NATIONAL INSTITUTE OF TECHNOLOGY KARNATAKA SURATHKAL
DEPARTMENT OF INFORMATION TECHNOLOGY

IT 301 Parallel Computing LAB 2

19th August 2020

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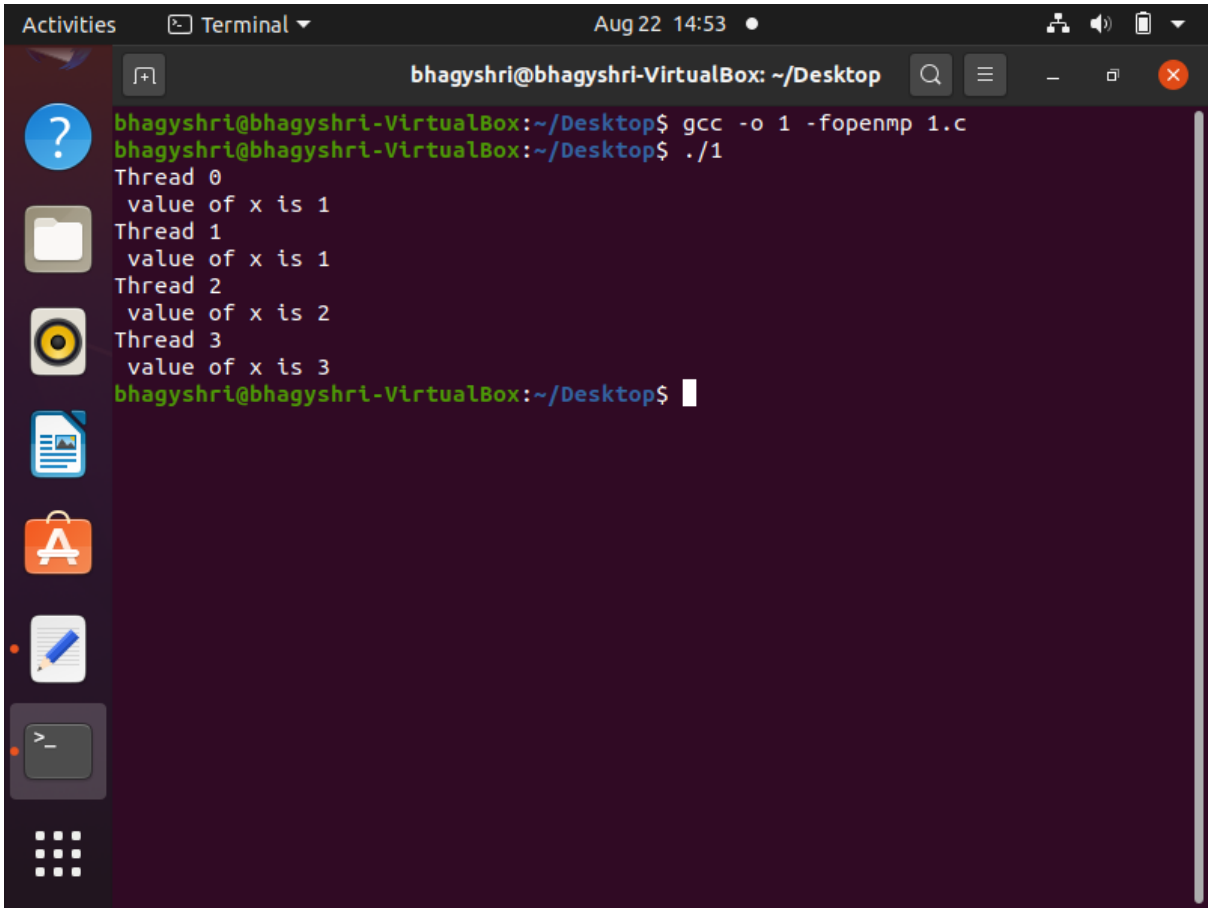
Program 1:

To understand and analyze shared clause in parallel directive.

