CSCE 330 Fall 2000
MIDTERM EXAM
Friday 00/9/29—Two Pages

1 Short Questions–1 point each; 15 points total

1. What programming language has dominated scientific computing over the past 35 years? **Answer:** FORTRAN
2. What programming language has dominated business applications over the past 35 years? **Answer:** COBOL
3. What programming language has dominated artificial intelligence programming over the past 35 years? **Answer:** LISP (Also acceptable: LISP and Prolog)
4. In what language is UNIX written? **Answer:** C
5. How can user-defined overloading harm the readability of a program? **Answer:** A reader must refer to the declarations in which an operator is overloaded to be certain of the meaning of the operator when the operator is used.
6. What is exception handling? **Answer:** The provision of facilities to handle run-time errors within a
7. Fill in the correct word in place of *mystery* in the following sentence: The Ariane 5 launcher disaster occurred because of an uncaught *mystery* during a type conversion. **Answer:** Exception
8. What is the name of the family of programming languages whose structure is dictated by the von Neumann computer architecture? **Answer:** Imperative
9. Following up on the previous question, what are the names of the two other main families of programming languages? **Answer:** functional (or applicative) and logic
10. What are the three fundamental features of an object-oriented programming language? **Answer:** Encapsulation, inheritance, and dynamic type binding (or polymorphism)
11. Who developed LISP? **Answer:** John McCarthy
12. In which language was block structure introduced? **Answer:** ALGOL 60

13. What are the three components of the state in the denotational semantics approach[1]? **Answer:** mem, i, o

14. What is the *initial* value of the memory function (*mem*) for every identifier in the denotational semantics of a program? **Answer:** undef

15. What populates the Smalltalk world? **Answer:** Objects

2 Denotational Semantics–10 points

a (2 points) What is aliasing?

b (3 points) Complete this sentence: The memory function, *mem*, is a function from the set of *mysteries1* to the set of *mysteries2*. **Answer:** identifiers, integers (also acceptable: identifiers, values).

c (5 points) Why is aliasing difficult to capture in denotational semantics?

Answer: Because one has to enforce the requirement that some identifiers have the same value at all times.

3 BNF–10 points

a (2 points) What does it mean for a grammar to be *ambiguous*? **Answer:** The grammar generates a sentence that has two or more distinct parse trees.

b (8 points, problem 7 on p.152 of Sebesta's textbook) Prove that the following grammar is ambiguous:

```
<S> -> <A>
<A> -> <A> + <A> | <id>
<id> -> a | b | c
```

Answer: Provide two distinct parse trees derivations of a+b+c

4 EBNF–6 points

Provide a BNF rule or BNF rules corresponding to the following EBNF rules:

a <proc_call> -> ident [(<expr_list>)] **Answer:** <proc_call> -> ident | ident (<expr_list>)

b <expr> -> <expr> (+ | -) <term> **Answer:** <expr> -> <expr> + <term> | <expr> - <term>

[1] Every question on denotational semantics refers to the simple language described in class.

5 Syntax Graphs–4 points

Draw a syntax graph corresponding to the following EBNF rule:
`<ident> -> letter {letter | digit}`