EC-351:INTRODUCTION TO ALGORITHMS

ASSIGNMENT-2

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Consider the following computational problems. Find out the Time complexity of all the problems. Write your comments and observations for each problem.

1)Find the sum of two numbers A and B.

ALGORITHM:

STEP 1: START
STEP 2: Input First number
STEP 3: Input Second number
STEP 4: Add
STEP 5: Display sum
STEP 6: STOP

Time Complexity-O(1)

The algorithm involves basic adding of two numbers and printing the output.There is no loop which would require more time in repetition of code.Hence this algorithm will need constant time i.e O(1).

Therefore Time complexity=O(n)

2)Convert temperature from Celsius(C) to Fahrenheit (F) and Fahrenheit to Celsius.

ALGORITHM:

STEP 1: START
STEP 2: Input temperature in Celsius(C) or Fahrenheit(F)
STEP 3: F = (9.0/5.0 x C) + 32
STEP 4: C = 5.0/9.0 (F - 32)
STEP 5: Display the result temperature
STEP 6: STOP

Time Complexity-O(1)

This algorithm is to convert temperature from Celsius(C) to Fahrenheit(F) if input in C and from Fahrenheit(F) to Celsius(C) if input in F. It involves basic arithmetic operations and printing the result.

Therefore Time complexity is O(1).

3)Find Area(A) and Perimeter (P) of a Square.

ALGORITHM:

STEP 1: START
STEP 2: Input the length(L) of the square
STEP 3: Compute A=L*L
STEP 4: Compute P=4*L
STEP 5: Display Area(A) and Perimeter(P)
STEP 6: STOP

Time Complexity-O(1)

The Algorithm inputs the side of a square to find its area(A) and Perimeter(P).The program involves only basic algorithmic operation that is multiplication to calculate both area and perimeter. Then it prints area and perimeter. It does not involve any loop or array. Hence it needs only constant time.

4)Find the Compound Interest (CI).

ALGORITHM:

STEP 1:	START	
STEP 2:	Input the values of P,N,R	P- Principal amount
STEP 3:	Compute CI=P(1+R/100)N - P	N- Time span
STEP 4:	Display CI	R- Rate of Interest
STEP 5:	STOP	

Time Complexity-O(1)

The Algorithm is used to compute Compound Interest(CI) using principal(P), rate of interest (R) and time(n). It outputs Compound interest by mathematical formula which involves basic operations.There is no loop involved for the computation.

Therefore Time complexity=O(1)

5)Swap Two Numbers using Temporary Variable.

ALGORITHM:

STEP 1: START
STEP 2: Input two numbers a and b
STEP 3: Display the numbers
STEP 4: Temp=a
STEP 5: a=b
STEP 6: b=Temp
STEP 7: Display the numbers.
STEP 8: STOP

Time Complexity-O(1)

The algorithm swaps two values using a third(temporary) variable.It stores the first value in the the temporary variable. Then the second value is stored in the first, and it gets replaced with the value of the temporary variable. And hence the two variables get swapped. There is no difficult computation nor any loop involved. So, it requires constant time.

Time complexity=O(1)+O(1)+O(1)= 3O(1) = O(1)

Therefore Time complexity=O(1)

6)Find the Smallest of two numbers A and B.

ALGORITHM:

STEP 1: START
STEP 2: Input two numbers A and B
STEP 3: If A<B
        Display A
    Else
        Display B
STEP 4: STOP

Time Complexity-O(1)

The algorithm involves an ‘if-else’ condition statement which will output A if it is less than B. Else it outputs B.It doesn't require more than a constant time to output the smallest of given two numbers.

Time complexity=O(1) **or** O(1)

(The program will display either the ‘if’ part or the ‘else’ part where both will require O(1) time because of a simple ‘print’ statement)

Therefore Time complexity=O(1).

7)Find the largest of three numbers A, B and C.

ALGORITHM:

STEP 1: START
STEP 2: Input three values A,B and C
STEP 3: If A>B
Goto STEP 5
STEP 4: If B>C
Display B
Else
Display C
Go to STEP 6
STEP 5: If A>C
Display A
Else
Display C
STEP 6: STOP

Time Complexity-O(1)

This algorithm involves comparing three values and prints the largest among them. It compares the first variable with the second and if true compares with the third one too. If it satisfies all the conditions, the output is the first variable. If the first condition is not true, the algorithm takes the second variable and compares it with the third one. If it is larger than the third variable, the algorithm outputs it ,else it will output the third variable. If the first variable is smaller than the third one, the algorithm prints the third variable as the maximum of all the three element. All the comparisons take constant time i.e O(1).

Hence O(1)+O(1)+O(1)+.... till one value is printed.
Hence Time complexity=O(n).

8)Find Even numbers between 1 to 50.

ALGORITHM:

STEP 1: START
STEP 2: Initialize i=1
STEP 3: If i>50
Goto STEP 7
STEP 4: IF (i%2==0)
Display i
STEP 5: i=i+1
STEP 6: Goto STEP 3
STEP 7: STOP

Time Complexity-O(1)

This algorithm prints the even numbers from 1 to 50. If it is divisible by 2, it's a even number else the loop variable is incremented and checked again.As the program involves no loop, there is only checking of a condition upto a constant limit.

Therefore, Time complexity=O(1)+O(1)+O(1)+O(1)+O(1)+O(1)+..... upto 50.

Hence the time complexity becomes O(1).

9) Find Sum of Series 1+2+3+.....+N.

ALGORITHM:

STEP 1: START
STEP 2: Input the value of N
STEP 3: Initialize i=1,sum=0
STEP 4: If i>N
Goto STEP 8
STEP 5: sum=sum+i
STEP 6: i=i+1
STEP 7: Goto STEP 4
STEP 8: Display sum
STEP 9: STOP

Time Complexity-O(N)

The Algorithm prints the sum of integers which involves looping of the function starting from i=1 up to i=N. Though the sum and the increment variable is replaced every time , the program has to keep record of its previous value adding more time to fetch and function. Hence time taken by the algorithm increases and so time complexity reaches O(n).