Configuration of the system :

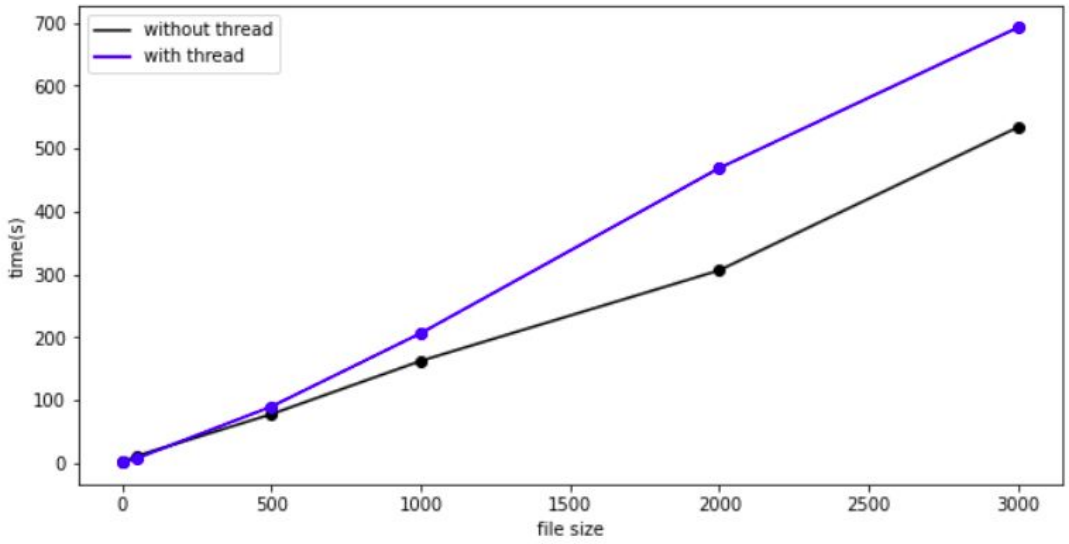
OS : Linux
RAM : 12 Gb
CPU : i5 -7200 @2.5GHz

[output of “lshw” command]
*-memory
description: System memory
physical id: 0
size: 12GiB
*-cpu
product: Intel(R) Core(TM) i5-7200U CPU @ 2.50GHz
vendor: Intel Corp.
physical id: 1
bus info: cpu@0
size: 790MHz
capacity: 3100MHz

Observations

1. **Varying FileSize with constant memory :**

File Size	4.9MB	49MB	489MB	977MB	1.5GB	2GB	2.5GB
Memory Limit	100MB	100MB	100MB	100MB	100MB	100MB	100MB
Time(With Thread in sec)	0.71	9.22	69.6	266.4	474.84	760.37	911.84
Time(Without Thread in sec)	0.81	10.157	83.24	186.42	336.33	453.83	563.99



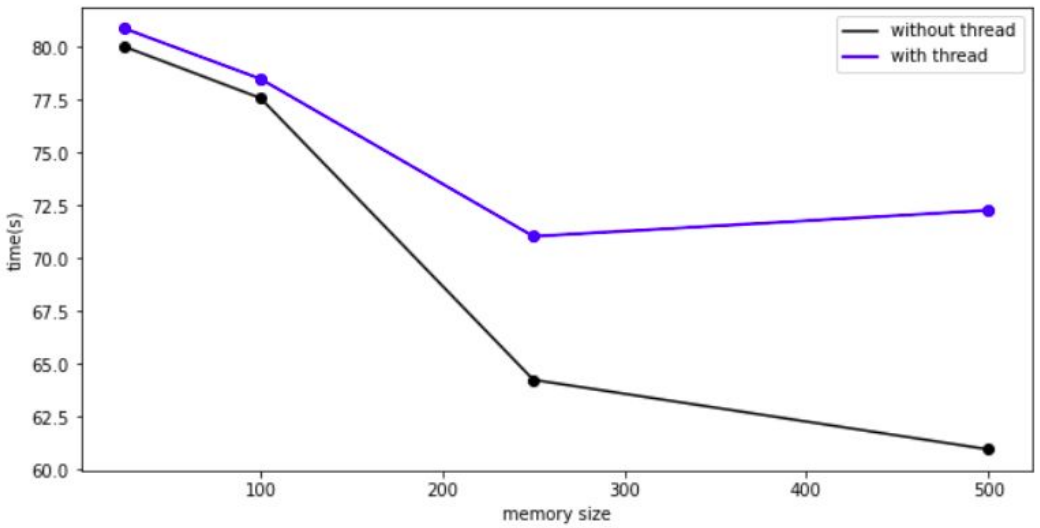
Above Observations are recorded by running 2-phase Merge Sort giving 100MB as memory limit and running on file size - 5MB, 50MB, 500MB, 1GB, 1.5GB, 2GB, 2.5GB

It can be observed that the execution time increases with the increase in file size as no of intermediate files increases. Thus increasing the disk read and write which inherently takes up most of the execution time.

There can be seen a significant increase in the time with thread execution as with threading the memory is divided equally among threads and indirectly increases the no of intermediate files. As no of intermediate files increases, disk read and write operation increases and execution time increases.

2.Varying memory with constant FileSize :

File Size	489MB	489MB	489MB	489MB
Memory Limit	25MB	100MB	250MB	500MB
Time (With Thread in sec)	81.89	71.5	68.05	59.28
Time (Without Thread in sec)	83.03	75.59	70.26	62.97



Above Observations are recorded by running 2-phase Merge Sort giving 500MB as file size and running by giving memory limit - 25MB, 100MB, 250MB, 500MB.

With the increase in memory size while the file size remains constant, we can see a drastic decrease in the execution time as the no of intermediate files decreases thus decreasing the disk read and writes and in turn decreasing the execution time.

The previous reason for the difference in execution time of with and without threads also holds here.