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CS 143

HW #4

1.

a. $\dfrac{1\ kB}{sector} \times \dfrac{500\ sectors}{track} \times \dfrac{6\ tracks}{cylinder} \times \dfrac{10^4\ cyl}{disk} = 3.00 \times 10^7\ kB / 2^{20}\,\tfrac{kB}{GB} = \boxed{28.61\ GB}$

b. $6000\ \dfrac{rot}{min} \cdot \dfrac{1\ min}{60s} \cdot \dfrac{1s}{10^3\ ms} = 10^{-1}\ \dfrac{rot}{ms} = \dfrac{10\ ms}{rot}$ at worst.

On avg, $5\ \dfrac{ms}{rot} \cdot \dfrac{1\ rot}{read} + \dfrac{10\ ms}{read} = \boxed{15\ \dfrac{ms}{read}}$ on avg.

c. $\dfrac{1\ tuple}{72\ bytes} \cdot \dfrac{1024\ bytes}{block} = \dfrac{14\ tuples}{block} \cdot \dfrac{1000\ tup}{14\ tup/block} = \boxed{71\ blocks.}$

d. 15 ms for first read, then 0.02 ms/block.
$15\ ms + (0.02 \cdot 71)\ ms = 16.42\ ms.$

e. 15 ms for track change + random block access, on avg.
0.06 ms to read 3 sequential blocks.
$\left(\dfrac{15ms + 0.02\ ms}{cluster\ \ block} \cdot \dfrac{3\ blocks}{cluster}\right)$ 24 clusters $= 361.44$ ms to read 24 clusters

f. $n = \dfrac{1024\ bytes}{4\ bytes/key} \Rightarrow 256\ \dfrac{keys}{node}$

$\log_{128}(10^3) = 1.42$ blocks to read $\to$ at most 2 blocks.
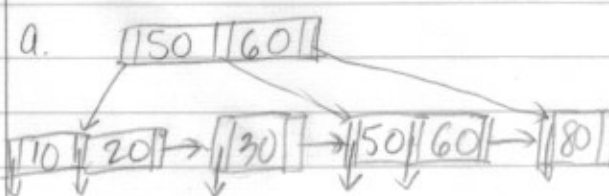
In this case, using a B+ slows down exec.

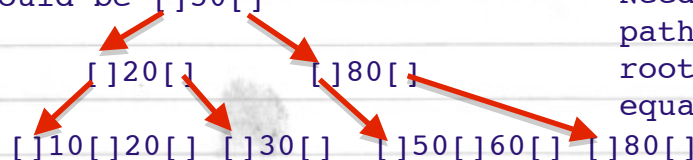So, at most $15ms + 0.04\ ms = 15.04\ ms.$
The B+ tree is helpful.

Need to do 10 random I/Os to retreive all 2005 tuples (since there are 10 classes per year).

2.

a.

b.

2a is wrong. Should be []50[]
[]20[]   []80[]
[]10[]20[] []30[] []50[]60[] []80[]

Need to make sure path length from root to leaf is equal for all leaves.

3. max fanout = 5, max order = 2. max keys = 300 min-

max height: $2^h = 300 \rightarrow h = 9$

min height: $5^h = 300 \rightarrow h = 4$