

Introduction to Computer Science-101

Homework 4_solution

1. Using the bubble sort algorithm manually sort the following list and show your work in each pass using a table: (10%)

14 7 23 31 40 56 78 9 2

The status of the list and the location of the wall after each pass is shown below:

Pass	List								
	14	7	23	31	40	56	78	9	2
1	2	14	7	23	31	40	56	78	9
2	2	7	14	9	23	31	40	56	78
3	2	7	9	14	23	31	40	56	78
4	2	7	9	14	23	31	40	56	78
5	2	7	9	14	23	31	40	56	78
6	2	7	9	14	23	31	40	56	78
7	2	7	9	14	23	31	40	56	78
8	2	7	9	14	23	31	40	56	78

2. A list contains the following elements. The first two elements have been sorted using the selection sort algorithm. What is the value of the elements in the list after three more passes of the selection sort? (10%)

7 8 26 44 13 23 98 57

The status of the list and the location of the wall after each pass is shown below:

Pass	List							
	7	8	26	44	13	23	98	57
1	7	8	13	44	26	23	98	57
2	7	8	13	23	26	44	98	57
3	7	8	13	23	26	44	98	57

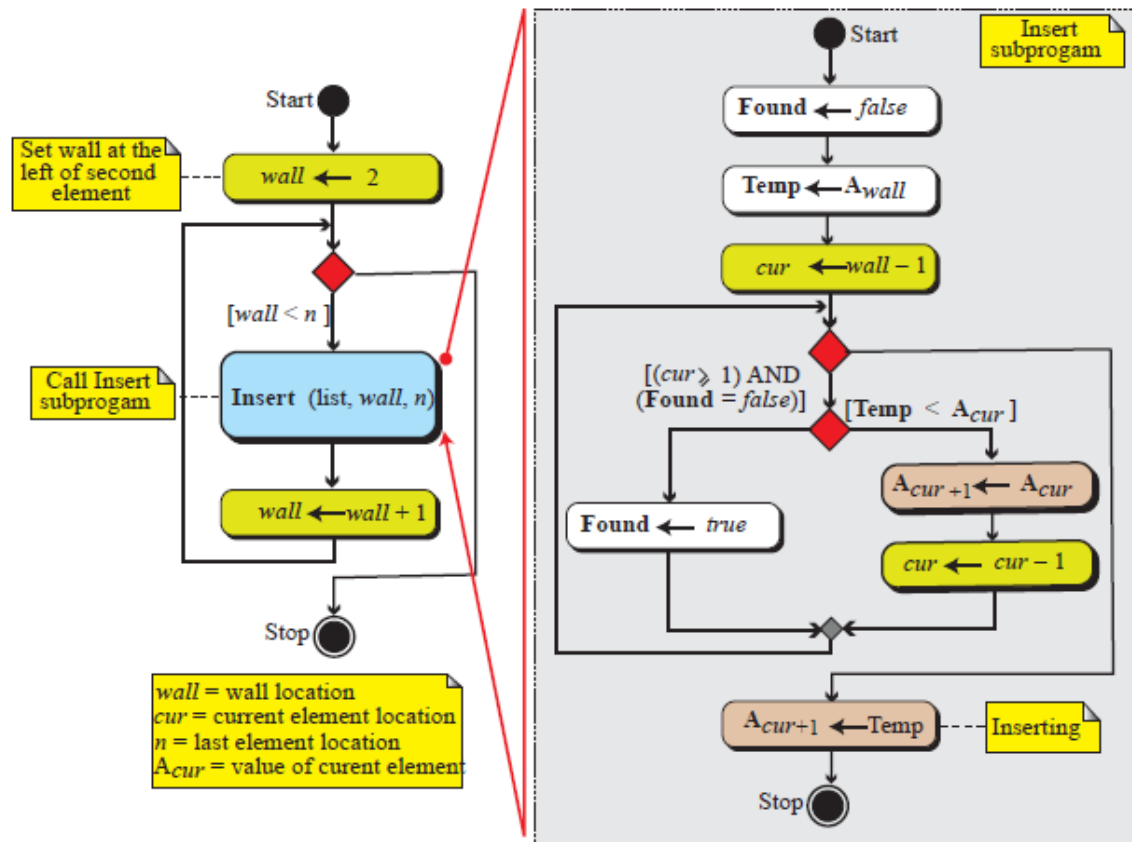
3. A list contains the following elements. Using the binary search algorithm, trace the steps followed to find 88. At each step, show the value of *first*, *last*, and *mid*. (10%)

8 13 17 26 44 56 88 97

The binary search for this problem follows the table shown below. The target (88) is found at index $i = 7$.

<i>first</i>	<i>last</i>	<i>mid</i>	1	2	3	4	5	6	7	8	
1	8	4	8	13	17	26	44	56	88	97	target > 44
5	8	6					44	56	88	97	target > 56
7	8	7							88	97	target = 88

4. Draw a UML diagram for the insertion sort algorithm that uses a subalgorithm. The subalgorithm is used to do the insertion into the sorted sublist. (10%)



5. Write an algorithm in pseudocode for the selection sort using two nested loops. (10%)

```
Algorithm: SelectionSort(list, n)
Purpose: to sort a list using selection sort method
Pre: Given: A list of numbers
Post: None
Return:
{
    wall ← 1 // Set wall at the left of first element
    while (wall < n) // Outer loop
    {
        smallest ← wall
        cur ← wall // The current item is the one left to the wall
        while (cur < n) // Inner loop
        {
            if (Acur < Asmallest) // Move the current element
                smallest ← cur
            cur ← cur + 1
        }
        Temp ← Awall // The next three lines perform swapping
        Awall ← Asmallest
        Asmallest ← Temp
        wall ← wall + 1 // Move wall one element to the left
    }
}
```

6. Distinguish between compilation and interpretation.(10%)

Compilation translates the whole source program into the object module before executing the program. Interpretation refers to process of translating each line of the source program into the corresponding line of the object program and executing the translated line.

7. Find how many times the statement in the following code segment in C is executed:(10%)

```
for(int i = 5; i < 20; i++)
{
    statement;
    i = i + 1;
}
```

The statement is executed eight times (i = 5, 7, 9, 11, 13, 15, 17, 19). Note that in each iteration the value of i is incremented twice: the first time inside the header (i++), the second time in the body of the loop (i = i + 1).

8. Compare and contrast a procedural paradigm with an object-oriented paradigm.(10%)

In the procedural paradigm, a program is an active agent that manipulates passive objects (data). In an object-oriented paradigm, data are designed as active objects. The action to be performed on these objects are included in the object.

9. Define the three constructs used in structured programming.(10%)

- a. Sequence
- b. Decision
- c. Repetition

Sequence: An algorithm is a sequence of instructions, which can be a simple instruction or either of the other two constructs.

Decision (selection): Tests a condition. If the result of testing is true, it follows a sequence of instructions; if it is false, it follows a different sequence of instructions.

Repetition: This construct repeats a set of instructions.

10. If the subprogram needs to get a value for A (A is declared in main program) from the keyboard and return it to the main program, should you pass A to the subprogram by value or by reference? (10%)

It can be passed either by value or by reference, but it is normally passed by value to keep the value of the variable in the main untouched.