Design and Analysis of Algorithm Lab

Lab 2 – Selvakumar G (22MAI1004)

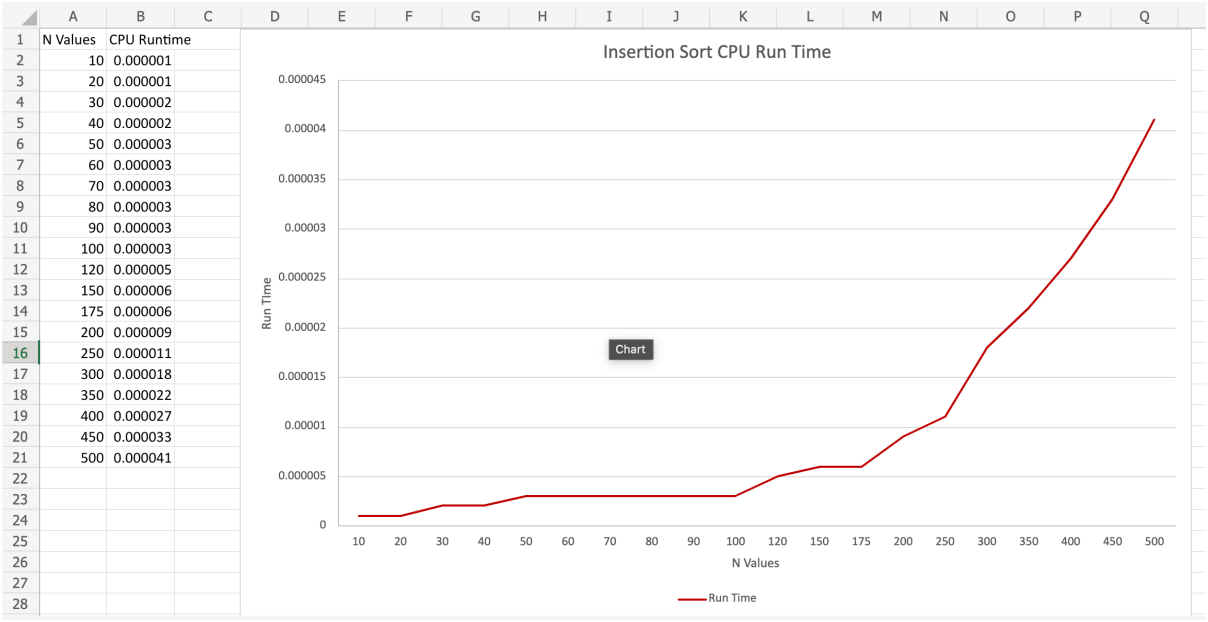
Program : Execution Time Analysis: Insertion Sort

Code:

```
#include <math.h>
#include <stdio.h>
#include<ctime>
#include<cstdlib>
#include <fstream>
#include<iostream>
using namespace std;

/* Function to sort an array
  using insertion sort*/
void insertionSort(int arr[], int n)
{
   int i, key, j;
   for (i = 1; i < n; i++)
   {
      key = arr[i];
      j = i - 1;

      /* Move elements of arr[0..i-1],
        that are greater than key,
        to one position ahead of
        their current position */
      while (j >= 0 && arr[j] > key)
      {
         arr[j + 1] = arr[j];
         j = j - 1;
      }
      arr[j + 1] = key;
   }
}

// A utility function to print
// an array of size n
void printArray(int arr[], int n)
{
   int i;
```

```
    for (i = 0; i < n; i++)
        printf("%d ", arr[i]);
    printf("\n");
}

// Driver code
int main()
{
    ofstream MyFile("executionTime.csv");

    for(int n = 1;  n <= 100000; n*=2)
    {
        int arr[n];

        for(int i = 0; i < n; i++)
        {
            arr[i] = rand();
        }

        clock_t tStart = clock();
        insertionSort(arr, n);
        double time1=(double)(clock() - tStart)/CLOCKS_PER_SEC;
        MyFile << n << "," << time1<< endl;
    }

    return 0;
}
```

