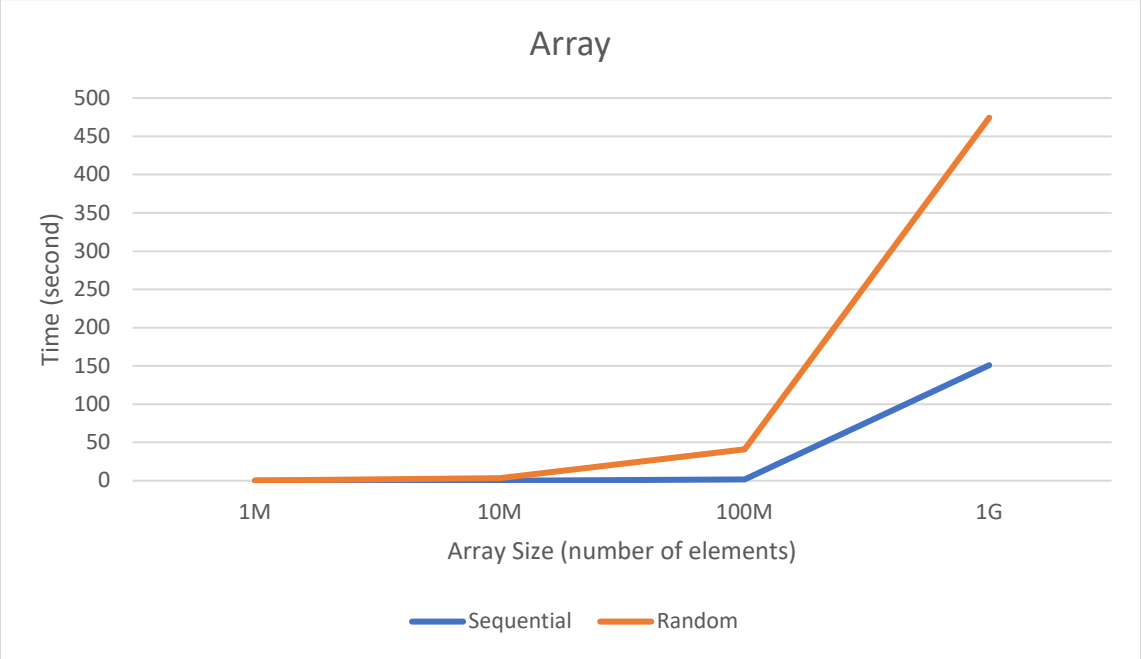
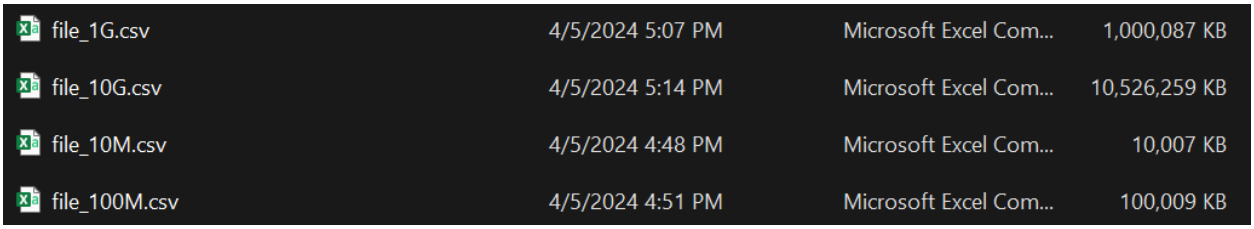
1) Read an array of size *N* = 1*M*, 10*M*, 100*M*, 1*G* sequentially and randomly and compute their running time. Prepare a report of your experiment. Don't take the time of computing random numbers into account.
    - In the written code, an array is created for each given size, and then the access time is measured for both sequential and random mode.
    - For random mode, random indices are generated to access elements of arrays in random orders. This is generated before setting the start point of timer, so it does not affect the access times. First an array is created in range of 0 to N, and then is shuffled to get random indices.
    - Then the start point is set, and array is read in both modes. At last, the end time is set, and the consumed time is calculated

```
------------------ Sequential ------------------
Array size 1M read time: 0.0114 seconds
Array size 10M read time: 0.1119 seconds
Array size 100M read time: 1.4624 seconds
Array size 1G read time: 150.8985 seconds
-------------------- Random --------------------
Array size 1M read time: 0.2467 seconds
Array size 10M read time: 3.2723 seconds
Array size 100M read time: 40.8265 seconds
Array size 1G read time: 4474.4259 seconds
```

- As we can see in the output of the code, running time of reading the array of different sizes randomly is much more than sequential mode, about 30 times.
- The more understandable comparison can be figured out from the plot below



2) Read a file of size *N* = 10*M;* 100*M;* 1*G;* 10*G* sequentially and randomly and compute their running time. Prepare a report of your experiment.

