Assignment 3 – solutions

Problem 1.

What is the total capacity of RAID 0 with 10 drives?

RAID 0 - non-redundant (full capacity of drives) = drive capacity * 10 = 1 TB * 10 = 10 TB

What is the total capacity of RAID 5 with 10 drives?

RAID 5 - parity redundancy - uses 1 drive for parity so have 9 data drives = drive capacity * 9 = 1 TB * 9 = 9 TB

How many blocks are needed for spanned and unspanned records, respectively?

Unspanned

$\left\lfloor \frac{block\ size}{record\ size} \right\rfloor = \left\lfloor \frac{4096}{2050} \right\rfloor =$ = **1 record/block (unspanned)**

Spanned

$\frac{block\ size}{record\ size} = \frac{4096}{2050} =$ **1.99 record/block (spanned)**

What is the block (space) utilization in both cases?

Unspanned

utilization = used space/total space = $\frac{1\ record\ per\ block * 2050\ bytes\ per\ record}{4096\ bytes\ per\ block} = 0.5$

Spanned

utilization = used space/total space = $\frac{1.99\ records\ per\ block * 2050\ bytes\ per\ record}{4096\ bytes\ per\ block} = 0.995$

Assume that the disk has a read bandwidth of 1 GB/sec. Suppose that data is stored sequentially. What is the time to read all records in the unspanned configuration?

Unspanned

# of blocks in unspanned = $\frac{\#\ records}{\#\ records\ per\ block} = \frac{100{,}000}{1\ record} = 100{,}000$ blocks.

Transfer time = $\frac{\#\ blocks * size\ of\ a\ block}{tranfer\ \text{bandwidth}} = \frac{100.000 * 4096}{1\ GB/sec} = 38\ sec$

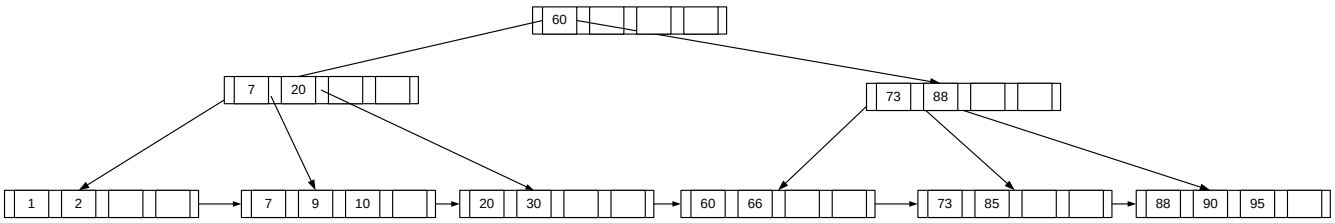
Problem 2.

1. Bytes/track = (bytes/ sector) x (sectors/track) = 1024 x 100 = 102400 bytes = 100KB.
2. Bytes/surface = (bytes/track) x (tracks/surface) = 100KB x 4000 = 400,000KB.
3. Bytes/disk = (bytes/surface) x (surfaces/disk) = 400,000 x 10 x 2 = 80,000,000KB.
4. 4000, i.e., same as the number of tracks.
5. One complete rotation takes 1/7200 in a minute = 1/7200 x 60 seconds ≈ 0.0083 seconds = 8.3 ms. The average rotational delay is half of the rotation time, i.e., 4.15 ms.
6. A track has 100KB. It takes about 8.3ms to make a revolution. Hence, transfer rate is 100KB/8.3ms ≈ 12.05 KB/ms.

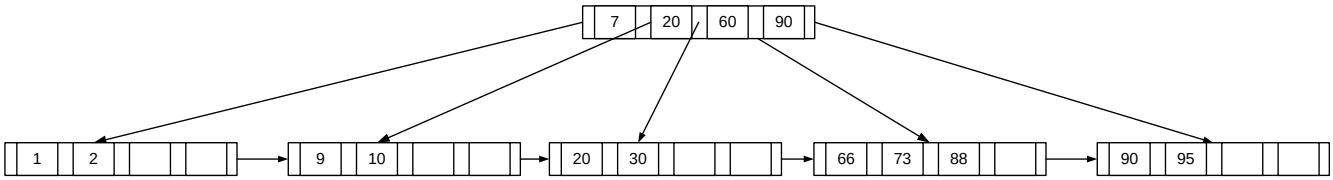
   If you are asked to give the TOTAL transfer time then this is given by:
   Total transfer time = seek time + latency + transfer time = 10ms + 4.15ms + 12.05ms = 26.2ms

Problem 3.

Insert Tree:



Delete Tree:



Problem 3.

T1:R(X), T2:R(X), T1:W(X), T2:W(X).

It is:

- serializable (the outcome is equal to the outcome of T1 → T2)
- not conflict serializable
- not view serializable: it fails the second condition for either T1 → T2 or T2 → T1.

T1:W(X), T2:R(Y), T1:R(Y), T2:R(X).

It is:

- serializable
- conflict-serializable
- view-serializable

T1:R(X), T2:R(Y), T3:W(X), T2:R(X), T1:R(Y).

It is:

- serializable
- not conflict-serializable
- view-serializable

T1:R(X), T1:R(Y), T1:W(X), T2:R(Y), T3:W(Y), T1:W(X), T2:R(Y).

It is:

- serializable
- not conflict-serializable
- view-serializable