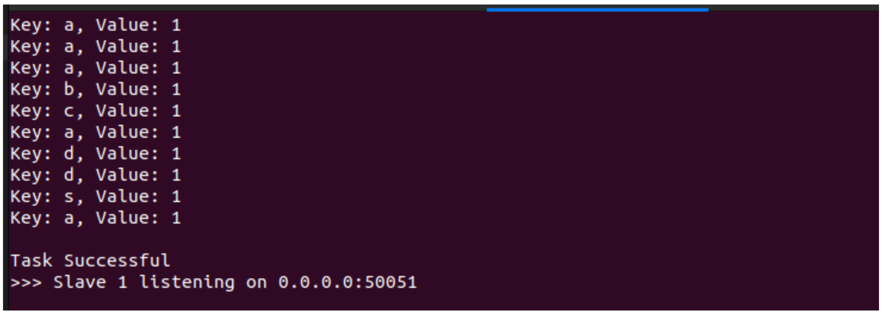
Name: Sheikh Muhmmad Umer Khalid **Roll#**: BSCS20002

Parallel & Distributed Computing

Assignment – 5.2

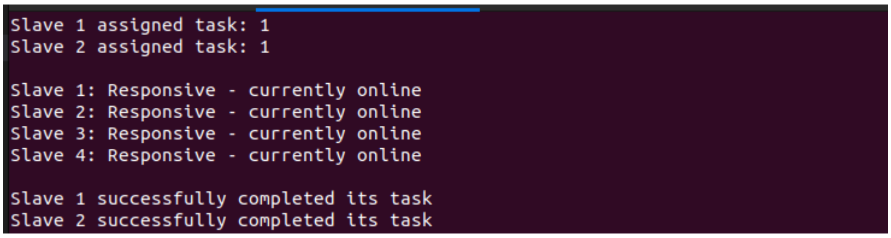
I used 4 slaves, 2 work as mappers and 2 work as reducers. Initially, both the mappers are given tasks, and for fault tolerance, each mapper contains a copy of the input of the other mapper slave. I used multi-threading to run tasks on each slave in a parallel manner. If there is no error in connectivity, and all mappers are online each mapper performs its task where they return a key-value pair (Fig. 1), and it is displayed to the master that the mappers are executing their tasks and notifies the master once they complete their task (Fig. 2).



```
Key: a, Value: 1
Key: a, Value: 1
Key: a, Value: 1
Key: b, Value: 1
Key: c, Value: 1
Key: a, Value: 1
Key: d, Value: 1
Key: d, Value: 1
Key: s, Value: 1
Key: a, Value: 1

Task Successful
>>> Slave 1 listening on 0.0.0.0:50051
```

Figure 1



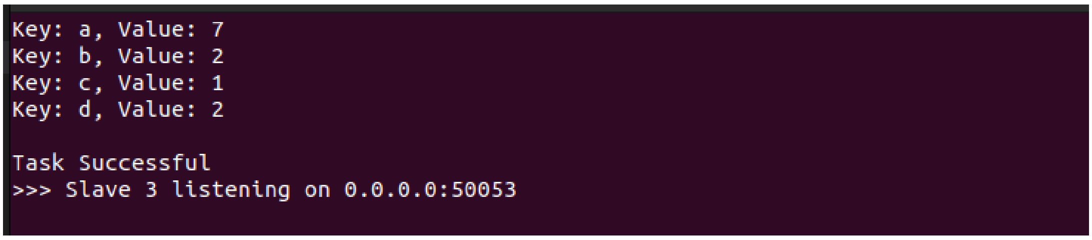
```
Slave 1 assigned task: 1
Slave 2 assigned task: 1

Slave 1: Responsive - currently online
Slave 2: Responsive - currently online
Slave 3: Responsive - currently online
Slave 4: Responsive - currently online

Slave 1 successfully completed its task
Slave 2 successfully completed its task
```

Figure 2

Once every slave has completed its task, then the output generated by each mapper slave is processed after which it is then directed to reducer slaves where they count all the occurrences of every word and return a kay-value pair (Fig. 3).

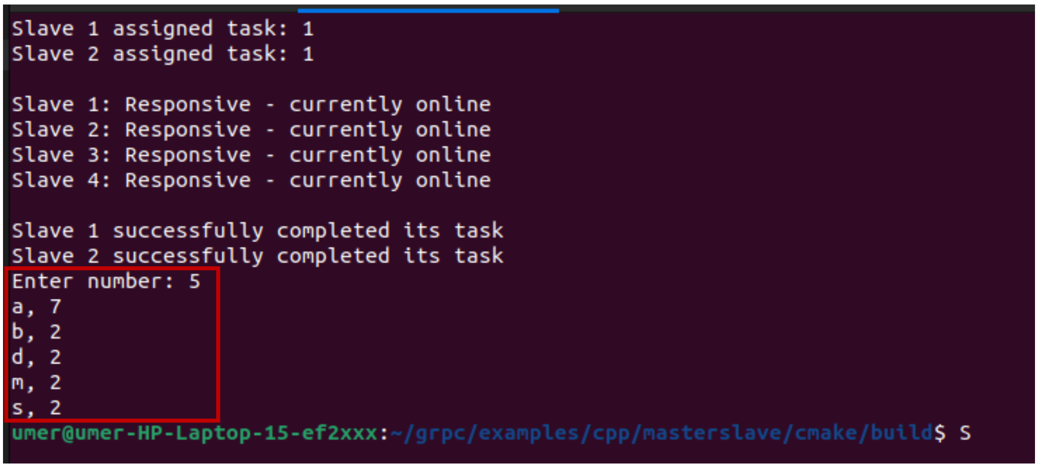


```
Key: a, Value: 7
Key: b, Value: 2
Key: c, Value: 1
Key: d, Value: 2

Task Successful
>>> Slave 3 listening on 0.0.0.0:50053
```

Figure 3

Then the outputs generated by each reducer slave is accumulated to produce the final single output containing all key value pairs. Then, the user enters a number n to display the top n keys with their corresponding occurrences.



```
Slave 1 assigned task: 1
Slave 2 assigned task: 1

Slave 1: Responsive - currently online
Slave 2: Responsive - currently online
Slave 3: Responsive - currently online
Slave 4: Responsive - currently online

Slave 1 successfully completed its task
Slave 2 successfully completed its task
Enter number: 5
a, 7
b, 2
d, 2
m, 2
s, 2
umer@umer-HP-Laptop-15-ef2xxx:~/grpc/examples/cpp/masterslave/cmake/build$ S
```

Figure 4