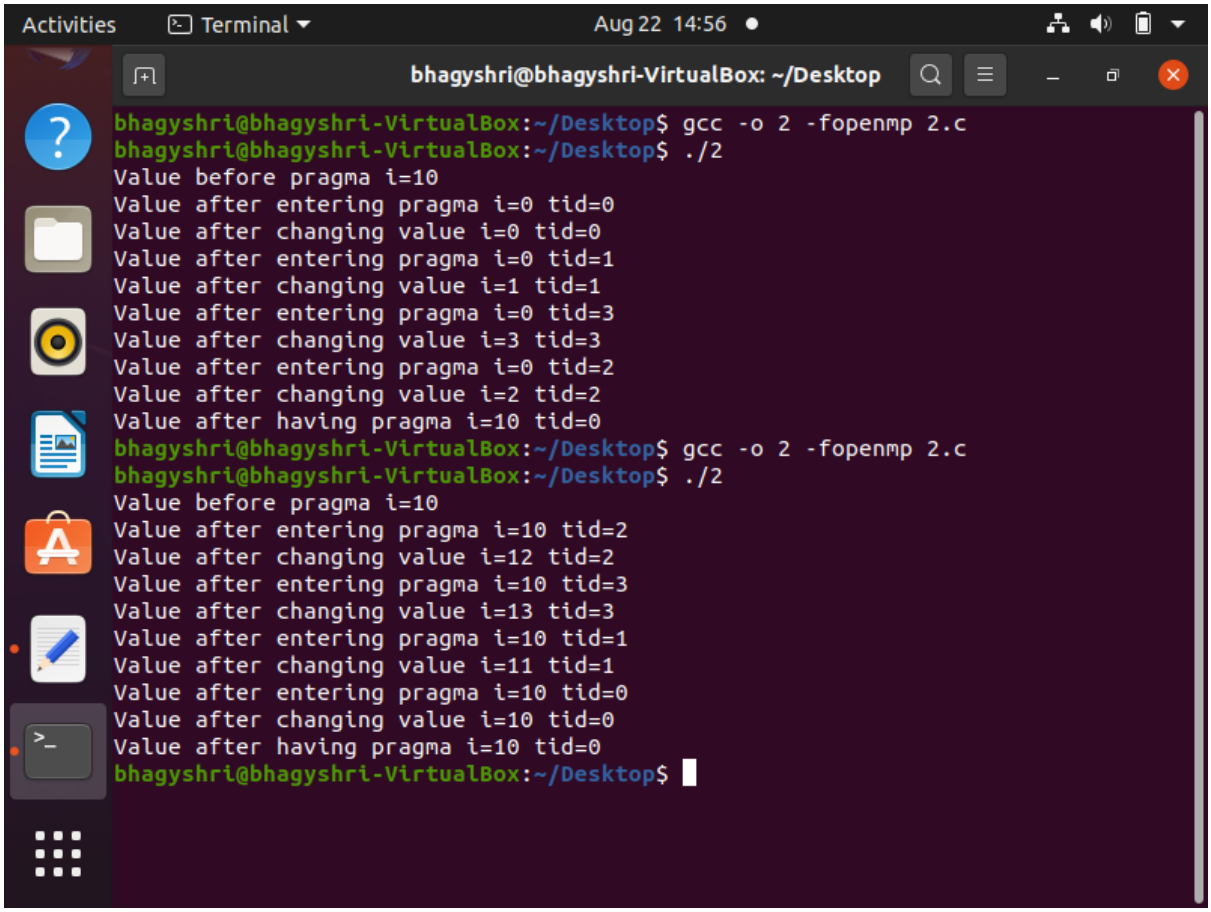


Value 1 is shared by three threads 1,0

2. Program 2

Learn the concept of private (), firstprivate ()

