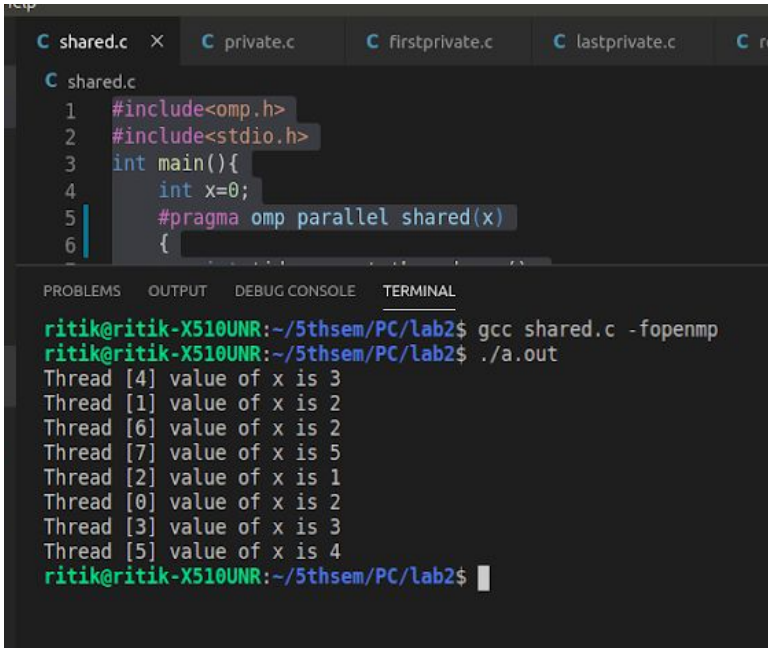
Ritik Pansuriya(181IT237):

Assignment lab_2:

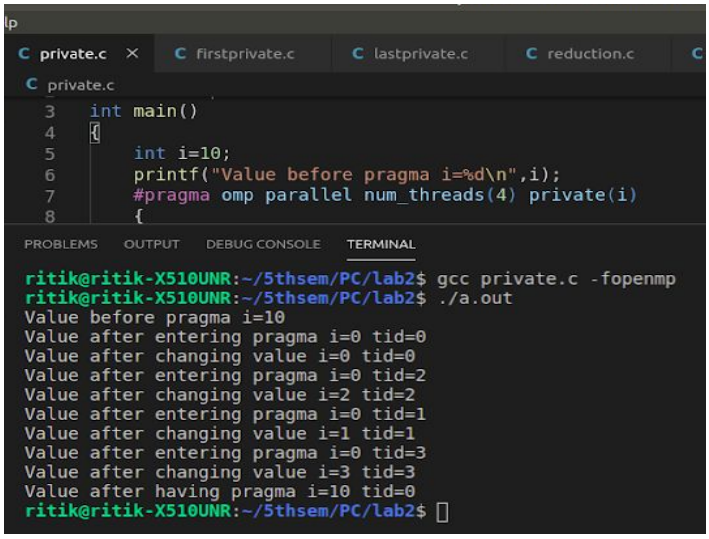
1. Program 1 : **As X is a shared variable, all the threads will change it's value**.
Aim: To understand and analyze shared clause in parallel directive

```c
#include<omp.h>

#include<stdio.h>

int main(){

   int x=0;

   #pragma omp parallel shared(x)

   {

        int tid=omp_get_thread_num();

        x=x+1;

        printf("Thread [%d] value of x is %d \n",tid,x);

   }

}
```



