Data Management and File Organization

Midterm Exam Questions

Question 1

- Assume the blocks of a data file are to be stored on a hard disk. The first option to store them is using different sectors of the same track. (for example sectors 2, 5, 11, 29 from track 30).
- The second option is using the same sector from different tracks (for example sector 2 from tracks 4, 5, 10, 12). Which option will give a faster file access? Why?

Solution of Question 1

- When the blocks of a file are on the same track reading different blocks does not require moving the head form one track to the other. The time required to read the file will be r (rotational latency time) and Btt. Therefore, option 1 is better.

Question 2

- A pile file with 20,000 records is given. Assume record size is 100 bytes, and the block size is 1000 bytes. Using the following disk parameters, find the average time needed to update a record.
  - s time = 18 msec
  - r time = 10 msec
  - Btt = 0.12 msec
  - ebt = 0.15 msec

Solution of Question 2

- The time to update a record is s+r+(b/2)*ebt+2r
- Bkfr = 1000/100 = 10
- b = 20,000 / 10 = 2000
- T_u = 18 + 10 + (2000/2) * 0.15 + 2*10 = 198 msec

Question 3

- A sorted sequential file includes 25000 active and 1000 deleted records in the sorted area, and 1500 active and 500 deleted in the overflow area. Assuming the blocking factor = 10, and using the following disk parameters, find the average time to fetch a record given its key value.
  - s time = 18 msec
  - r time = 10 msec
  - Btt = 0.12 msec
  - ebt = 0.15 msec

Solution of Question 3

- Number of blocks in sorted area = (25000+1000)/10 = 2600
- Number of blocks in overflow = (1500+500)/10 = 200
- Total number of blocks = 2800
- $T_f = (2600/2800)(\log_2(2600)*(18+10+0.12)) +$
  $(200/2800)(18+10+(200/2)*0.15) = ?$

Question 4

- The following data file will be sorted using heap sort algorithm (external sorting). Assume the memory space allocated for the heap tree can hold only 10 numbers. Apply the algorithm and show the steps used.
- 9, 11, 3, 16, 19, 22, 43, 8, 12, 45, 28, 6, 10, 20, 7, 44, 33, 1, 18, 29

Solution of Question 4

- The memory has enough space for 10 records. So we create a heap tree of size 10, write it into a run, then create a second heap tree and write it into another run. Then we merge the runs.