private() Each thread 0, 1, 2 and 3 has its own instance of variable i=0

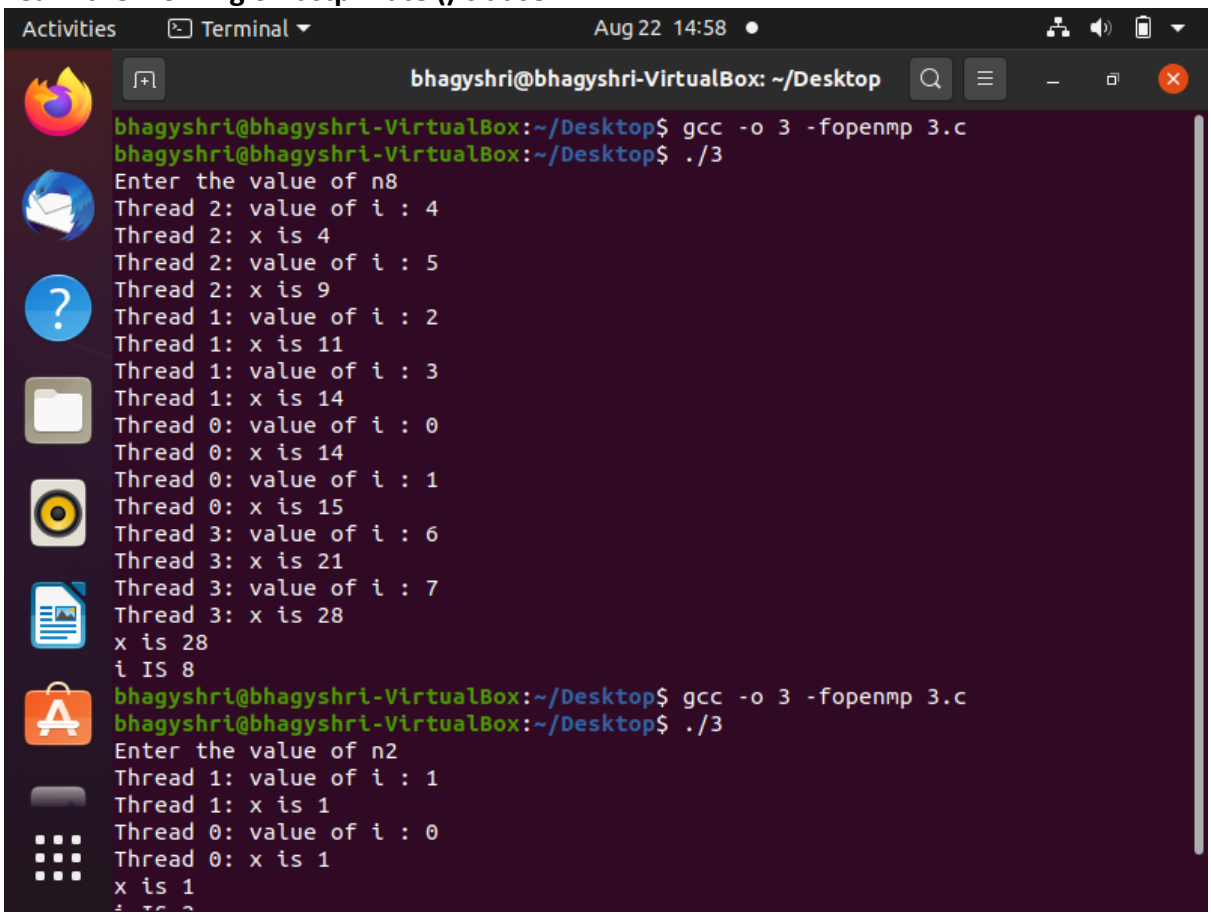


firstprivate()

Every thread 0, 1, 2 and 3 has its own instance of the variable and the variable is initialized with the value of the variable. The threads 0, 1, 2 and 3 have i=10.

