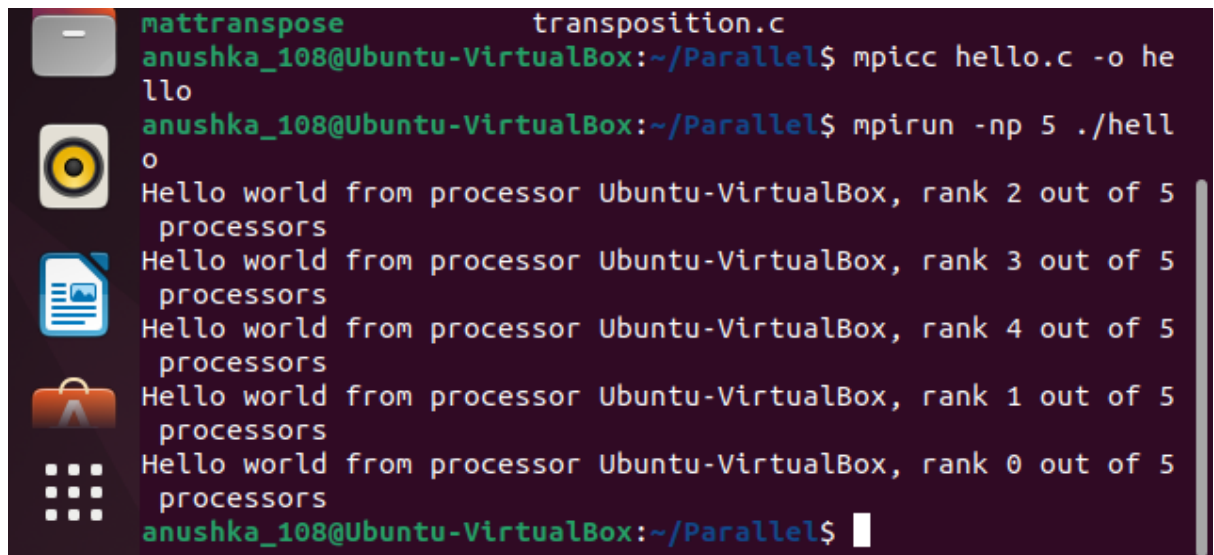


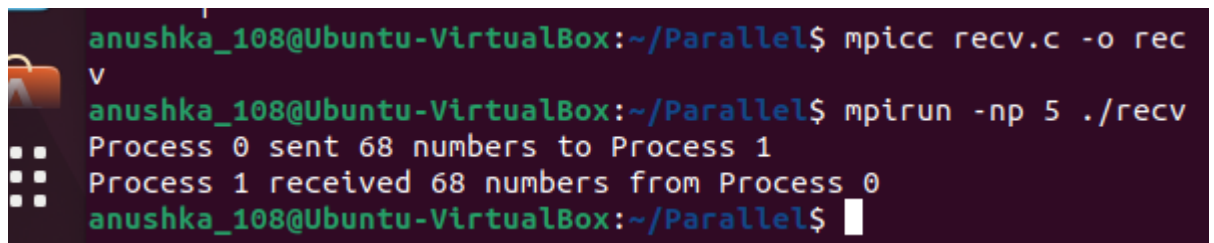
Assignment 1

1. MPI hello world

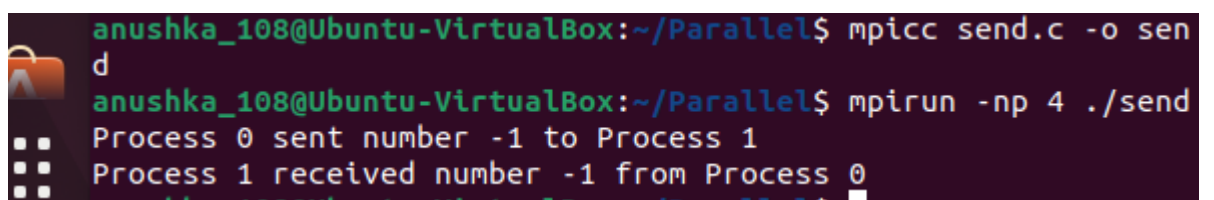
A terminal window with a dark background and light-colored text. The prompt is 'anushka_108@Ubuntu-VirtualBox:~/Parallel\$'. The user enters 'mpicc hello.c -o hello' and then 'mpirun -np 5 ./hello'. The output shows five lines of 'Hello world from processor Ubuntu-VirtualBox, rank X out of 5 processors' where X is 2, 3, 4, 1, and 0 respectively. The prompt returns at the end.

```
mattranspose      transposition.c
anushka_108@Ubuntu-VirtualBox:~/Parallel$ mpicc hello.c -o hello
anushka_108@Ubuntu-VirtualBox:~/Parallel$ mpirun -np 5 ./hello
Hello world from processor Ubuntu-VirtualBox, rank 2 out of 5 processors
Hello world from processor Ubuntu-VirtualBox, rank 3 out of 5 processors
Hello world from processor Ubuntu-VirtualBox, rank 4 out of 5 processors
Hello world from processor Ubuntu-VirtualBox, rank 1 out of 5 processors
Hello world from processor Ubuntu-VirtualBox, rank 0 out of 5 processors
anushka_108@Ubuntu-VirtualBox:~/Parallel$
```