Output:

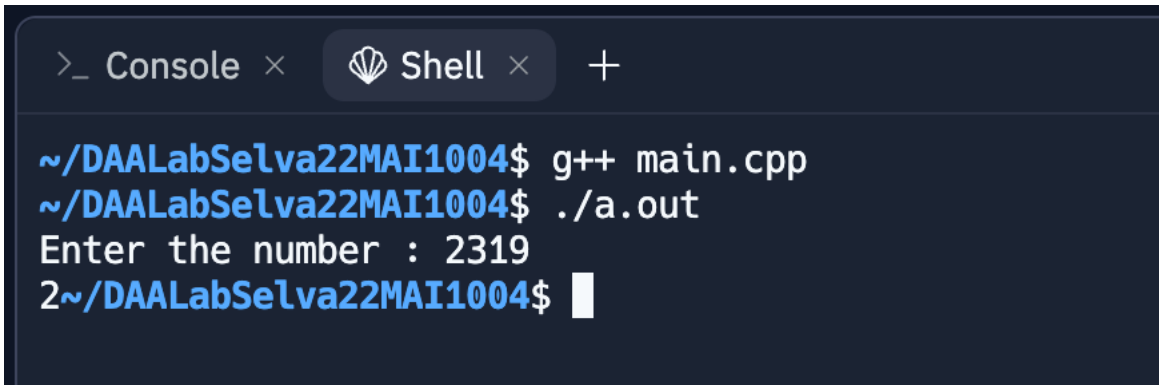


Program 1. Define function to find first digit of a number

Code:

```
#include<iostream>
using namespace std;
void PrintLastDigit(int n){
   if(n > 10){
      PrintLastDigit(n/10);
   }
   else{
      cout<<n;
   }
}
int main()
{
   int n;
   std::cout<<"Enter the number : ";
   std::cin>>n;
   PrintLastDigit(n);
   return 0;
}
```

Output:

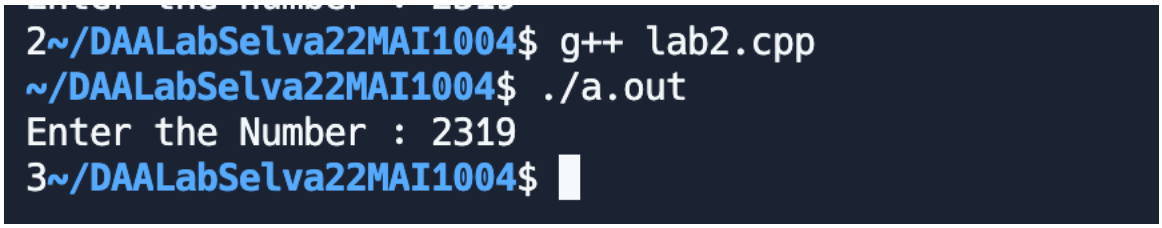


Program 2. Define function to find second digit of a number.

Code:

```
#include<iostream>
using namespace std;

void PrintSecondDigit(int n)
{
   if(n > 100)
   {
      PrintSecondDigit(n/10);
   }

   else
      cout<<n%10;
}

int main()
{
   int n;

   cout<<"Enter the Number : ";
   cin>>n;

   if(n < 10){
      cout<<"Please enter numbers having atleast 2 digits!! Try again.."<<endl;
   }
   else
      PrintSecondDigit(n);

   return 0;
}
```

Output:



Program 3. Define function to find the number of digits.

