Exam

1. σ Π_{name} ($\sigma_{member.memb-no = borrowed.memb-no}$ (member $\bowtie$ borrowed

Π_{name} ($\sigma_{publisher = \text{"mc graw hill"}}$ (member $\bowtie$ (books $\bowtie$ borrowed)))
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2. $A = \Pi_{memb-no, count}$ (member)
   $B = \Pi_{memb-no, count}$ ($\sigma_{publisher \neq \text{"mc grawhill"}}$ (books $\bowtie$ borrowed))

   Π_{name} ((A-B) $\bowtie$ member)

3. Π_{name} (member $\bowtie$ $\Pi_{memb-no}$ borrowed $\bowtie$ books (Π_{isbn}
   ($\sigma_{publisher = \text{"mc grawhill"}}$
   $\cap$ count (isbn) > 5
   (books)))

4. Π

5. ~~$\Pi_{count(*)} \times count_{(*)} \text{member}$~~

2. A traveller wants to travel from Madison city to New York with maximum 2 changes between flights.

The above SQL lists the flights from Madison to New York which arrives in New York before 18:00

3.1. 1. ABCDE   (R) $A \to B, BC \to B, ED \to A$
~~BCD~~ $BC \to E$ $\Rightarrow$ $BCD \to ED$ (aug) $\Rightarrow BCD \to A$
$\Rightarrow BCD \to BCD$ (reflexive)
$\therefore BCD \to ABCDE$
$\Rightarrow BCD \to R$ $\therefore$ $\underline{BCD = superkey}$

using augmentation BCD, ABCD, BCDE, ABCDE are also superkey

2. R is not 3NF
$ED \to A$ is not trivial
$\therefore ED$ is not superkey also
$\therefore A$ is not part of any candidate key

3.2 1. $X \to X, \ X \to Y, \ XZ \to Y$

$F = \begin{cases} X \to X, \ X \to Y, \ XZ \to Y, \ Y \to Y, \ Z \to Z \\ ZY \to Y, \ ZY \to ZY, \ ZY \to Z, \\ XY \to X, \ XY \to XYZ, \ XY \to Y \\ ZX \to Y, \ ZX \to ZX, \ ZX \to X \\ XYZ \to Z, \ XYZ \to Y, \ XYZ \to X \\ XYZ \to XY, \ XYZ \to XZ, \ XYZ \to YZ \\ XYZ \to XYZ \end{cases}$

2. $X \to Y, \ XZ \to Y, \ X \to X$ (list will be same as above due to these initial dependencies)

4. This Java Program gives out the name of the manger whose employee name = "dog" then it gives out the name of the manager of that manager till it reaches a point where an employee (Boss) doesn't have a manager

5.
sector size = 512 bytes
tracks per surface = 2000
sectors per track = 50
double sided platters = 5
avg seek time = 10 msec

5.1 capacity of track (bytes) =
$$\frac{bytes}{sector} \cdot \frac{sector}{track} = 512 \times 50 = \underline{25600}$$

capacity of each surface =
$$\frac{bytes}{track} \times \frac{tracks}{surface} = 25600 \times 2000 = \underline{\frac{51200000}{bytes}}$$

capacity of disk =
$$\frac{bytes}{surface} \cdot \frac{surface}{disk} = 51200000 \times 10 = \underline{\frac{512000000}{bytes}}$$

5.2 no. of cylinder the disk have :-
$$\underline{2000}$$ (same as no. of tracks per surface)

5.3 block size = 512n   (n = 1, 2, ----) (shouldn't exceed capacity of track)
256 is not valid
2048 is valid
51200 is not valid (shouldn't exceed capacity of track)

5.4   rotation = 5400 rpm   =   90 rps

     rotational delay = Time period = $\dfrac{1}{90}$ = $\underline{0.011 \text{ sec}}$

5.5   transfer rate = capacity of track × frequency (rps)

          =   25600 × 90 = 2304000

6. B^+ tree

     20000 records , 40 byte string index (candidate key)

     pointers (10 byte)

     one disk page = 1000 bytes

     bottom - up fashion (bulk loading algo)

     nodes filled as much as possible

6.

6.1 node has atmost $2n$ keys & $2n+1$ children

∴ $2n \cdot 40 + 10 \cdot (2n+1) \leq 1000$

→ $80n + 20n + 10 \leq 1000$

→ $100n \leq 990$

∴ $n \leq 9$ ∴ $\underline{n = 9}$

∴ each node has 18 keys & 19 children

leaf node has a size of 50 bytes
∴ total space for data entry = $\mathbf{20}$

$$h \approx \left\lceil \log_{19}\left(\frac{20000}{20}\right) \right\rceil \approx \underline{4}.$$

6.2 root node = 1   (to

leaf node = 1000   (level 4)
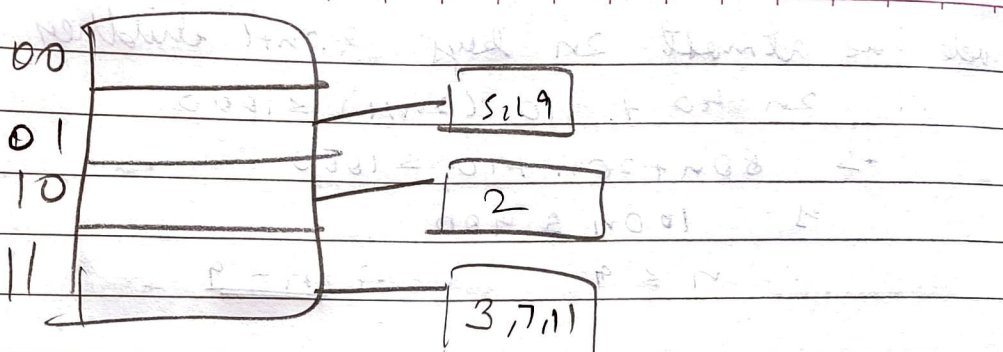
$\text{nodes} = \left\{\dfrac{1000}{19}\right\} \approx \cancel{52} \, 53$ (level 3)

$\text{nodes} = \dfrac{52}{19} \approx 3$ (level 2)

$$\begin{array}{r} 52.6 \\ 19\overline{)1000} \\ \underline{95} \\ 50 \\ -38 \end{array}$$

$$\begin{array}{r} 18 \\ 2.6 \\ 19\overline{)120} \\ \end{array}$$

7. $h(x) = x \bmod 4$

bucket size = 3

keys = 2, 3, 5, 7, 11, 17, 19, 23, 29, 31

00

01

10

11

5,9

2

3,7,11

$N(x) = x \bmod N$