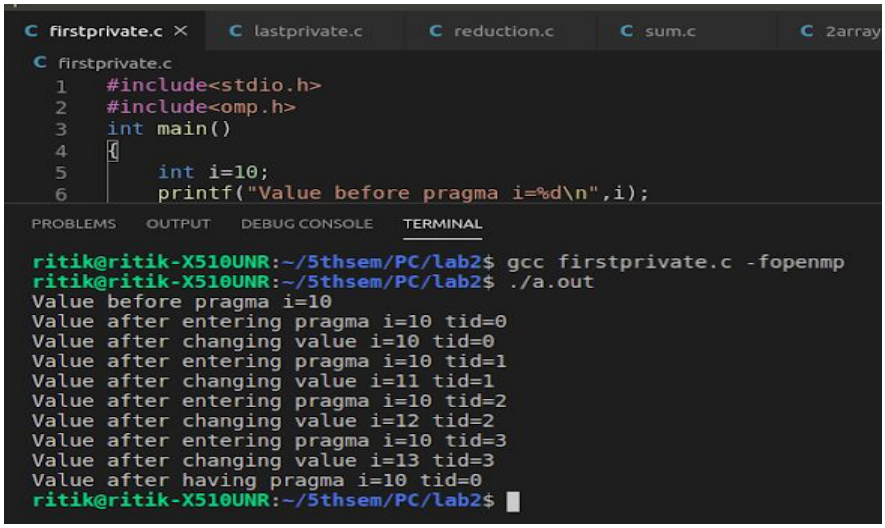
2. Program 2: Learn the concept of private():
As i variable is private so no thread can see other threads i value and (i=0) in all.

```c
#include<stdio.h>

#include<omp.h>

int main()

{

   int i=10;

   printf("Value before pragma i=%d\n",i);

   #pragma omp parallel num_threads(4) private(i)

   {

       printf("Value after entering pragma i=%d tid=%d\n",i,
omp_get_thread_num());

       i=i+omp_get_thread_num(); //adds thread_id to i

       printf("Value after changing value i=%d tid=%d\n",i,
omp_get_thread_num());

   }

   printf("Value after having pragma i=%d tid=%d\n",i,
omp_get_thread_num());

}
```



*Note down the result by changing private() to firstprivate() : **Here When we change to Firstprivate i=10 is initialized to all(private) i in each thread thus we can observe Addition in output.**

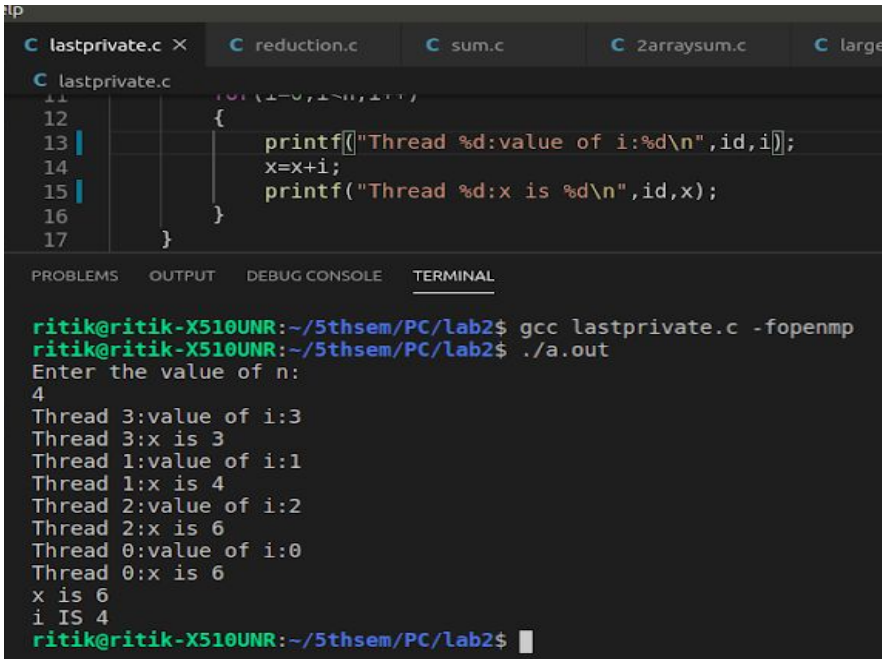
```c
#include<stdio.h>

#include<omp.h>

int main()

{

   int i=10;

   printf("Value before pragma i=%d\n",i);

   #pragma omp parallel num_threads(4) firstprivate(i)

   {

       printf("Value after entering pragma i=%d tid=%d\n",i,
omp_get_thread_num());

       i=i+omp_get_thread_num(); //adds thread_id to i

       printf("Value after changing value i=%d tid=%d\n",i,
omp_get_thread_num());

   }

   printf("Value after having pragma i=%d tid=%d\n",i,
omp_get_thread_num());

}
```