2. Sending and receiving with MPI_Send and MPI_Recv

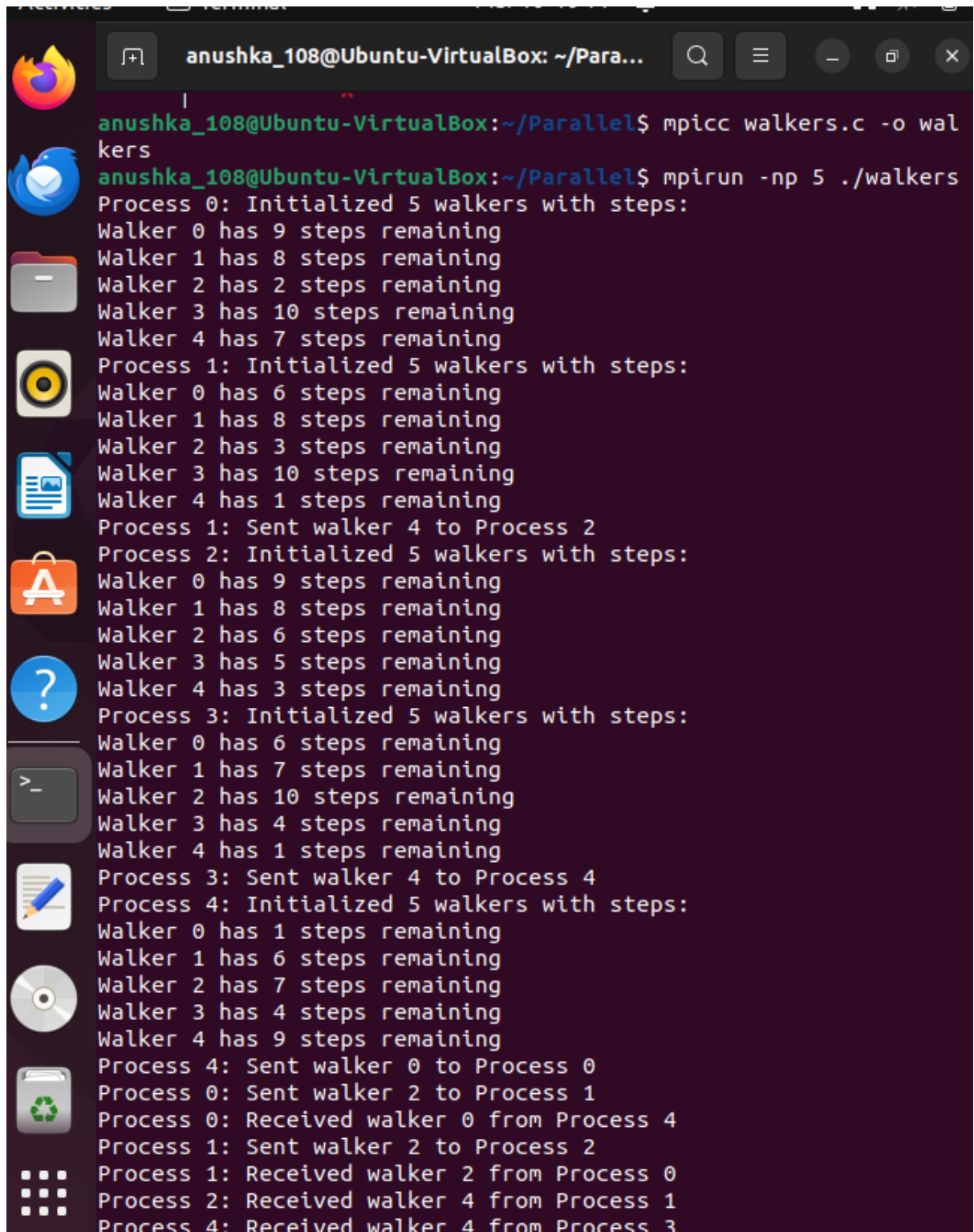
A terminal window showing the compilation and execution of a program that sends and receives 68 numbers. The prompt is 'anushka_108@Ubuntu-VirtualBox:~/Parallel\$'. The user enters 'mpicc recv.c -o recv' and then 'mpirun -np 5 ./recv'. The output shows 'Process 0 sent 68 numbers to Process 1' and 'Process 1 received 68 numbers from Process 0'. The prompt returns at the end.

```
anushka_108@Ubuntu-VirtualBox:~/Parallel$ mpicc recv.c -o recv
anushka_108@Ubuntu-VirtualBox:~/Parallel$ mpirun -np 5 ./recv
Process 0 sent 68 numbers to Process 1
Process 1 received 68 numbers from Process 0
anushka_108@Ubuntu-VirtualBox:~/Parallel$
```

