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## Assignment #3

### Part 1

a)  $\text{westboro} \leftarrow \sigma_{\text{School\_name} = \text{"Westboro School"} } (\text{School})$

$\text{west\_Activity} \leftarrow \sigma_{(\text{westboro} \bowtie \text{Activity})}$

$\text{Art} \leftarrow \sigma_{\text{Activity} = \text{"Art"} } (\text{Activity}, \bowtie \text{Participate})$

$\text{Art\_student} \leftarrow \sigma_{\text{ranking} = 4 } (\text{Art})$

$\text{Result} \leftarrow \Pi_{\text{grade}} (\text{F}_{\text{max}} \text{ grade} (\text{Art\_student} \bowtie \text{student}))$

b)  $\text{school\_heads} \leftarrow \sigma (\text{School} \bowtie \text{Staff})$

$(\text{School\_head} = \text{SID})$

$\text{Result} \leftarrow \Pi_{\text{Frame}} \text{ lname } \sigma (\text{School\_heads} \bowtie \text{Staff})$

$(\text{frame} = \text{frame})$

d)  $\Pi_{\text{School\_name}, \text{Salary}} (\text{F}_{\text{avg}} \text{ Salary} (\text{School} \bowtie \text{staff}))$

e)  $\text{All\_student} \leftarrow \Pi_{\text{std-ID}} (\text{student})$

$\text{Part\_Student} \leftarrow \Pi_{\text{std-ID}} (\text{Participate})$

$\text{Non\_Part\_Student} \leftarrow \text{All\_student} - \text{Part\_student}$

$\text{Result} \leftarrow \Pi_{\text{lname}, \text{frame}} (\text{student} \bowtie \text{non\_part\_student})$

e)  $\text{All\_student} \leftarrow \Pi_{\text{std-ID}} (\text{student})$

$\text{Part\_Student} \leftarrow \Pi_{\text{std-ID}} (\text{Participate})$

$\text{All\_Part\_Student\_All} \leftarrow (\text{All\_student} \div \text{Part\_student})$

$\text{Result} \leftarrow \Pi_{\text{lname}, \text{frame}} (\text{student} * \text{All\_Part\_student\_All})$

## Part 2 Normalization

2.1 Relation  $R = \{A, B, C, D, E, F\}$

$$F = \{\{A \rightarrow CF\}, \{C \rightarrow D\}, \{B \rightarrow E\}\}$$

a)  $(A)^+ = (CFD)$   
 $(B)^+ = (E)$

b) The relation is in 2NF because there is no partial dependency making it at least 2NF, however there is a transitive relationship so it is not 3NF.

c)  $R = \{BE\}$  stays the same  
 $P = \{ACF\}$  A reference to both C and F and  
 $Q = \{CD\}$  eliminates the transitive property

## 2.2

a) No, it is not in 3NF because there is a partial dependency. So it is not even in 2NF. Although there is no transitive property, there is still a partial dependency. So it is not 3NF

b) As explained above, because there is a partial dependency it is not in 2NF

2.3

a) FD1: {SSN} → (Name, Sname, StAddr, StPhone, BDate, sex, clss,  
major, minor, program)

FD2: {Lname} → (Name, SSN, STAddr, StPhone, BDate, sex, clss  
major, minor, program)

FD3: {DNAME} → (Dcode, DOffice, DPhone, DCollege)

FD4: {DCODE} → (DNAME, DOFFICE, DPHONE, DCOLLEGE)

FD5: {CNIM} → (CName, CDesc, credit, Level, class)

FD6: {Course, Semester, Year, Section} → (Tname)

b)

## Part 3 Storage and Indexing

### 3.1

$$a) R = 6B + 25B + 25B + 40B + 1B + 4B + 6B + 6B + 1B \\ = 114B$$

$$b) \text{bfr} = \left\lceil \frac{R}{B} \right\rceil = \left\lceil \frac{2400B}{114B} \right\rceil = 21 \frac{\text{records}}{\text{block}}$$

$$b = \left\lceil \frac{r}{bfr} \right\rceil = \left\lceil \frac{40000}{21 \frac{\text{records}}{\text{block}}} \right\rceil = 1905 \text{ Blocks}$$

c) Half of the 1905 blocks will be looked at in order to find a specific record

The seek time and rotational delay will happen once if + 2 file " contiguous and double-buffered after + 2 + 1 the 953 contiguous blocks will be read.