3. Program 3 : Learn the working of lastprivate() clause:

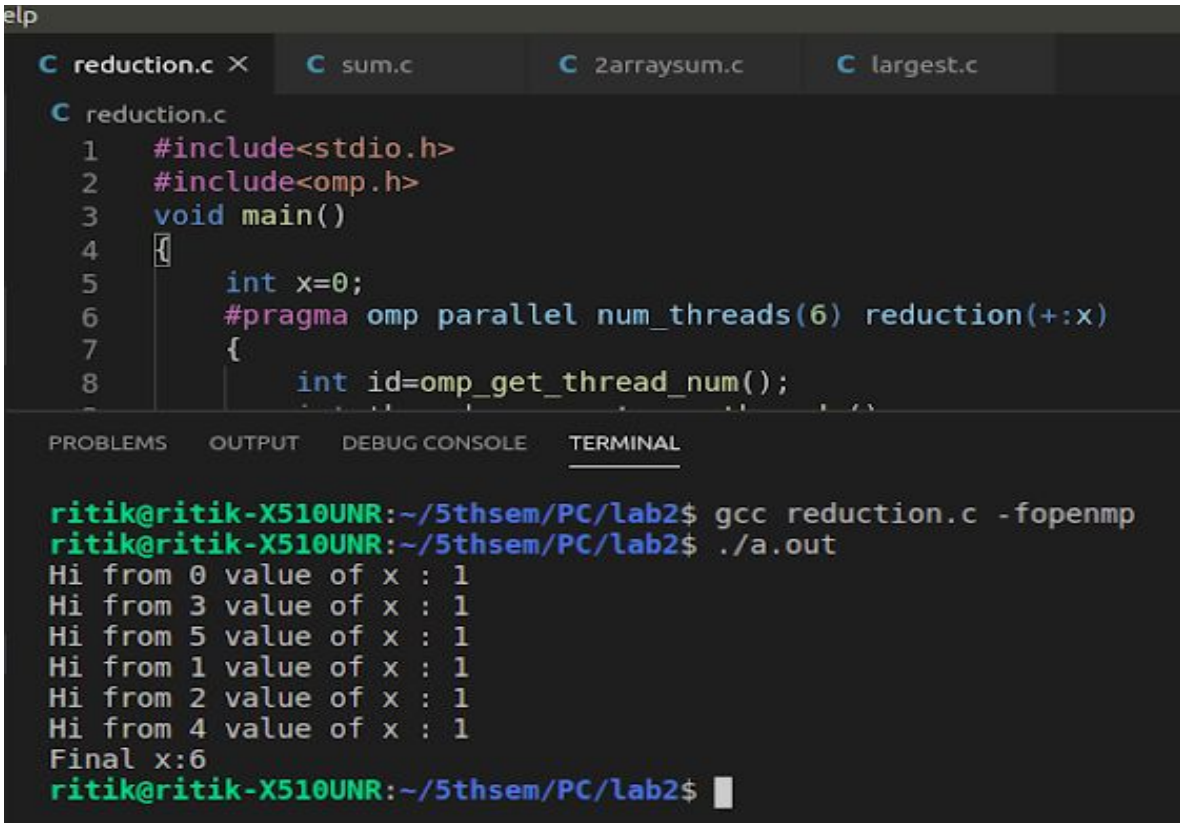
Here we used lastprivate so we can see that value of x is stored as the value of x In last iteration (which is thead 0) and equals 6.

```c
#include<stdio.h>
#include<omp.h>
void main(){
   int x=0,i,n;
   printf("Enter the value of n: \n");
   scanf("%d",&n);
   #pragma omp parallel
   {
       int id=omp_get_thread_num();
       #pragma omp for lastprivate(i)
       for(i=0;i<n;i++)
       {
           printf("Thread %d:value of i:%d\n",id,i);
           x=x+i;
           printf("Thread %d:x is %d\n",id,x);
       }
   }
   printf("x is %d\n",x);
   printf("i IS %d\n",i);
}
```



