

Name: _____	CS Username: _____
Grade: _____	Blackboard Username: _____

- Be sure to begin by printing your *name* and both *usernames* clearly in the spaces provided above.
- If you find a question ambiguous: write the most reasonable assumptions you can think of near the question, and then answer the question under these assumptions.
- The exam is graded as 100 percentage points. The points available for individual questions are shown in parentheses. There are 17 numbered questions on 4 pages.

1. What kind of programming construct is the following Pascal fragment? (mark **one**) (5 points)

```
for n=1 to 20 do
  ...
```

- (a) a sequencing statement
  - (b) a selection statement
  - (c) an enumeration-controlled loop
  - (d) a logically-controlled loop
2. What is short-circuit evaluation of Boolean expressions? (5 points)
- (a) it means that these expressions are evaluated at compile time
  - (b) it means that the evaluation of an operand can be skipped when the logical result can be determined from the evaluation of another operand
  - (c) it means that if both operands of an operator are the same, then only one needs to be evaluated
  - (d) it means that the logical result of a Boolean operator always evaluates to the same value
3. What does the **throws** keyword do in Java? (mark **one**) (5 points)
- (a) it raises an exception
  - (b) it defines a list of exceptions that a method can raise
  - (c) it removes and throws away an object
  - (d) it catches an exception in an exception handler
4. Give examples of two different *selection statement* constructs in C, C++, or Java. (10 points)

5. Give an example of a *tail-recursive* function in C. (5 points)

6. Re-write your example to eliminate tail-recursion using a loop. (5 points)

7. What is the value printed by the following pseudo-code program for each of the parameter passing modes shown in the table? (10 points)

```
procedure p(integer x)
begin
  x := x + 1;
end

begin // main program
  integer a;
  a := 2;
  p(a);
  print(a);
end
```

	By value	By reference
Output:		

8. Mark the entries in the table indicating which parameter passing modes pass parameters in and/or out (**check** those that apply) (5 points)

Passing Mode	In	Out
Value		
Reference		
Sharing		
Value/Result		
Name		

9. Consider the following C construct:

```
for (i = 0; i < 100; ++i)
{ ... }
```

What sort of programming construct is this? (mark **one**) (5 points)

- (a) an enumeration controlled loop
  - (b) a logically controlled pre-test loop
  - (c) a logically controlled post-test loop
  - (d) a logically controlled mid-test loop
10. Name the seven major categories of control-flow ordering constructs. Indicate which of these are implemented in C/C++ [C] and Java [J]. (10 points)

11. Consider the following Prolog definitions:

```
needs(andy, [driver,hammer,saw]).
needs(buzz, [drill,pliers,saw]).
needs(carl, [drill,hammer]).
share_tool(T) :- needs(X,A), needs(Y,B), \+(X=Y), member(T,A), member(T,B).
```

Which of the following queries are successful? (mark **one or more**) (5 points)

- (a) `share_tool(buzz).`
- (b) `share_tool(drill).`
- (c) `share_tool(pliers).`
- (d) `share_tool(X).`

12. *Non-structured* control flow means that ... (mark **one**) (5 points)
- (a) ... **C structs** are not used in a program
  - (b) ... proper indentation is not used
  - (c) ... **gotos** are used
  - (d) ... concurrency is not used
13. Which of the four sentences below is *false*? (mark **one or more**) (5 points)
- (a) logically controlled *pretest loops* check loop conditions before each iteration
  - (b) in C++ the binding time of a variable to its type declaration is at run time
  - (c) an *l-value* is a logical value
  - (d) in a *statically scoped language* the exact storage location of a variable can always be determined at compile time
14. What happens when a dynamically allocated object's lifetime exceeds its binding lifetime indefinitely (until program termination)? (mark **one**) (5 points)
- (a) produces dangling references to the object
  - (b) gives a runtime error
  - (c) introduces a memory leak
  - (d) the object is still in scope
15. After executing the code in a **catch** handler in C++ when an exception occurred, where does the program normally continue? (mark **one**) (5 points)
- (a) in the caller of the current function (current function exits)
  - (b) the statements that immediately follow the **throw** statement in the **try** block
  - (c) the statements that immediately follow the last **catch** clause
  - (d) the statements in another **catch** clause for the same exception
16. Show the typical layout of a stack-allocated subroutine frame, label the frame's slots, and describe the content of each slot. (10 points)
17. Suppose a programming language uses garbage collection. What kind of (de)allocation problems do *not* occur? (mark **one or more**) (5 points)
- (a) memory leaks
  - (b) internal and external heap fragmentation
  - (c) dangling references
  - (d) dereferencing uninitialized pointers