Analysis

Time taken for Q4 i.e., dates was departure time not recorded/went missing?

- Using T1 (Multi - threading): 10 threads ➜ 80.57 seconds
- Using T2 (Multi - processing): 4 processes ➜ 47.41 seconds
- Using T3 (MPI): 4 workers ➜ 25.42 seconds

T1-> When we are creating 10 threads which are more than number of cores of my computer there will be context switching involved in them which is kind of overhead, so I think that's why multithreading is taking more time than multiprocessing and MPI. Furthermore, when I created 8 threads on my machine i.e., equal to number of logical processors of my computer it took around 78 seconds.

T2-> We can see that multiprocessing is faster than multi-threading in this case as each process run on one individual core and which way faster than multithreading as it achieves true parallelism over the concurrency and also each process will have its local cache which enables faster data access but in multithreading we can lose cache locality which can lead to delay as data needed will be removed and new data that is required.

T3-> As we are using MPI on single machine, so I each worker will have its own core. Moreover, OpenMPI has been optimized to have every process has its own core, that's why it took the minimum time for execution among all three.