have lexemes.

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?

(a) Nonterminal symbols are found at the internal nodes of a parse tree.

(b) Terminal symbols are found at the leaves of a parse tree.

4. One of the most significant contributions from the developers of ALGOL 60 also limited the success of that language. What was that contribution?

The revised method of syntax description called Backus-Naur Form, or BNF.

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

LISP creators were trying to solve the lack of portability among programs written in various dialets.

6. What is an ambiguous context free grammar?

A grammar that generates a sentential form for which there are two or more distinct parse trees is called ambiguous context free grammar.

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?

Parsing algorithms that work for unambiguous grammar are complicated and inefficient.The complexitiy of such algorithms is O n to power 3.All algorithms used for the syntax analyzers that conform to the grammars of programming languages have complexity O(n).

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

Before Unicode, most commonly used coding was the 8-bit ASCII code. Unicode is a 16-bit character set. Unicode made huge impacts on the globalization of business and the need for computers to communicate with other computers around the world.

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

The float type is stored in four bytes of memory. Binary coded decimals are stored one digit per byte, in some cases, they are packed two digits per byte and it takes at least four bits to code a decimal digit.

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

Enumeration types.

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

In Mathematics, OR and AND operators have equal precedence. However, C-based languages assign higher precedence to AND than OR because programmers tend to associate multipliacation with AND and addition with OR, which would naturally assign higher precedence to AND.

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

Because `==` forces the operand to match the type. Yet, `===` does not coerce the operands of this operator.

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

Suppose that short-circuit evaluation is used on an expression and part of the expression that contains a side effect is not evaluated; then the side effect will occur only in complete evaluations of the whole expression. If the program correctness depends on the side effect, short-circuit evaluation can cause serious problems.

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

First, all cells in the heap have their indicators set to indicate they are garbage.In the second part, every pointer in the program is traced into the heap and all reachable cells are marked as not being garbage. In the third part, all cells in the heap that have not been specifically marked as still being used are returned to the list of available spaces.

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

Because he was dissatisfied with the design of Perl and Python, although both of them support object-oriented language, neither is a pure object-oriented language, at least in the sense that each has primitive(nonobject) types and each supports functions.

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

The purpose of C# is to provide a language for component-based software development, specifically for .NET framework.