Week 10 Assignment Solution

1. Bisection method is used to find
    a) Derivative of a function at a given point
    b) Numerical integration of a function within a range
    c) The root of a function
    d) None of the above

Solution: (c) The root of a function

2. In ……, the search starts at the beginning of the list and checks every element in the list.
    a) Linear search
    b) Binary search
    c) Hash search
    d) Binary tree search

Solution: (a) Linear search

3. What is the worst-case time complexity of Linear Search?
    a) O(1)
    b) O(logn)
    c) O(n)
    d) $O(n^2)$

Answer: c) O(n)

Explanation: In the worst-case scenario, Linear Search may require O(n) time to find an element in an array of n elements.

4. What is the worst-case complexity of bubble sort?
    a) O(N log N)
    b) O(log N)
    c) O(N)
    d) $O(N^2)$

Solution: (d)
Explanation: Bubble sort works by starting from the first element and swapping the elements if required in each iteration. Therefore, in the worst case, the complexity is O(N^2).

5. What maximum number of comparisons can occur when a bubble sort is implemented? Assume there are n elements in the array.
    a) (1/2) (n-1)
    b) (1/2) n(n-1)
    c) (1/4) n(n-1)
    d) None of the above

Solution: (b)(½)n(n-1)

The total number of comparisons, therefore, is (n - 1) + (n - 2) ... (2) + (1) = n (n - 1)/2

6. What are the correct intermediate steps of the following data set when it is being sorted with the bubble sort? 7,4,1,8,2
   a) 4,7,1,8,2→4,1,7,2,8→4,1,2,7,8→1,4,2,7,8→1,2,4,7,8
   b) 4,7,1,8,2→4,1,7,8,2→4,1,7,2,8→1,4,7,2,8→1,4,2,7,8→1,2,4,7,8
   c) 4,7,1,8,2→1,4,7,8,2→1,4,2,7,8→1,2,4,7,8
   d) 4,7,1,8,2→4,7,1,2,8→1,4,7,2,8→1,4,2,7,8→1,2,4,7,8

Solution: (b) Bubble sort works by starting from the first element and swapping the elements if required in each iteration. Therefore, the order when the changes happen are as shown in the steps of the answer.

7. What is the main disadvantage of the Bisection Method?
   a) It is computationally expensive
   b) It cannot find complex roots
   c) It requires the function to be differentiable
   d) It is not guaranteed to converge

Answer: b) It cannot find complex roots

Explanation: The Bisection Method is only applicable for real roots and cannot find complex roots of a function.

8. What will be the output of the following snippet?

```
int arr[] = {10, 20, 30, 40, 50};
int *ptr1 = arr;
int *ptr2 = ptr1 + 3;
printf("%d", *ptr2 - *ptr1);
```

Solution: 30
ptr1 points to the first element (10), and ptr2 points to the fourth element (40). *ptr2 - *ptr1 will be 40−10=40−10=30.

9. What is the solution of the equation given below using the Bisection Method up to four decimal places? (Consider the root lying on positive quadrant only and compute the root till five iterations only)

$$f(x) = xe^{2x} - 3x^2 - 5$$

Solution: 1.0312 (short answer type)
The root lies between 1 and 2. Using bisection method, we can find the root as 1.0312 (up to three decimal accuracy)

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10. What will be the output?

```
#include <stdio.h>
int main(void)
{
int a[] = {10, 12, 6, 7, 2};
int i, *p;
p=a+4;
for(i=0; i<5; i++)
printf("%d ", p[-i]);
return 0;
}
```

a) 10 12 6 7 2
b) 10 12 6 7
c) 2 7 6 12
d) 2 7 6 12 10

Solution: (d) The pointer p after the operation p = a + 4, essentially points the last element of the array. Therefore, when the for loop iterates, it keeps printing from the last element to the beginning.