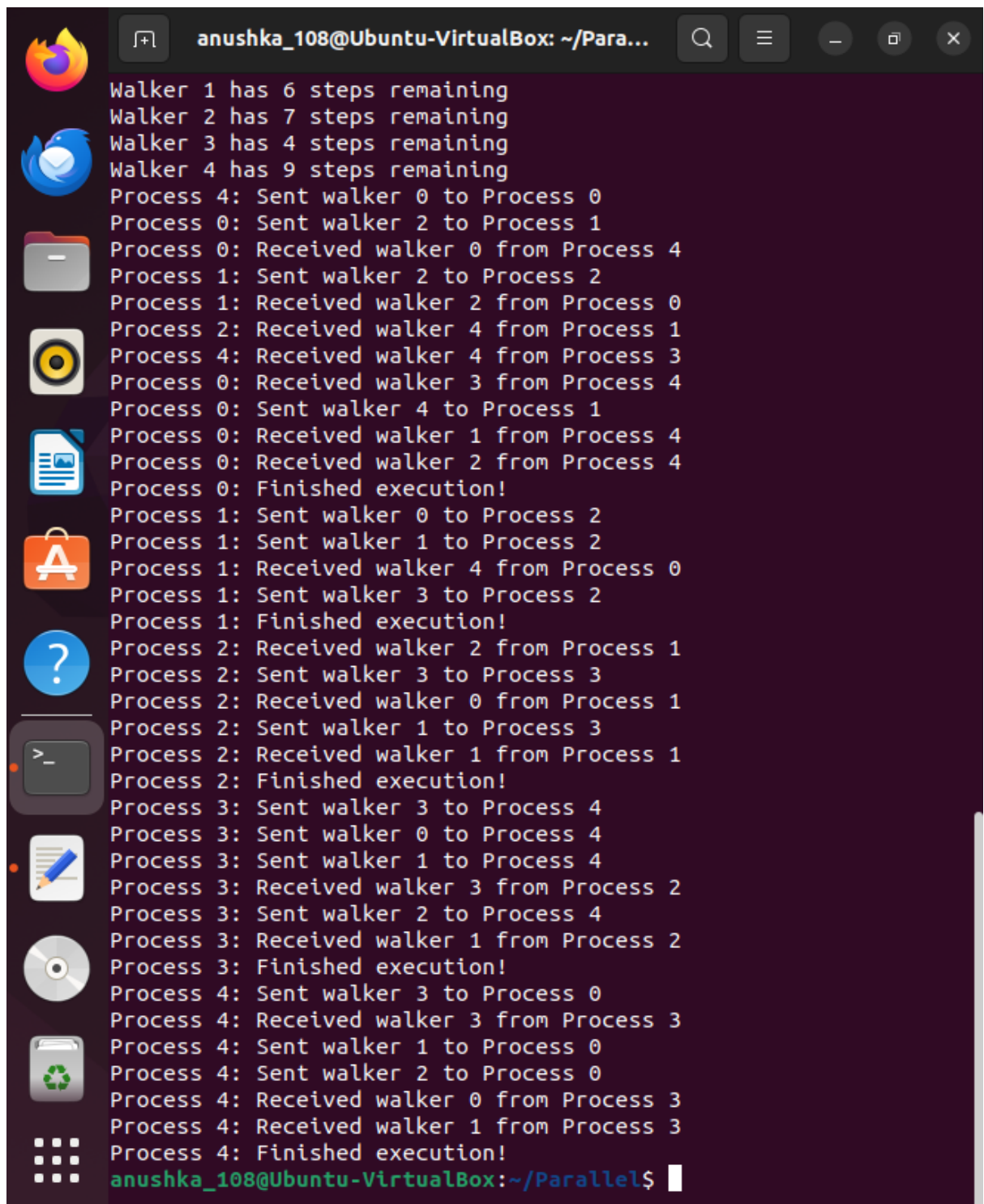
A terminal window showing the compilation and execution of a program that sends and receives a single number. The prompt is 'anushka_108@Ubuntu-VirtualBox:~/Parallel\$'. The user enters 'mpicc send.c -o send' and then 'mpirun -np 4 ./send'. The output shows 'Process 0 sent number -1 to Process 1' and 'Process 1 received number -1 from Process 0'. The prompt returns at the end.

```
anushka_108@Ubuntu-VirtualBox:~/Parallel$ mpicc send.c -o send
anushka_108@Ubuntu-VirtualBox:~/Parallel$ mpirun -np 4 ./send
Process 0 sent number -1 to Process 1
Process 1 received number -1 from Process 0
anushka_108@Ubuntu-VirtualBox:~/Parallel$
```

