

Master	Worker 1	Worker 2	Worker 3	Worker 4	Description
	P1, P2	P1, P2	P3	P2, P3	Initial Contents
send map commands	map command	map command	map command	map command	Start Map Master tells worker servers to start the map phase, providing the map function.
	mapResult 1 Red 1 Mean 1 TwoTwo 1	mapResult 2 Mine 1 Mine 1 Mean 1	mapResult 3 Red 1 TwoTwo 1 Mean 1	mapResult Empty	Workers Perform Map Workers execute the map task and store their results in the mapResult file. Then, they inform the master server that the map task has been completed. If a worker server is not used, leave the box blank.
return the path of map results to master;	Path	Path	Path	Path	Start Shuffle Master tells worker servers to start the shuffle phase.
master sends shuffle commands to workers. workers send map results to each other	shuffle command mean, 1 TwoTwo, 1	shuffle command Mine, 1 Mine, 1	shuffle command Red, 1 Mean, 1	shuffle command	Workers Perform Shuffle Workers send the map results to each other, based on the hashcode of the key. Workers store these results in another file. Then, they inform the master server when they are done. If a worker server is not used, leave the box blank. <div> $h(\text{Red}) = 0 \rightarrow \text{worker 1}$ $h(\text{Mean}) = 1 \rightarrow \text{worker 2}$ $h(\text{TwoTwo}) = 2 \rightarrow \text{worker 3}$ $h(\text{Mine}) = 3 \rightarrow \text{worker 4}$ </div>
	shuffleResult Red 1 Red 1	shuffleResult Mean 1 Mean 1 Mean 1	shuffleResult TwoTwo 1 TwoTwo 1	shuffleResult Mine 1 Mine 1	Start Reduce Master tells worker servers to start the reduce phase, providing the reduce function.
	reduce command reduce function	reduce command reduce function	reduce command reduce function	reduce command reduce function	Workers Perform Reduce Workers execute the reduce task, creating a new file with the final results of the map-reduce task. Then, they inform the master server they are done, providing the file location of the result. In this case, the file location is always the same for simplicity.
Inform done, provide file locations of final results	finalResult red, 2	finalResult Mean, 3	finalResult TwoTwo, 2	finalResult Mine, 2	