Code:

```
#include<iostream>
using namespace std;

int GetNumberOfDigits(int n){
   if(n < 10){
      return 1;
   }

   return 1 + GetNumberOfDigits(n / 10);
}

int main(){

   int n;
   cout<<"Enter the number : ";
   cin>>n;

   cout<<GetNumberOfDigits(n);

   return 0;
}
```

Output:

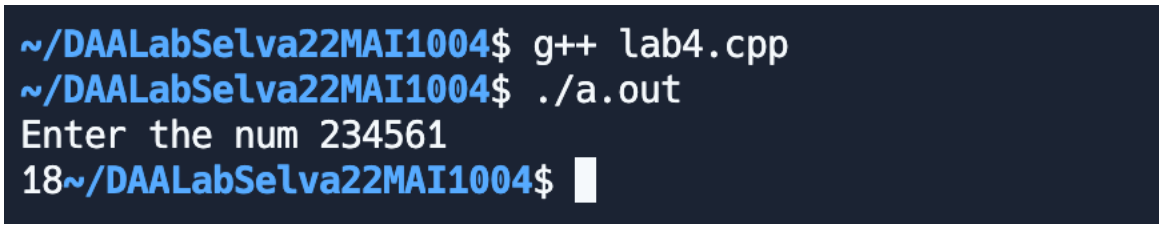
```
~/DAALabSelva22MAI1004$ g++ lab3.cpp
~/DAALabSelva22MAI1004$ ./a.out
Enter the number : 231908
6~/DAALabSelva22MAI1004$
```

Program 4. Define function to find sum of digits except second digit. sum(231456)=2+1+4+5+6=18.

Code:

```
#include<iostream>
using namespace std;

int SumDigits(int n){

   if(n < 10)
      return n;

   if(n > 10 && n < 100){
      return SumDigits(n/10);
   }

   return (n % 10) + SumDigits(n / 10);
}

int main(){
   int n;
   cout<<"Enter the num ";
   cin>>n;

   cout<<SumDigits(n);

   return 0;
}
```

Output:

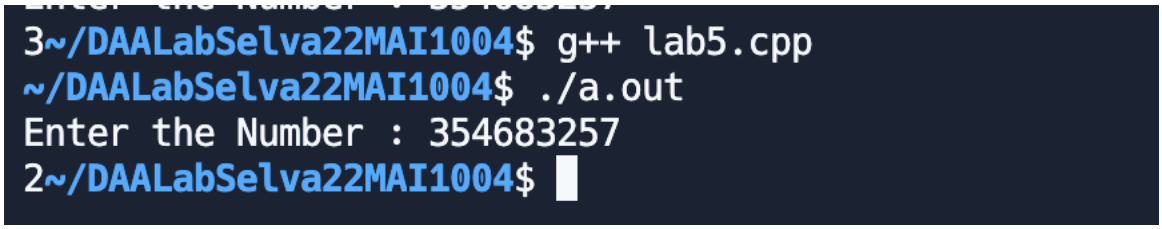


Program 5. Define function to find last even digit. f(354683257) returns 2

Code:

```
#include<iostream>
using namespace std;

void PrintLastEven(int n){
   if((n % 10) % 2 == 0){
      cout<< n % 10;
   }

   else{
      PrintLastEven(n / 10);
   }
}

int main(){
   int n;

   cout<<"Enter the Number : ";
   cin>>n;

   PrintLastEven(n);

   return 0;
}
```

Output:

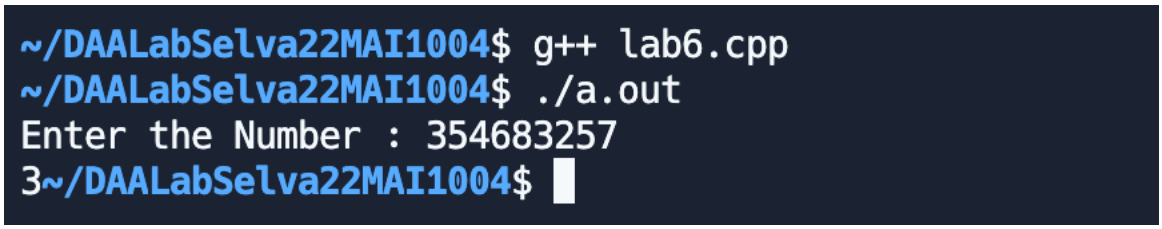


Program 6. Define function to find digit before last even digit. f(354683257) returns 3

