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

<table>
<thead>
<tr>
<th>Passing Mode</th>
<th>In</th>
<th>Out</th>
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</thead>
<tbody>
<tr>
<td>Value</td>
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<tr>
<td>Reference</td>
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<td>Value/Result</td>
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8. Mark the entries in the table indicating which parameter passing modes pass parameters in and/or out *(check those that apply)* (5 points)
9. Consider the following C construct:

```c
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:

```prolog
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