Sheet (3)

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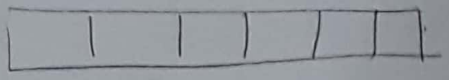
Couse: Database " Audience Course "

Department: Communications & Electronics

Database Management System ["DBMS"]

Indexing

1

- $Size_{Block}$ = 512 bytes
- $Size_{Pointer}$ = 6 bytes 
- $Size_{Pointer_{Record}}$ = 7 bytes long.

r = 30,000 EMPLOYEE Records.

Record [EMPLOYEE]

Name (30) bytes	SSN (9) bytes	DEPARTMENT Code (9) bytes	ADDRESS (40) bytes	PHONE (9) bytes
BIRTH DATE (8) bytes	SEX (1) byte	JOBCODE (4) bytes	SALARY (4) bytes real number	Deletion Marker (1) byte

(a) .. record Size R = 30 + 9 + 9 + 40 + 9 + 8 + 1 + 4 + 4 + 1 byte

bytes

$Size_R$ = 115 bytes

(b) $bfr = \text{blocking factor} = \text{floor}\left\lfloor \frac{B}{R} \right\rfloor = \left\lfloor \frac{512}{115} \right\rfloor = 4$ records/block (Block size)

$b = \text{File blocks} = \text{Ceiling}\left\lceil \frac{r}{bfr} \right\rceil = \left\lceil \frac{30,000}{4} \right\rceil = 7500$ blocks

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(c)

(i) $bfr_{(i)} = \text{index} = f_o = \text{fan-out} = \left\lfloor \frac{B}{i_p} \right\rfloor = \frac{512}{6} = 85$ index/block

(ii)
- # of 1st Level index entries = # of records = $r = 30,000$
- Size of entry = 9 bytes (SSN)
- # of 1st Level index blocks $= \left\lceil \frac{\#\ 1^{st}\text{ level entries}}{\text{index bfr}} \right\rceil = \left\lceil \frac{30,000}{85} \right\rceil$

$= 353$ blocks

(iii) # of levels $= \left\lceil \log_{bfr_{(i)}} N_{1^{st}\text{ Level index blocks}} \right\rceil$

$= \left\lceil \log_{85} 353 \right\rceil = 2$ Levels

(iv) $\#\ \text{blocks}_{tot}\ (\text{in multi level index}) = \sum_{\text{Level}=1}^{2} \text{block} = 353 + 2$

$= 355$

(v) # blocks Accesses = # levels + 1 = 2 + 1 = 3 Accesses

(d) Secondary index:

i) f_o = 85 index/block $= \left\lfloor \frac{B}{i_p + p} \right\rfloor = \frac{512}{6+9} = 34$

ii). # 1st Level entries = # Distinct Secondary Values = 30,000
- # 1st Level blocks = $\left\lceil \frac{\#\ 1^{st}\text{ Level entries}}{\text{index bfr}} \right\rceil = 883$

iii). # of levels = $\left\lceil \log_{34} 883 \right\rceil = 2$ Levels

iv) # block = 883 + 3 + 2 = 888 blocks

(v) # blocks Accesses = 3 + 1 = 4 Accesses

(e)

i) $bfr_i = f_o = \left\lfloor \frac{512}{15} \right\rfloor = 34$

ii) $\#\ blocks = \left\lceil \frac{\#\ record\ Pointer * \#\ records}{block\ size} \right\rceil$

$= \left\lceil \frac{30,000 * 7}{512} \right\rceil = 411\ blocks$

iii) $\#\ 1^{st}\ level\ Entries = \#\ distinct\ SSN = 30,000$

$\#\ ,,\ ,,\ Blocks = \frac{\#\ 1st\ Entries}{bfr_i} = \frac{30,000}{34} = 883$

iv) $\#\ levels = \log 883 = 3\ levels.$

v) $\#\ block_{tot} = \sum_{level=1}^{3} {}^{34}\ block = 883 + 3 + 2 = 888\ blocks.$

vi) $\#\ block\ Accesses = \#\ levels + 1 = 3 + 1 = 4$

(f) i) $brf_i = f_o = \left\lfloor \frac{B}{R} \right\rfloor = \left\lfloor \frac{512}{106} \right\rfloor = 4$

new R = Size of record = Size of Fixed Length + Deletion Marker

$= 30 + 9 + 40 + 9 + 8 + 1 + 4 + 4 + 1 = 106\ bytes$

ii) $\#\ 1^{st}\ level\ entries = distinct\ DEP\_CODE = 1,000\ Entries$

$\#\ ,,\ ,,\ blocks = \left\lceil \frac{\#\ 1^{st}\ Level\ entries}{brf_i} \right\rceil = \frac{1000}{4} = 250\ blocks$

iii) $\#\ Levels = 1$ (because of clustering index anchors)

iv) $\#\ blocks_{tot} = \#\ 1^{st}\ Level\ blocks = 250$

v) $\#\ block\ Accesses = 1$ (because of the Clustring index using anchors)

