1. Specify the correct order for these operations: execution, translation, linking, and loading. (4%)

2. What is an abstract data type? (2%)

3. What is the relationship between a class and an object? (2%)

4. Explain the use of a stack in recursion. (3%)

5. If a problem can be solved by recursion and this problem also can be solved by iteration, which is generally more efficient, recursion or iteration? (2%)

6. A ________ file consists of a stream of character codes. (2%)
   A ________ file is a sequence of values of any type represented exactly as they would be in main memory. (2%)

7. What are the differences between a stack and a queue? (4%)
   If W, X, Y, Z are inserted into a stack and a queue, what will be the order of removal for the stack? (2%) for the queue? (2%)

8. What is an exception? (2%) Explain the relationships among an exception, a try block, and a catch clause. (2%)

9. What is the difference between the method overloading and the method overriding? (2%)
   Which enables polymorphism? (2%) Can a constructor be overridden? (2%)

10. Inheritance is known as the (2%)
    (a) "knows-a" relationship.
    (b) "has-a" relationship.
    (c) "is-a" relationship.
    (d) "uses-a" relationship.
11. Polymorphism allows for specifics to be dealt with during (2%) 
   (a). Execution time 
   (b). Compile time 
   (c). Programming 
   (d). Debugging 

12. What does the following code segment display if the input is 12345? (3%) 
    Then, describe the action of the code. (3%) 

    ```c
    int data;
    printf("Enter a positive integer: "); scanf("%d", &data);
    do { printf("%3d", data%10); } while(data > 0);
    data /= 10;
    ```

    Note: x%y: the remainder of x divided by y

13. A selection sort searches an array for the smallest element in the array, and swaps that 
    element with the first element of the array. The process is repeated for the subarray 
    beginning with the second element. Each pass of the array places one element in its proper 
    location.

    (a). Write the status of the list L={16, 5, 20, 31, 98, 7} after each pass of the selection sort. 
        (5%) 
    (b). Write a function to perform the selection sort. (5%) 
    (c). Analyze the efficiency of the selection sort by using big-O notation. (5%)
14. (a). What is ideal behind a hash function? (3%)  
(b). When does the collision occur? (3%)  
(c). Consider the hash function  
   int Hashfun( int key)  
   { return (key*key >> 3) % 512;  
   }  
What is the size of the hash table? (3%)  
What are Hashfun(16) and Hashfun(1000)? (6%)  

15. A robot can take steps of 1 meter or 2 meters. As examples:  

<table>
<thead>
<tr>
<th>Distance</th>
<th>Sequence of Steps</th>
<th>Number of ways to Walk</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>1,1 or 2</td>
<td>2</td>
</tr>
<tr>
<td>3</td>
<td>1,1,1 or 1,2 or 2,1</td>
<td>3</td>
</tr>
</tbody>
</table>

Let walk(n) denote the number of ways the robot can work n meters.  
(a). What is the value of walk(5). (3%)  
(b). Write the formula for the walk(n). (4%)  
(c). Write a recursive function to calculate the number of ways the robot can walk n meters. (5%)  

16. The towers of HANOI problem:  

Move n disks from peg X to peg Y using peg Z as needed. The following conditions apply:  
(I). Only one disk at a time may be moved, and this disk must be the top disk on a peg.  
(II). A larger disk can never be placed on top of a smaller disk.  

(a). How many moves are needed to solve the 6-disk problem. (3%)  
(b). Please describe how to solve this problem. (5%)  
(c). Write a recursive function that prints out the sequence of moves needed to accomplish this task. (5%)