3. Point-to-point communication application - Random walking



```
anushka_108@Ubuntu-VirtualBox: ~/Parallel$ mpicc walkers.c -o walkers
anushka_108@Ubuntu-VirtualBox:~/Parallel$ mpirun -np 5 ./walkers
Process 0: Initialized 5 walkers with steps:
Walker 0 has 9 steps remaining
Walker 1 has 8 steps remaining
Walker 2 has 2 steps remaining
Walker 3 has 10 steps remaining
Walker 4 has 7 steps remaining
Process 1: Initialized 5 walkers with steps:
Walker 0 has 6 steps remaining
Walker 1 has 8 steps remaining
Walker 2 has 3 steps remaining
Walker 3 has 10 steps remaining
Walker 4 has 1 steps remaining
Process 1: Sent walker 4 to Process 2
Process 2: Initialized 5 walkers with steps:
Walker 0 has 9 steps remaining
Walker 1 has 8 steps remaining
Walker 2 has 6 steps remaining
Walker 3 has 5 steps remaining
Walker 4 has 3 steps remaining
Process 3: Initialized 5 walkers with steps:
Walker 0 has 6 steps remaining
Walker 1 has 7 steps remaining
Walker 2 has 10 steps remaining
Walker 3 has 4 steps remaining
Walker 4 has 1 steps remaining
Process 3: Sent walker 4 to Process 4
Process 4: Initialized 5 walkers with steps:
Walker 0 has 1 steps remaining
Walker 1 has 6 steps remaining
Walker 2 has 7 steps remaining
Walker 3 has 4 steps remaining
Walker 4 has 9 steps remaining
Process 4: Sent walker 0 to Process 0
Process 0: Sent walker 2 to Process 1
Process 0: Received walker 0 from Process 4
Process 1: Sent walker 2 to Process 2
Process 1: Received walker 2 from Process 0
Process 2: Received walker 4 from Process 1
Process 4: Received walker 4 from Process 3
```



```
anushka_108@Ubuntu-VirtualBox: ~/Para...  
Walker 1 has 6 steps remaining  
Walker 2 has 7 steps remaining  
Walker 3 has 4 steps remaining  
Walker 4 has 9 steps remaining  
Process 4: Sent walker 0 to Process 0  
Process 0: Sent walker 2 to Process 1  
Process 0: Received walker 0 from Process 4  
Process 1: Sent walker 2 to Process 2  
Process 1: Received walker 2 from Process 0  
Process 2: Received walker 4 from Process 1  
Process 4: Received walker 4 from Process 3  
Process 0: Received walker 3 from Process 4  
Process 0: Sent walker 4 to Process 1  
Process 0: Received walker 1 from Process 4  
Process 0: Received walker 2 from Process 4  
Process 0: Finished execution!  
Process 1: Sent walker 0 to Process 2  
Process 1: Sent walker 1 to Process 2  
Process 1: Received walker 4 from Process 0  
Process 1: Sent walker 3 to Process 2  
Process 1: Finished execution!  
Process 2: Received walker 2 from Process 1  
Process 2: Sent walker 3 to Process 3  
Process 2: Received walker 0 from Process 1  
Process 2: Sent walker 1 to Process 3  
Process 2: Received walker 1 from Process 1  
Process 2: Finished execution!  
Process 3: Sent walker 3 to Process 4  
Process 3: Sent walker 0 to Process 4  
Process 3: Sent walker 1 to Process 4  
Process 3: Received walker 3 from Process 2  
Process 3: Sent walker 2 to Process 4  
Process 3: Received walker 1 from Process 2  
Process 3: Finished execution!  
Process 4: Sent walker 3 to Process 0  
Process 4: Received walker 3 from Process 3  
Process 4: Sent walker 1 to Process 0  
Process 4: Sent walker 2 to Process 0  
Process 4: Received walker 0 from Process 3  
Process 4: Received walker 1 from Process 3  
Process 4: Finished execution!  
anushka_108@Ubuntu-VirtualBox: ~/Parallel$
```