Extra exercises 3: The Storage Layer

Question 1: Connect each definition with the corresponding part of the time needed for accessing a disk block:

A) Seek time
B) Rotational Delay
C) Transfer time

1) the time required for a disk's read/write head to move to the specified track on the disk where the desired data is located.
2) the time it takes for the desired disk block to rotate into position under the disk's read/write head,
3) the time it takes for the data to be transferred between the disk, and the computer's memory

Question 2: Assume that we want to store a dataset that each record is 50B on a database that has 4 disks, and each disk has 10 pages of 2MB.

A) How many records can be stored by forming RAID 0 methodology for disk management?
B) How many records can be stored by forming RAID 1 methodology for disk management?
C) How many records can be stored by forming RAID 5 methodology for disk management?

Question 3: Assume that we have four disks and we want to choose one of the disk management methodologies for our database design. Assume that we have 10 data pages. Sort the disk management methodologies based on the time to recover the data if one page of one disk crashes.

Question 4: Assume that we have four disks and we want to choose one of the disk management methodologies for our database design. Assume that we have 10 data pages. Sort the disk management methodologies based on the time to read all ten pages from the database. The faster one comes first.

Question 5: Assume that we have four disks and each disk has 4 pages of 1B and we use RAID 5 methodology for disk management. Put the following text in disks. Show the parity of A, B, and C as P(A, B, C). Each character is 1B. Space Text: ”CS-301+QUIZ!”

Question 6: A 1TB HDD is less expensive and more efficient in random reads than a 1TB SSD.

a) True
b) False

Question 7: Which option is correct about the usage of dirty bit in buffer management methods?

A) If a page is pinned and the dirty bit is set to True, then the page is a candidate for replacement.
B) If a page is unpinned and the dirty bit is set to True, then the page is a candidate for replacement and the page is written back on the disk.
C) If a page is pinned and the dirty bit is set to True, then the page is a candidate for replacement and the page is modified so the corresponding page on disk should be updated.
D) If a page is unpinned and the dirty bit is set to False, then the page is a candidate for replacement.

Question 8: Assume that we have 4 frames and we want to access to read the following pages. We use LRU buffer management.

Page access order: 2, 3, 4, 5, 6, 3, 7, 3, 2, 5, 4, 7, 4

A) Show the frame contents at the end of execution(the last step).
B) What is the hit rate?

Question 9: Assume that we have 4 frames and we want to access to read the following pages. We use MRU buffer management.

Page access order: 2, 3, 4, 5, 6, 3, 7, 3, 2, 5, 4, 7, 4

C) Show the frame contents at the end of execution(the last step).
D) What is the hit rate?

Extra exercises 4: The Storage Layer
Solutions

Answer 1: A→1, B→2, C→3

Answer 2:

A) 4*10*2*10^6/50 = 16000000
B) 4/2*10*2*10^6/50 = 8000000
C) 3*10*2*10^6/50 = 12000000

Answer 3:

1) RAID 1
2) RAID 5
3) RAID 0

Answer 4:

1) RAID 0
2) RAID 5
3) RAID 1

Answer 5:

1) Disk0:parity(C, S, -), 3, +, I
2) Disk1:C, parity(3, 0, 1), Q, Z
3) Disk2:S, 0, parity(+, Q, U), !
4) Disk3:-,1, U, parity(I, Z, !)

Answer 6: B
Answer 7: B, D
Answer 8:

A) 5, 7, 4, 2
B) 3/13

Answer 9:

A) 5, 3, 4, 6
B) 3/13