3. Program 3

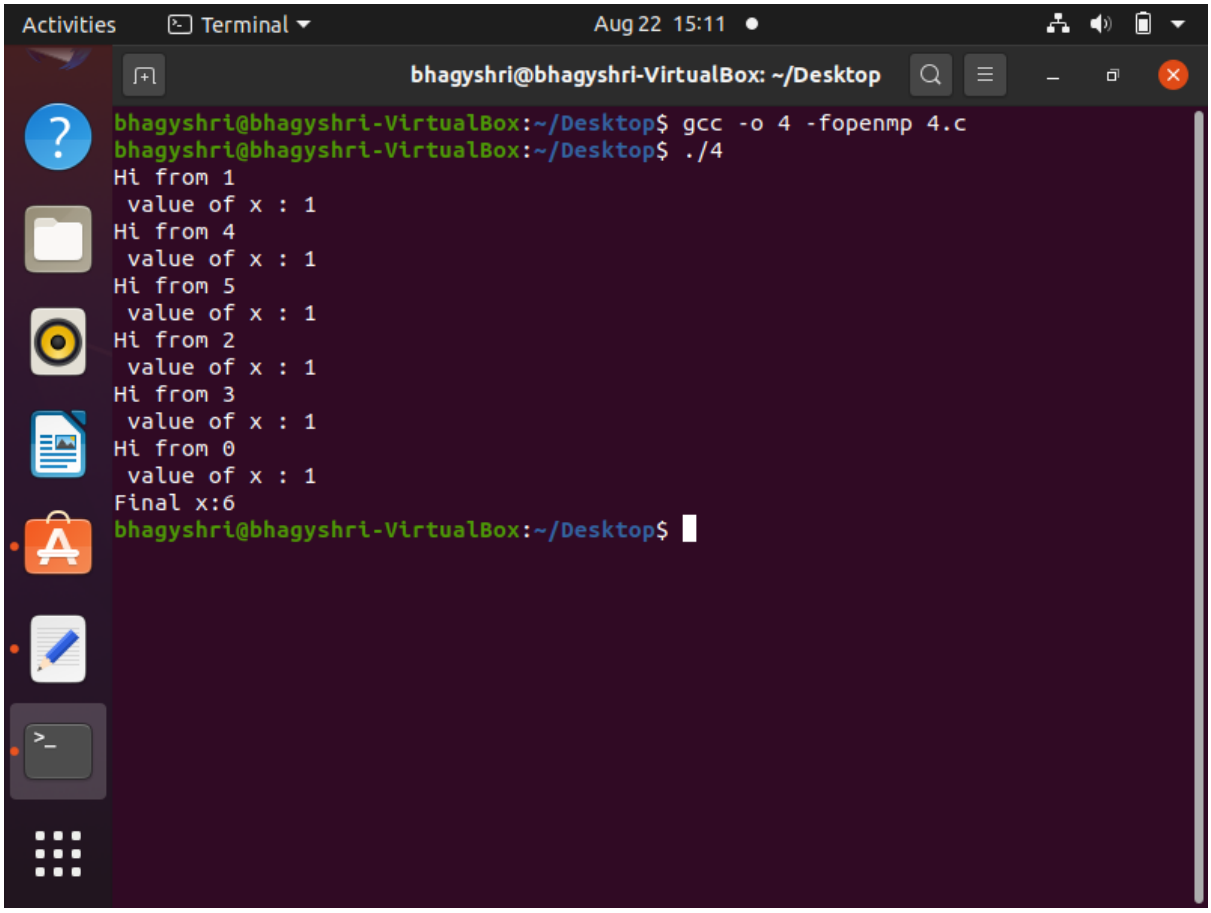
Learn the working of lastprivate () clause:



The value of x at the next iteration is i of the current iteration+ value of x at the previous iteration. The variable that is set equal to the private version of a particular thread executes the final iteration or the last section.