4. Demonstration of reduction clause in parallel directive.
Here x is used as in reduction clause where each thread will perform execution And then automatically adds the partial value of x for all threads to shared x. Also value of x in each thread is initialized as outer value of x.

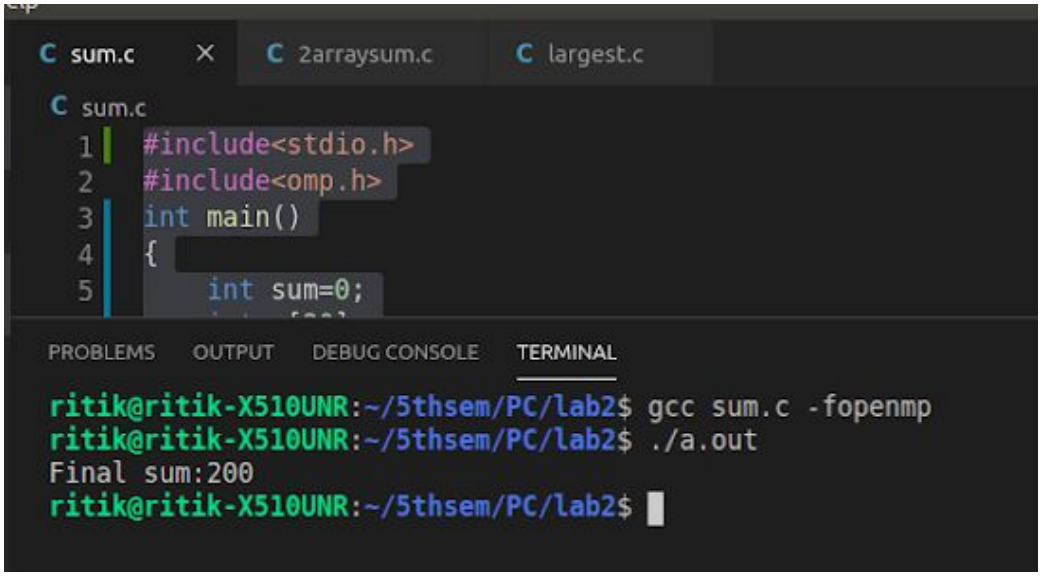
```c
#include<stdio.h>
#include<omp.h>
void main()
{
   int x=0;
   #pragma omp parallel num_threads(6) reduction(+:x)
   {
       int id=omp_get_thread_num();
       int threads=omp_get_num_threads();
       x=x+1;
       printf("Hi from %d value of x : %d\n",id,x);
   }
   printf("Final x:%d\n",x);
}
```



1. Write a parallel program to calculate the sum of elements in an array

Here i used reduction to calculate the sum because each thread in its iteration Will add corresponding array elements(defined by start and end) and atlast final addition of all partial sums will be done automatically due to the reduction clause. I took size of the array as 20 here which can change accordingly.