Code:

```
#include<iostream>
using namespace std;

void PrintLastEven(int n){
   if((n % 10) % 2 == 0){
      if(n > 10)
         cout<< (n / 10) % 10;
   }

   else{
      PrintLastEven(n / 10);
   }
}

int main(){
   int n;

   cout<<"Enter the Number : ";
   cin>>n;

   PrintLastEven(n);

   return 0;
}
```

Output:

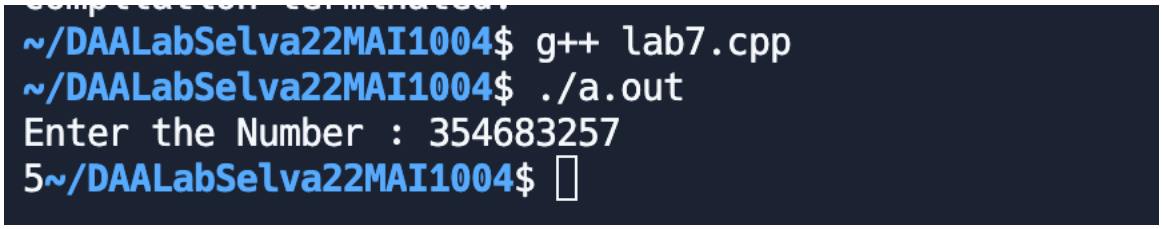


Program 7. Define function to find digit after last even digit. f(354683257) returns 5.

Code:

```
#include <iostream>
using namespace std;

void PrintLastEven(int n){
   if(n > 10 && ((n / 10) % 10) % 2 == 0){
         cout<< n % 10;
   }

   else{
      PrintLastEven(n / 10);
   }
}

int main(){
   int n;

   cout<<"Enter the Number : ";
   cin>>n;

   PrintLastEven(n);

   return 0;
}
```

Output:



Program 8. Define function to find the location of the last even digit from last. e.g. in 354683257 the last even digit is 2 and its location from last is 3.

Code:

```
#include<iostream>
using namespace std;

void PrintLastEven(int n, int pos){
   if((n % 10) % 2 == 0){
      cout<< "Digit : "<< n % 10 << " Location : " << pos;
   }

   else{
      PrintLastEven(n / 10, pos+1);
   }
}

int main(){
   int n;

   cout<<"Enter the Number : ";
   cin>>n;

   PrintLastEven(n, 1);

   return 0;
}
```

Output:

```
~/DAALabSelva22MAI1004$ g++ lab8.cpp
~/DAALabSelva22MAI1004$ ./a.out
Enter the Number : 354683257
Digit : 2 Location : 3~/DAALabSelva22MAI1004$
```

Program 9. Define function int g(int x, int k). It finds kth digit (from last) of number x. g(2536487,3) returns 4.

Code:

```
#include<iostream>
using namespace std;

void PrintLastEven(int n, int pos, int currentPos){
   if(pos == currentPos){
      cout<< "Digit : "<< n % 10;
   }

   else{
      PrintLastEven(n / 10, pos, currentPos + 1);
   }
}

int main(){
   int n;
   int pos;

   cout<<"Enter the Number : ";
   cin>>n;
   cout<<"Enter the position : ";
   cin>>pos;

   PrintLastEven(n, pos, 1);

   return 0;
}
```

Output:

```
~/DAALabSelva22MAI1004$ g++ lab9.cpp
~/DAALabSelva22MAI1004$ ./a.out
Enter the Number : 2536487
Enter the position : 3
Digit : 4~/DAALabSelva22MAI1004$
```

Program 10. Define function to find sum of even digits.

Code:

```
#include<iostream>
using namespace std;

int SumEvenDigits(int n){
   if(n < 10){
      if(n % 2 == 0) return n;

      return 0;
   }

   if((n % 10) % 2 == 0){
      return (n % 10) + SumEvenDigits(n / 10);
   }

   return SumEvenDigits(n / 10);
}

int main(){
   int n;

   cout<<"Enter the Number : ";
   cin>>n;

   cout<<SumEvenDigits(n);

   return 0;
}
```

Output: