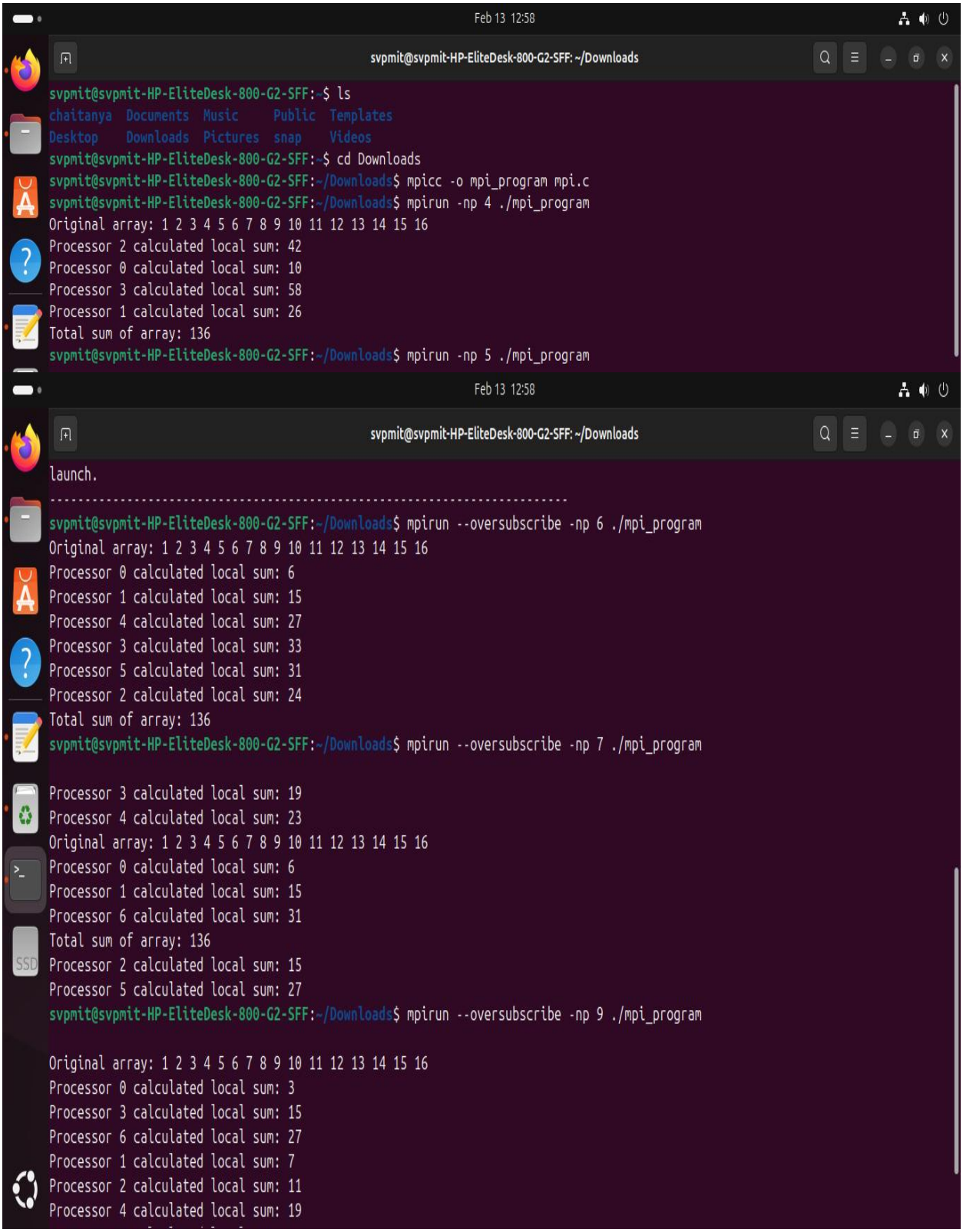
```
#include <mpi.h>
#include <stdio.h>
#include <stdlib.h>

int main(int argc, char* argv[]) {
   int rank, size;
   int N = 16;  // Total number of elements
   int array[N];
   int local_sum = 0, total_sum = 0;

   MPI_Init(&argc, &argv);
   MPI_Comm_rank(MPI_COMM_WORLD, &rank);
   MPI_Comm_size(MPI_COMM_WORLD, &size);

   int elements_per_proc = N / size;
   int remaining_elements = N % size;

   if (rank == 0) {
      for (int i = 0; i < N; i++) {
         array[i] = i + 1;
      }
      printf("Original array: ");
      for (int i = 0; i < N; i++) {
         printf("%d ", array[i]);
      }
      printf("\n");
   }

   int local_size = elements_per_proc + (rank < remaining_elements ? 1 : 0);
```

```
    int* local_array = (int*)malloc(local_size * sizeof(int));

    int displs[size], send_counts[size];
    if (rank == 0) {
        int offset = 0;
        for (int i = 0; i < size; i++) {
            send_counts[i] = elements_per_proc + (i < remaining_elements ? 1 : 0);
            displs[i] = offset;
            offset += send_counts[i];
        }
    }

    MPI_Scatterv(array, send_counts, displs, MPI_INT, local_array, local_size, MPI_INT, 0,
MPI_COMM_WORLD);
    for (int i = 0; i < local_size; i++) {
        local_sum += local_array[i];
    }
    free(local_array);
    printf("Processor %d calculated local sum: %d\n", rank, local_sum);

    MPI_Reduce(&local_sum, &total_sum, 1, MPI_INT, MPI_SUM, 0, MPI_COMM_WORLD);

    if (rank == 0) {
        printf("Total sum of array: %d\n", total_sum);
    }

    MPI_Finalize();
    return 0;
}
```


Feb 13 12:58
svpmit@svpmit-HP-EliteDesk-800-G2-SFF: ~/Downloads
svpmit@svpmit-HP-EliteDesk-800-G2-SFF:~$ ls
chaitanya Documents Music Public Templates
Desktop Downloads Pictures snap Videos
svpmit@svpmit-HP-EliteDesk-800-G2-SFF:~$ cd Downloads
svpmit@svpmit-HP-EliteDesk-800-G2-SFF:~/Downloads$ mpicc -o mpi_program mpi.c
svpmit@svpmit-HP-EliteDesk-800-G2-SFF:~/Downloads$ mpirun -np 4 ./mpi_program
Original array: 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16
Processor 2 calculated local sum: 42
Processor 0 calculated local sum: 10
Processor 3 calculated local sum: 58
Processor 1 calculated local sum: 26
Total sum of array: 136
svpmit@svpmit-HP-EliteDesk-800-G2-SFF:~/Downloads$ mpirun -np 5 ./mpi_program
Feb 13 12:58
svpmit@svpmit-HP-EliteDesk-800-G2-SFF: ~/Downloads
launch.
----
svpmit@svpmit-HP-EliteDesk-800-G2-SFF:~/Downloads$ mpirun --oversubscribe -np 6 ./mpi_program
Original array: 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16
Processor 0 calculated local sum: 6
Processor 1 calculated local sum: 15
Processor 4 calculated local sum: 27
Processor 3 calculated local sum: 33
Processor 5 calculated local sum: 31
Processor 2 calculated local sum: 24
Total sum of array: 136
svpmit@svpmit-HP-EliteDesk-800-G2-SFF:~/Downloads$ mpirun --oversubscribe -np 7 ./mpi_program
Processor 3 calculated local sum: 19
Processor 4 calculated local sum: 23
Original array: 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16
Processor 0 calculated local sum: 6
Processor 1 calculated local sum: 15
Processor 6 calculated local sum: 31
Total sum of array: 136
Processor 2 calculated local sum: 15
Processor 5 calculated local sum: 27
svpmit@svpmit-HP-EliteDesk-800-G2-SFF:~/Downloads$ mpirun --oversubscribe -np 9 ./mpi_program
Original array: 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16
Processor 0 calculated local sum: 3
Processor 3 calculated local sum: 15
Processor 6 calculated local sum: 27
Processor 1 calculated local sum: 7
Processor 2 calculated local sum: 11
Processor 4 calculated local sum: 19