(2) i) $P_{order} = ?$

* Size of Key = Size of SSN = 9 bytes

* ∴ Order $P = \left\lfloor \frac{\text{Block size} - \text{Pointer Size}}{\text{key size} + \text{Pointer size}} \right\rfloor$

$= \left\lfloor \frac{512 - 6}{9 + 6} \right\rfloor = 55.33 = 55$ bytes

ii) # Leaf-Level blocks = ?

* Size of record = 115 bytes
* fill factor = 69 %
* # records/block $= \left\lfloor \frac{B}{R} \right\rfloor = \left\lfloor \frac{512}{115} \right\rfloor = 4 = bfr$
* ∴ # Leaf blocks $= \left\lceil \frac{\text{\# records}}{\text{\# records / block}} \right\rceil = \frac{30{,}000}{4} = 7500$ blocks

iii) # levels $= \log_P N = \lceil \log_{55} 7500 \rceil = \lceil 2.2 \rceil \simeq 3$ levels

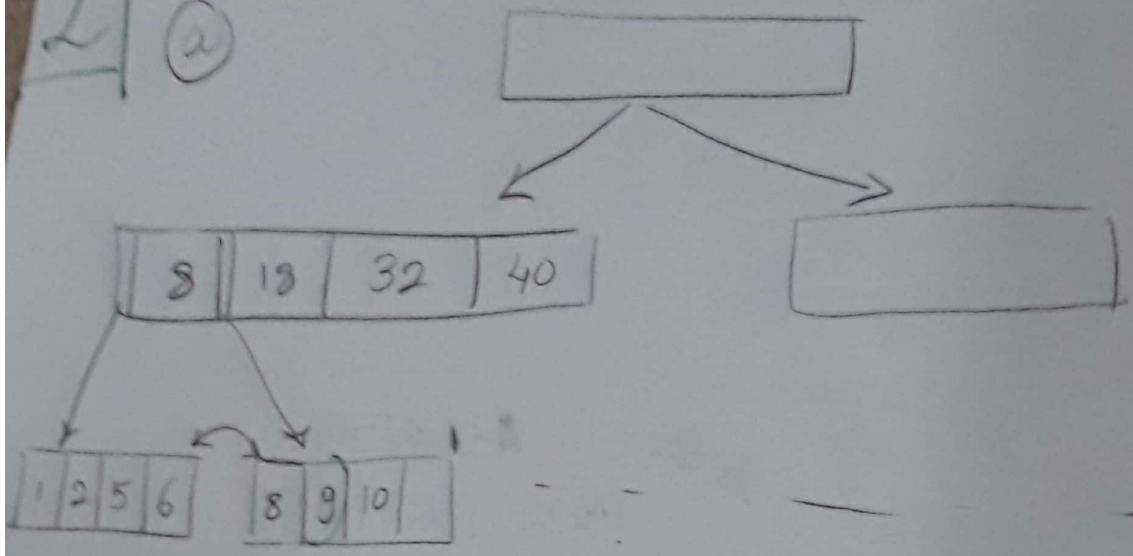
(N = # Leaf-Level Blocks)