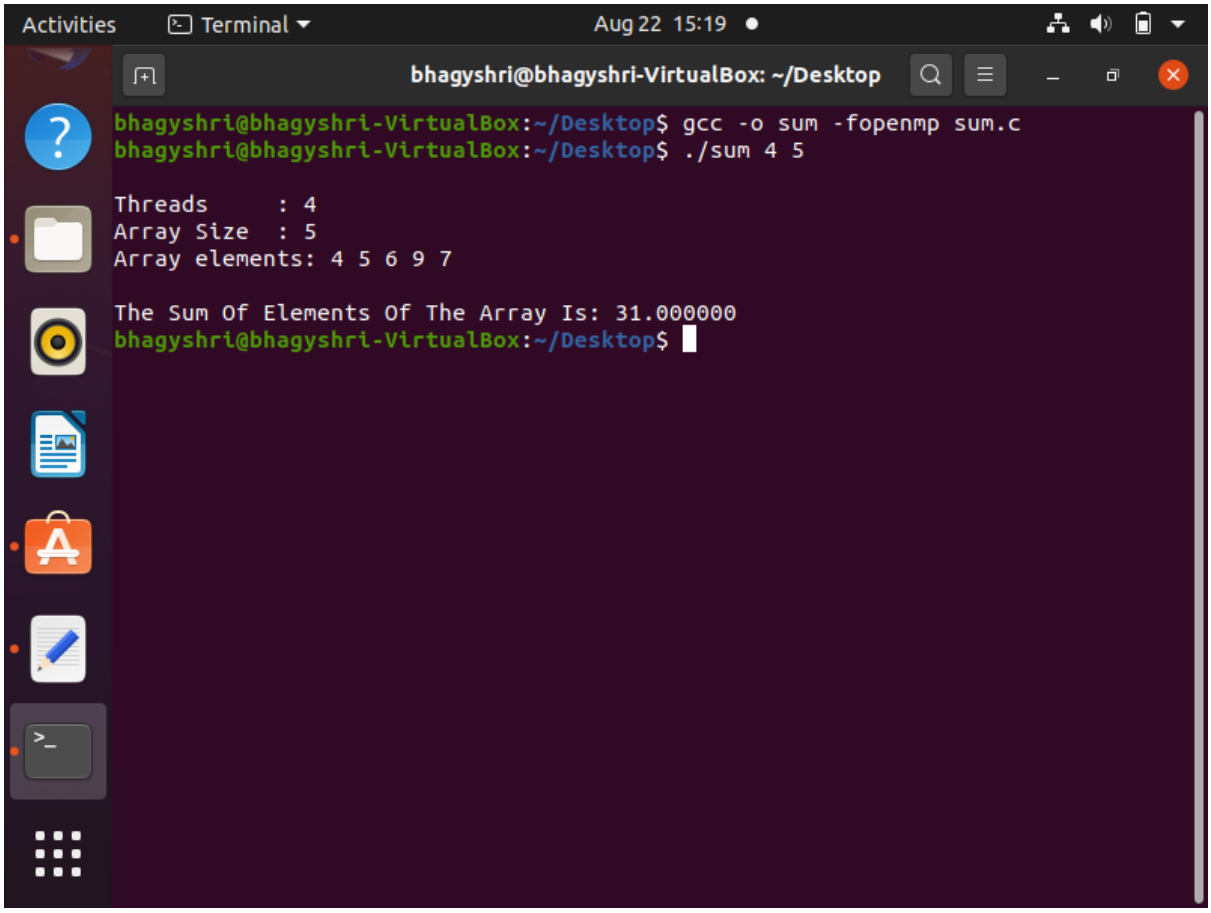
4. Program 4

Demonstration of reduction clause in parallel directive.


Activities
Terminal
Aug 22 15:11
bhagyshri@bhagyshri-VirtualBox: ~/Desktop
bhagyshri@bhagyshri-VirtualBox:~/Desktop$ gcc -o 4 -fopenmp 4.c
bhagyshri@bhagyshri-VirtualBox:~/Desktop$ ./4
Hi from 1
value of x : 1
Hi from 4
value of x : 1
Hi from 5
value of x : 1
Hi from 2
value of x : 1
Hi from 3
value of x : 1
Hi from 0
value of x : 1
Final x:6
bhagyshri@bhagyshri-VirtualBox:~/Desktop$

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

```
#include<stdio.h>
#include<omp.h>
#include<stdlib.h>
int main(int argc , char **argv)
{
       double *Array, sum;
       int array_size, i,threads, number;
        if( argc != 3 )
        {
           printf("Very Few Arguments\n ");
           printf("Syntax : exec <Threads> <array-size>\n");
           exit(-1);
        }

        threads=atoi(argv[1]);
        if ((threads!=1) && (threads!=2) && (threads!=4) &&
(threads!=8) && (threads!= 16) )
        {
               printf("\nNumber of threads should be 1,2,4,8 or 16 for
the execution of program. \n\n");
               exit(-1);
        }
        array_size=atoi(argv[2]);
       if (array_size <= 0) {
              printf("\nArray Size Should Be Of Positive Value ");
              exit(1);
       }

        printf("\nThreads     : %d ",threads);
        printf("\nArray Size  : %d ",array_size);
       Array = (double *) malloc(sizeof(double) * array_size);
       printf("\nArray elements: ");

       for (i = 0; i < array_size; i++) {
              scanf("%d",&number);
              Array[i] = number;
       }

       sum=0.0;
       omp_set_num_threads(threads);
#pragma omp parallel for
       for (i = 0; i < array_size; i++)
    {
#pragma omp critical
              sum = sum + Array[i];
    }
       free(Array);

       printf("\nThe Sum Of Elements Of The Array Is: %lf\n", sum);
       return 0;
}
```

