Sample Exam Solutions

CENG 351

Question 1

- Explain the followings:
  - Rotational latency time
  - Inter-block gap
  - Interleaving

Question 2

- A pile file contains 10,000 records of 256 bytes each. The block size is 1024 bytes. Assuming that tracks 10, 25, 33, and 120 have been allocated to this file, compute the time for exhaustive reading of the file.
- Assume Seek Time = 0.8 msec, Rotational Latency time = 0.2 msec, Block Transfer Time (btt) = 0.1, and Effective Block Transfer Time (ebt) =0.12 msec

Question 2-Solution

- Blocking factor = 1024/256 =4
- Total number of blocks = 10000 / 4 = 2500
- Time for exhaustive read =

  (4 x S) + (4 x r) + (2500 x ebt)

  4x0.8 + 4x0.2 + 2500x0.12 = 304

Question 3

- Suppose that we want to find 50 records in a sorted sequential file having 200,000 records. Considering the parameters: Blocking factor = 4, Seek Time = 0.8 msec, Rotational Latency time = 0.2 msec, Block Transfer Time (btt) = 0.1, and Effective Block Transfer Time (ebt)=0.12 msec, for the following two cases find the total time needed:
  - The records that we are looking for have random key values. Use binary search algorithm and consider the worst case for all searches.
  - The records have consecutive key values. (discuss the best and the worst cases)

Question 3-solution

- (random keys case) To find 1 record we need

  (s+r+btt)xlog(200,000)

  for 50 records = 50x(s+r+btt)xlog(200,000)

- (consecutive keys case) If records to be found are in order, find the first record and then read the rest

  (s+r+btt)xlog(200,000) [the first record]

(in the worst case no record is in the same block as the first record)

  (49/4) x ebt [read the rest, worst case]

(in the best case three record are in the same block as the first record)

  (46/4) x ebt [read the rest, best case]

Question 3 (Solution)

- When searching in a sorted sequential file, log(n) where n is the number of records is used. Although the unit of I/O from files is a block, since binary search jumps from a record to another one (when mid is computed), we have to consider log(n) (n=number of records)

Question 4

- Assume a pile file contains 100,000 records where each record is 400 bytes. We start modifying the file by inserting new records. After inserting three, a record is deleted. We stop modifying the file when the number of active records is 150,000. Assuming Bfr =6, find:
  - The time to re-organize the file
  - The time to fetch a record before and after re-organization

Solution 4

- When the file size is 150,000 records, we will have 25,000 deleted records (Insert 3 delete 1 rule)
- Total number of blocks = 175,000/6=29,167
- Number of active blocks = 150,000/6 = 25,000
- Time to re-organize:
  - Time to read the file= s+r+29,167*ebt
  - Time to write active blocks = s+r+25,000*ebt
  - Time to re-organize = (s+r+29,167*ebt)+ (s+r+25,000*ebt)

Solution 4

- Time to fetch a record before re-organization
  - S+r+(b/2)*ebt = s+r+(29,167/2)*ebt
- Time to fetch a record after re-organization
  - S+r+(b/2)*ebt = s+r+(25,000/2)*ebt

Question 5

- Assume in a sorted sequential file the number of blocks in the sorted area is 10,000 and in the overflow area is also 10,000. Find T_F
- $T_F = (P_{sorted\_area})$*Search in sorted area + $(P_{overflow\_area})$*Search in overflow area
  - Sorted Area Search = (10,000/20,000)*((s+r+btt)*log10,000)
  - Overflow Area Search = (10,000/20,000)*(s+r+(b/2)*ebt)

Question 6

- Compute the time needed to read 10 consecutive blocks from the same track. Assume no interleaving.
- Use:

  s=16 msec

  r=8.3msec

  btt=0.8 msec

  ebt=0.84 msec

Solution 6

- (Assume we know the location of the first block)
- To find the blocks we need s+r seconds. Then we read 10 blocks while we pass over the gaps between them (10*ebt)
- The total time will be s+r+10*ebt = 32.7msec

Question 7

- Find the time needed to read 10 random blocks from the disk. Assume the sector, and block numbers are given.

- Solution: for each block we need s+r+btt seconds.
- The total time will be = 10*(s+r+btt)

Question 8
Insert 16, 30, 33