iv) $\#\text{Blocks}_{tot} = \sum_{level=1}^{3} 2$ blocks

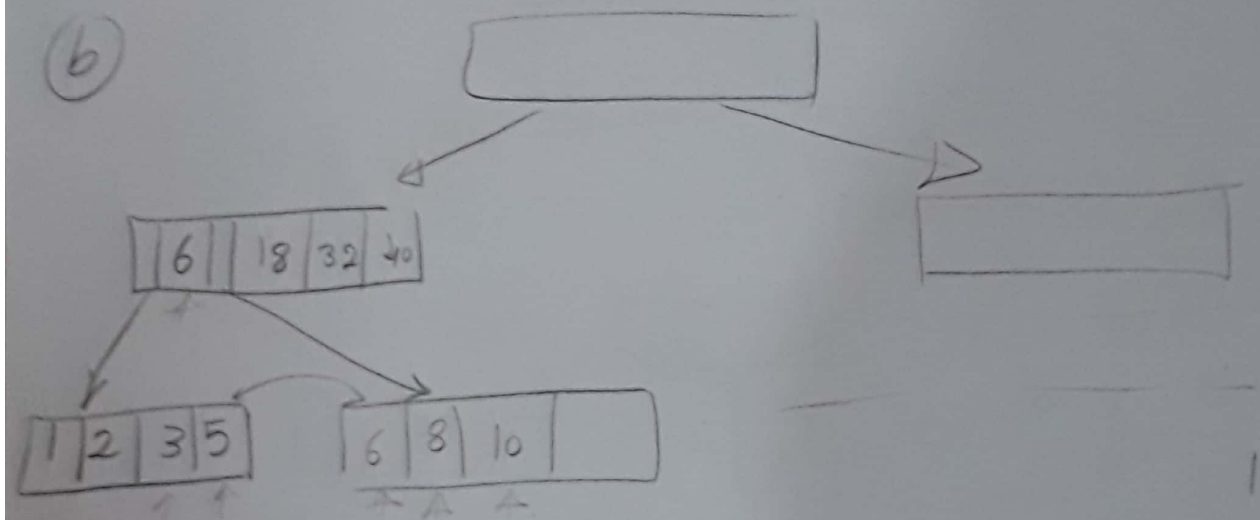
v) $\#\text{Accesses}_{Block} = \#\text{levels} + 1 = 3 + 1 = 4$ Accesses

