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***DEPARTMENT: COMPUTER SCIENCE***

***MATRIC NO: 210591123***

***COURSE: CSC 213***

1a. what is the time complexity for the following

1. for(int I = 0; I < n; i++) f(); ***solution:*** time complexity is O(n).
2. for(int I = 0; I < n; i++)

for(int j = 0; j <= i; j++)f(); ***solution:*** time complexity is O(n²).

1. for(int I = 0; I < n; i++)

for(int j = 0; j <= i; j++)f(); ***solution:*** time complexity is O(n²).

1. for(int I = 0; I < n; i++)

for(int j = 0; j < n; j++)

for(int k = 0; k < n; ++k)f(); ***solution:*** time complexity is O(n3).

1b. explain the following

1. **Data space:** it is anarea in a computer's memory where data is stored during program execution. It is a region of memory that holds variables, objects, arrays, and other data structures used by a program.
2. **Instruction Space**: it is the set of instructions or operations that are available to a computer or a programming language. It represents the range of actions or tasks that can be executed by a program.
3. **Environment space :** refers to the set of variables and their values that are accessible within a specific scope or context. It represents the memory area or data structure where variables are stored and can be accessed during program execution.

1c. **constant complexity** : takes the same amount of space regardless of the input size

*def sum\_of\_numbers(n):*

*total = 0*

*for i in range(1, n+1): total += I return total*

*result = sum\_of\_numbers(5)*

*print(result)*

**ii. Linear space complexity**: Linear space complexity, denoted as O(n), refers to an algorithm or program's space usage that grows linearly with the input size.

*def find\_duplicates(nums):*

*seen = set()*

*duplicates = []*

*for num in nums:*

*if num in seen:*

*duplicates.append(num)*

*else:*

*seen.add(num)*

*return duplicates*

*numbers = [1, 2, 3, 4, 5, 3, 2, 6]*

*result = find\_duplicates(numbers)*

*print(result)*

1d. state 4 purpose of memory in an algorithm

1. Memory is used to store the instructions of the program or algorithm
2. memory is used to store the local variables, parameters, and return addresses of the function
3. memory is dynamically allocated during runtime to create and manipulate data structures
4. Memory is used to store the input data, intermediate results, and final output