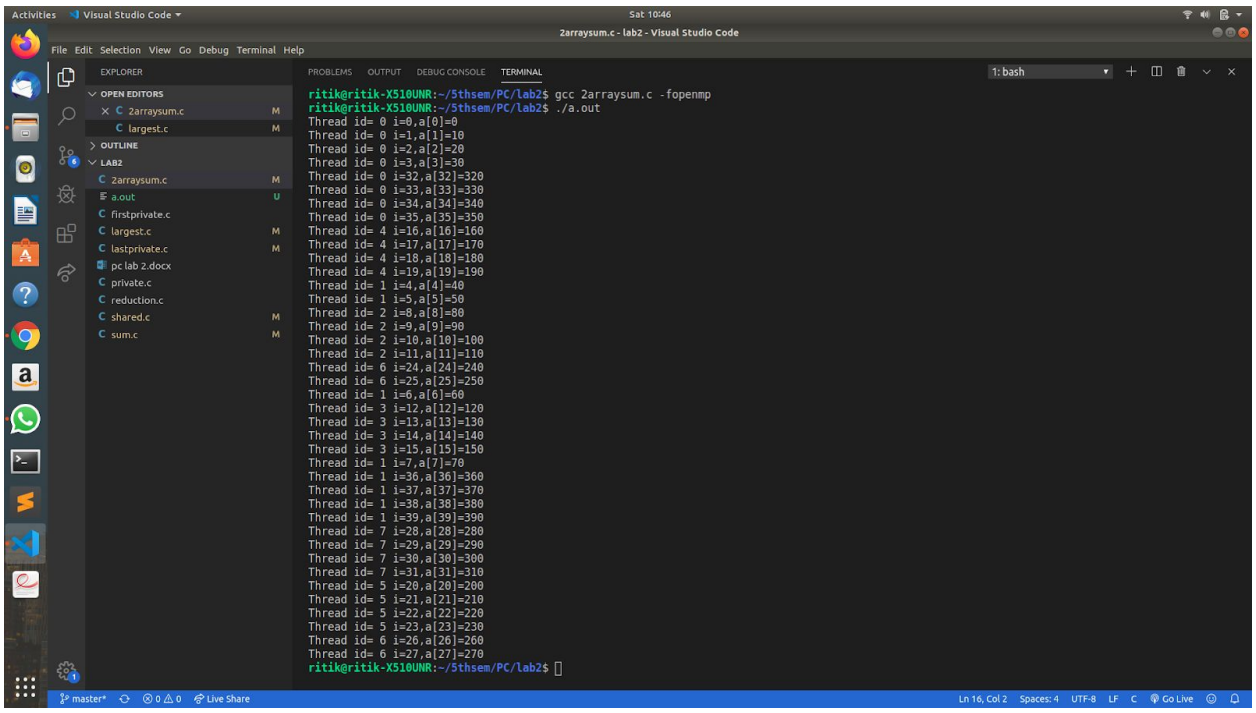
```c
#include<stdio.h>
#include<omp.h>
int main()
{
   int sum=0;
   int a[20];
   for(int i=0;i<20;i++) a[i]=10;
   #pragma omp parallel reduction(+:sum)
   {
       int id=omp_get_thread_num();
       int threads=omp_get_num_threads();
       int start=20*id/threads;
       int end=20*(id+1)/threads;
       for(int i=start; i<end; i++) sum=sum+a[i];
   }
   printf("Final sum:%d\n",sum);
   return 0;
}
```



2. Write a parallel program to calculate the a[i]=b[i]+c[i], for all elements in array b[] and c[].

Here I used normal schedule with static and chuck size 4, with number of threads As 8. It will be statically allocated the iterations to each thread in a round robin Pattern. Thus each index is allocated to one of the threads and they will calculate the sum and store it in the array "a".