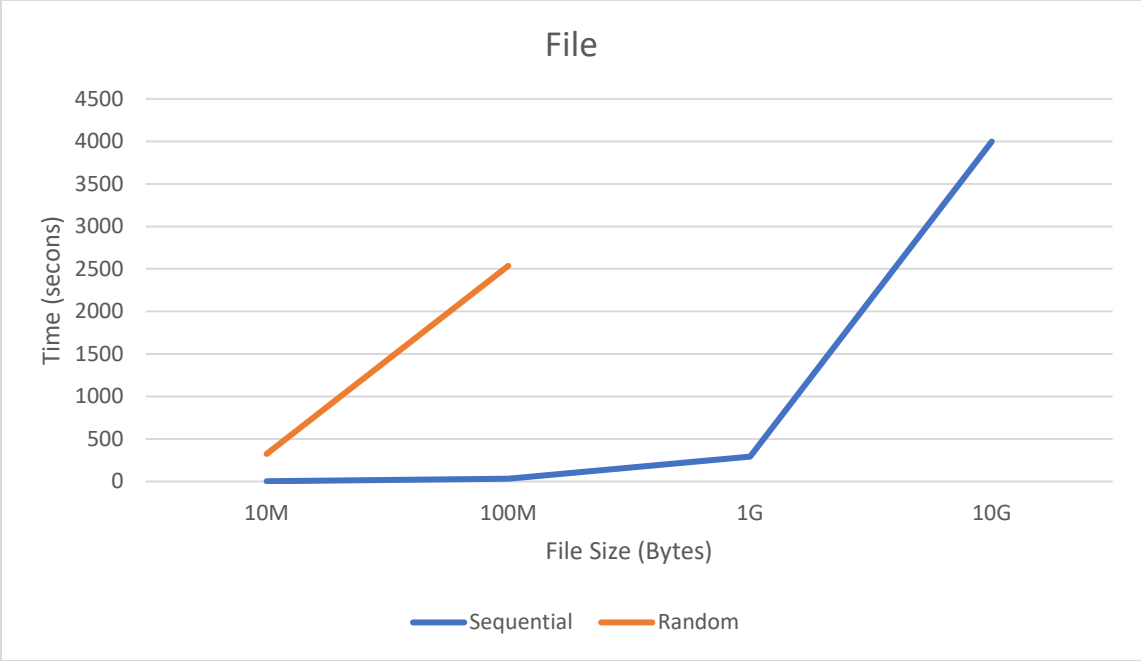


file_1G.csv	4/5/2024 5:07 PM	Microsoft Excel Com...	1,000,087 KB
file_10G.csv	4/5/2024 5:14 PM	Microsoft Excel Com...	10,526,259 KB
file_10M.csv	4/5/2024 4:48 PM	Microsoft Excel Com...	10,007 KB
file_100M.csv	4/5/2024 4:51 PM	Microsoft Excel Com...	100,009 KB

- In the written code, created files of given sizes have been read as bytes, and then the access time is measured for both sequential and random mode.
- Each file with given sizes have been opened and the number of bytes are calculated.
- For random mode, random indices are generated to set cursor of file reader and access bytes of files in random orders. This is generated before setting the start point of timer, so it does not affect the access times. First an array is created in range of 0 to N, and then is shuffled to get random indices.
- Then the cursor is set to the beginning of file, and the start point is set, and file is read in both modes. At last, the end time is set, and the consumed time is calculated

```
------------------- Sequential -----------------
File size 10M read time: 3.3073 seconds
File size 100M read time: 31.8954 seconds
File size 1G read time: 291.1034 seconds
File size 10G read time: 3998.0999 seconds
-------------------- Random --------------------
File size 10M read time: 324.0935 seconds
File size 100M read time: 2537.1172 seconds
```

- As we can see in the output of the code, running time of reading the files of different sizes randomly is much more than sequential mode, about 100 times.
- Unfortunately, the access time for 1G and 10G files could not be computed due to excessive amount of time need in random mode.
- The more understandable comparison can be figured out from the plot below.


File
4500
4000
3500
3000
2500
2000
1500
1000
500
0
Time (secons)
10M
100M
1G
10G
File Size (Bytes)
Sequential
Random