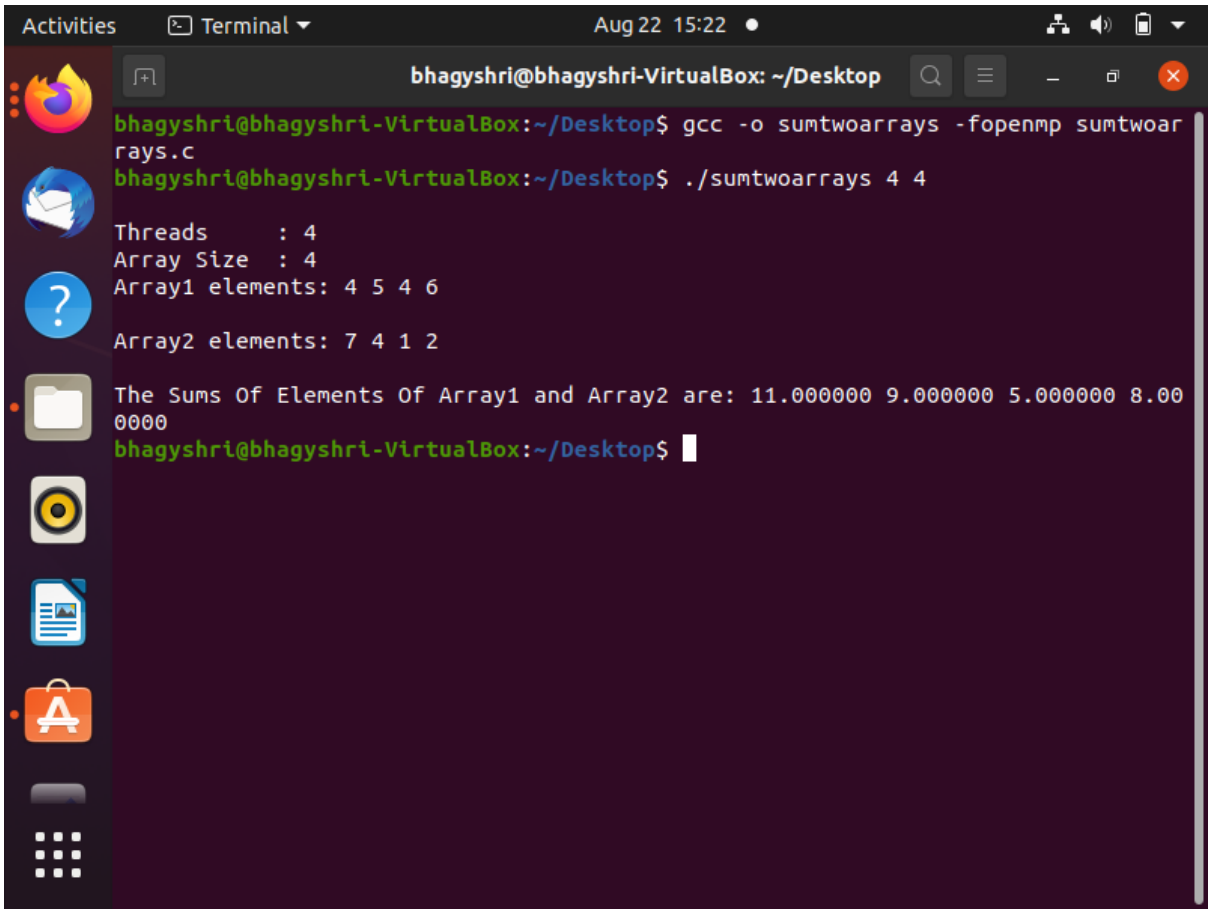

Activities
Terminal
Aug 22 15:19
bhagyshri@bhagyshri-VirtualBox: ~/Desktop
bhagyshri@bhagyshri-VirtualBox:~/Desktop$ gcc -o sum -fopenmp sum.c
bhagyshri@bhagyshri-VirtualBox:~/Desktop$ ./sum 4 5
Threads : 4
Array Size : 5
Array elements: 4 5 6 9 7
The Sum Of Elements Of The Array Is: 31.000000
bhagyshri@bhagyshri-VirtualBox:~/Desktop$

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

```
#include<stdio.h>
#include<omp.h>
#include<stdlib.h>
int main(int argc , char **argv)
{
        double *Array, *Array1, *Array2, sum;
        int array_size, i,threads, number;
         if( argc != 3 )
         {
            printf("Very Few Arguments\n ");
            printf("Syntax : exec <Threads> <array-size>\n");
            exit(-1);
         }

         threads=atoi(argv[1]);
         if ((threads!=1) && (threads!=2) && (threads!=4) &&
(threads!=8) && (threads!= 16) )
         {
                printf("\nNumber of threads should be 1,2,4,8 or 16 for
the execution of program. \n\n");
                exit(-1);
         }
         array_size=atoi(argv[2]);
        if (array_size <= 0) {
               printf("\nArray Size Should Be Of Positive Value ");
               exit(1);
        }

    printf("\nThreads     : %d ",threads);
    printf("\nArray Size  : %d ",array_size);
    Array = (double *) malloc(sizeof(double) * array_size);
        Array1 = (double *) malloc(sizeof(double) * array_size);
        Array2 = (double *) malloc(sizeof(double) * array_size);
        printf("\nArray1 elements: ");

        for (i = 0; i < array_size; i++) {
               scanf("%d",&number);
               Array1[i] = number;
        }
        printf("\nArray2 elements: ");

        for (i = 0; i < array_size; i++) {
               scanf("%d",&number);
               Array2[i] = number;
        }
        omp_set_num_threads(threads);
#pragma omp parallel for
        for (i = 0; i < array_size; i++)
    {
#pragma omp critical
               Array[i] = Array1[i] + Array2[i];
    }
```

```
        printf("\nThe Sums Of Elements Of Array1 and Array2 are: ");
        for (i = 0; i < array_size; i++)
        {
                printf("%lf ",Array[i]);
        }
        printf("\n");
        free(Array1);
        free(Array2);
        free(Array);
        return 0;
}
```