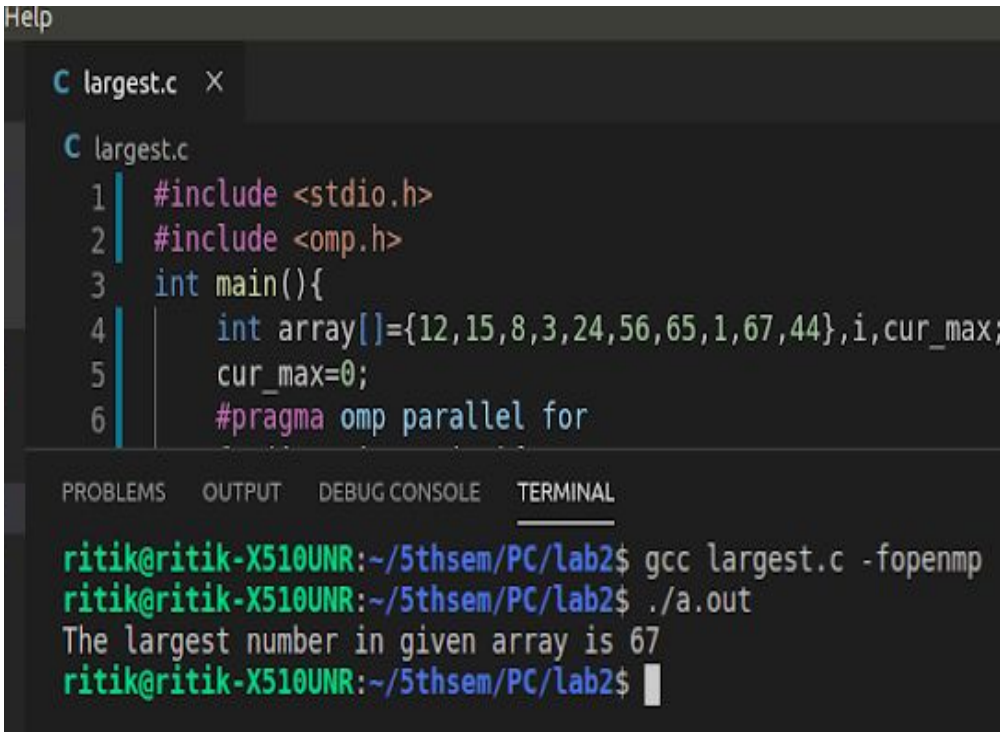
```
#include<omp.h>

#include<stdio.h>

int main(){

   int i,n=40;

   int a[40],b[40],c[40];

   for(i=0;i<n;i++){

       b[i]=i*4;

       c[i]=i*6;

   }

   #pragma omp parallel for schedule(static,4)

   for(i=0;i<n;i++)

   {

       a[i]=b[i]+c[i];

       printf("Thread id= %d i=%d,a[%d]=%d\n",
omp_get_thread_num(),i,i,a[i]);

   }

}
```



3. Write a parallel program to find the largest among all elements in an array.

Here I have a cur_max variable which store max element till now and will check If the current value is greater than max then we will update cur_max variable. Here critical construct restricts execution of the associated structured block to a single thread at a time. Because for last element to check we don't want That all the thread do that if we don't include the critical construct then it will Miss the last element if greatest.

```
#include <stdio.h>
#include <omp.h>
int main(){
   int array[]={12,15,8,3,24,56,65,1,67,44},i,cur_max;
   cur_max=0;
   #pragma omp parallel for
   for(i=0; i<10; i++){
       if(array[i]>cur_max)
           #pragma omp critical
               if(array[i]>cur_max)
                   cur_max=array[i];
   }
   printf("The largest number in given array is %d\n",cur_max);
   return 0;
}
```


Help
largest.c
largest.c
#include <stdio.h>
#include <omp.h>
int main(){
int array[]={12,15,8,3,24,56,65,1,67,44},i,cur_max;
cur_max=0;
#pragma omp parallel for
PROBLEMS
OUTPUT
DEBUG CONSOLE
TERMINAL
ritik@ritik-X510UNR:~/5thsem/PC/lab2$ gcc largest.c -fopenmp
ritik@ritik-X510UNR:~/5thsem/PC/lab2$ ./a.out
The largest number in given array is 67
ritik@ritik-X510UNR:~/5thsem/PC/lab2$