2

a



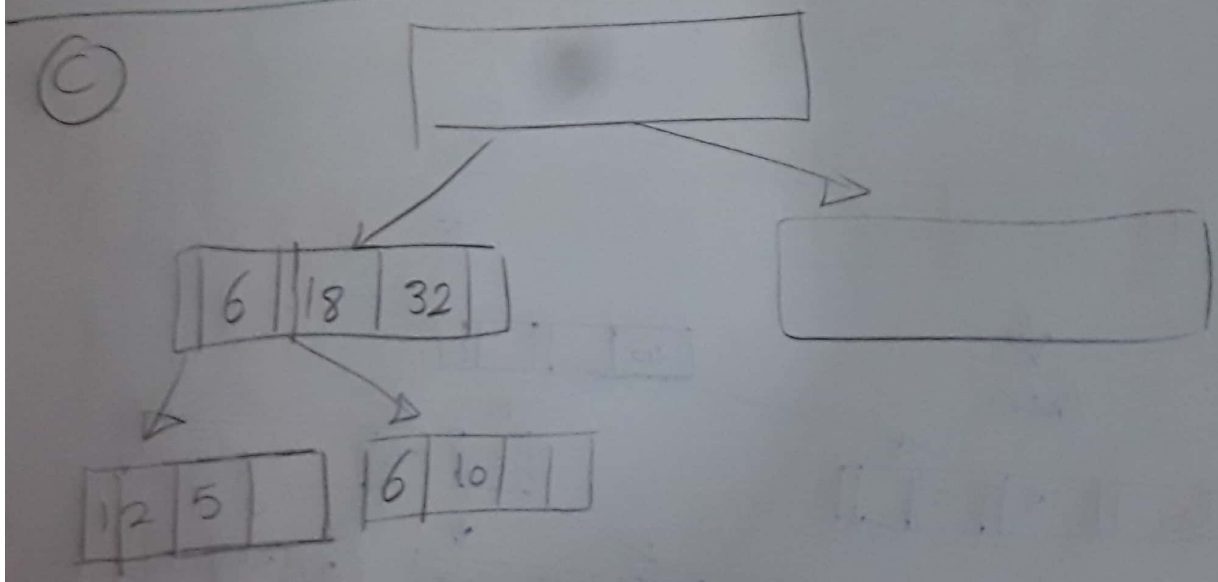
b

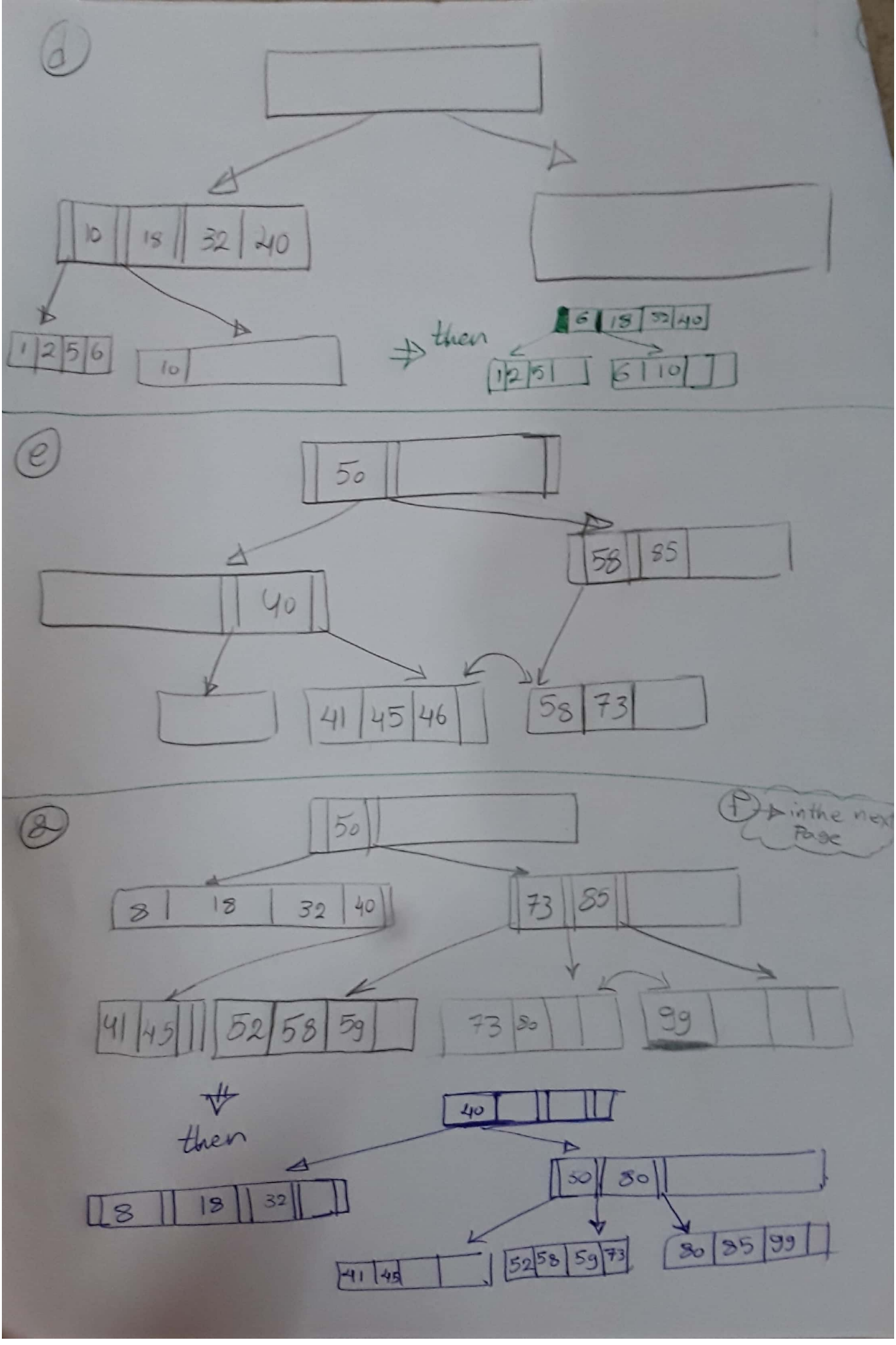


5 reads

6 write

c

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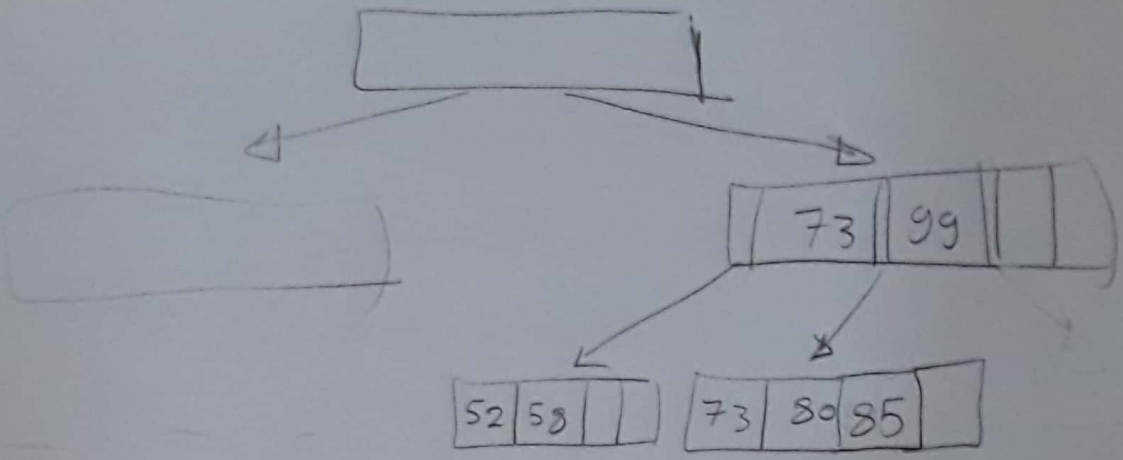
(f)



(h)