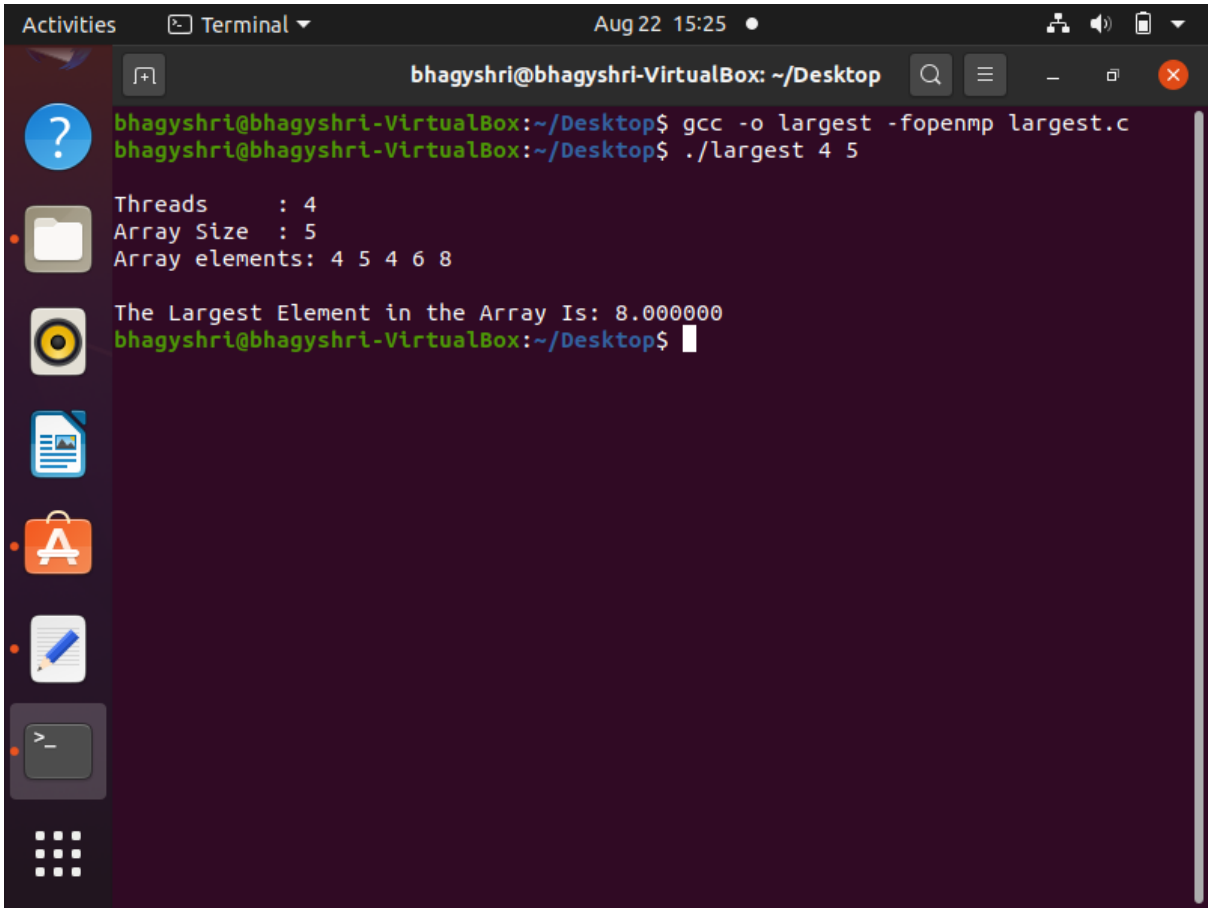
output



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

```
#include<stdio.h>
#include<omp.h>
#include<stdlib.h>
int main(int argc , char **argv)
{
       double *Array, largest;
       int array_size, i,threads, number;
        if( argc != 3 )
        {
           printf("Very Few Arguments\n ");
           printf("Syntax : exec <Threads> <array-size>\n");
           exit(-1);
        }

        threads=atoi(argv[1]);
        if ((threads!=1) && (threads!=2) && (threads!=4) &&
(threads!=8) && (threads!= 16) )
        {
               printf("\nNumber of threads should be 1,2,4,8 or 16 for
the execution of program. \n\n");
               exit(-1);
        }
        array_size=atoi(argv[2]);
       if (array_size <= 0) {
              printf("\nArray Size Should Be Of Positive Value ");
              exit(1);
       }

        printf("\nThreads     : %d ",threads);
        printf("\nArray Size  : %d ",array_size);
       Array = (double *) malloc(sizeof(double) * array_size);
       printf("\nArray elements: ");

       for (i = 0; i < array_size; i++) {
              scanf("%d",&number);
              Array[i] = number;
       }
       largest=Array[0];
       omp_set_num_threads(threads);
#pragma omp parallel for
       for (i = 0; i < array_size; i++)
    {
#pragma omp critical
       if(Array[i]>=largest) largest = Array[i];
    }


       printf("\nThe Largest Element in the Array Is: %lf\n", largest);
    free(Array);
       return 0;
}
```

output


Activities
Terminal
Aug 22 15:25
bhagyshri@bhagyshri-VirtualBox: ~/Desktop
bhagyshri@bhagyshri-VirtualBox:~/Desktop$ gcc -o largest -fopenmp largest.c
bhagyshri@bhagyshri-VirtualBox:~/Desktop$ ./largest 4 5
Threads : 4
Array Size : 5
Array elements: 4 5 4 6 8
The Largest Element in the Array Is: 8.000000
bhagyshri@bhagyshri-VirtualBox:~/Desktop$