$$S+rd + 953 \cdot \frac{B}{m} = 20\text{msec} + 10\text{msec} + 953 \cdot 1 = 983 \text{ msec}$$

$$S+rd + \frac{B}{m} = 20 + 10 + \frac{2400 \text{ bytes}}{2400 \text{ bytes/sec}} \\ = 31 \text{ msec}$$

$$953 \cdot 31 \text{ msec} = 29543$$

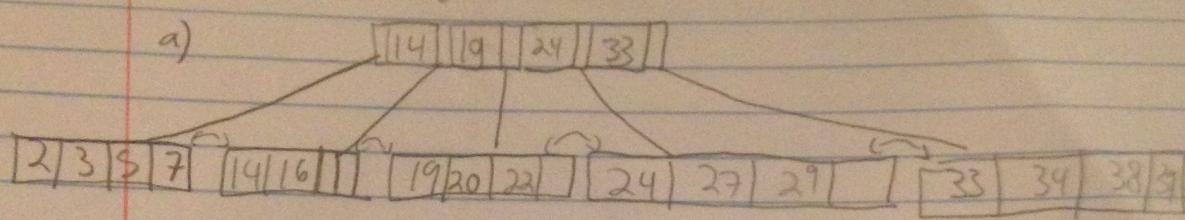
### 3.2

$$4 + (4 \times 2) + (10 \times 5) \\ \underline{4 + 8 + 50} \\ = 62 \text{ bytes}$$

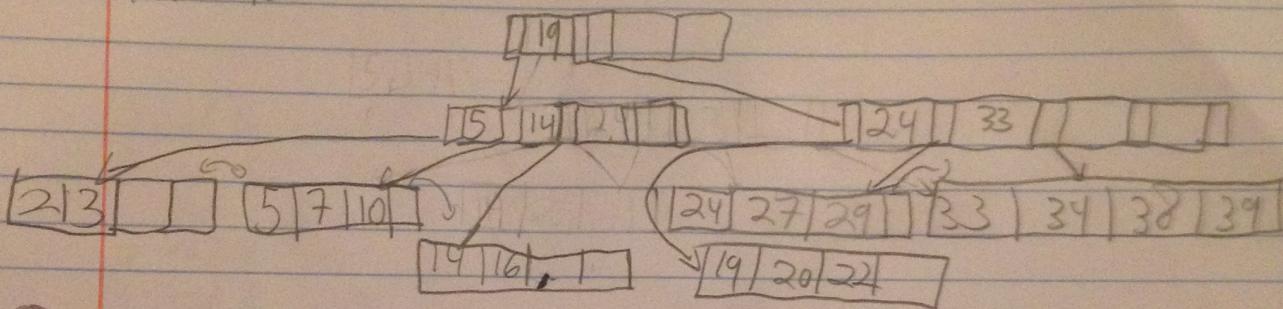
3.3

root  
↓

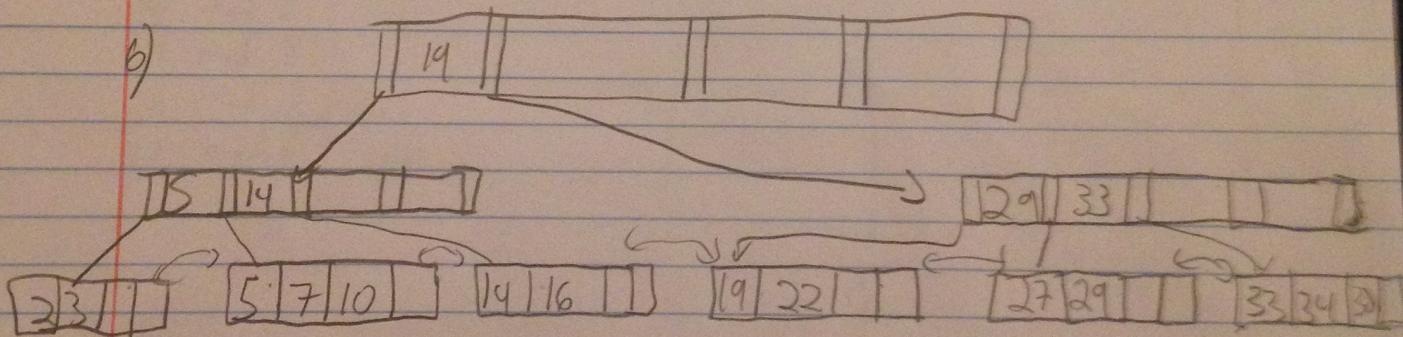
a)



Insert 10\*



b)

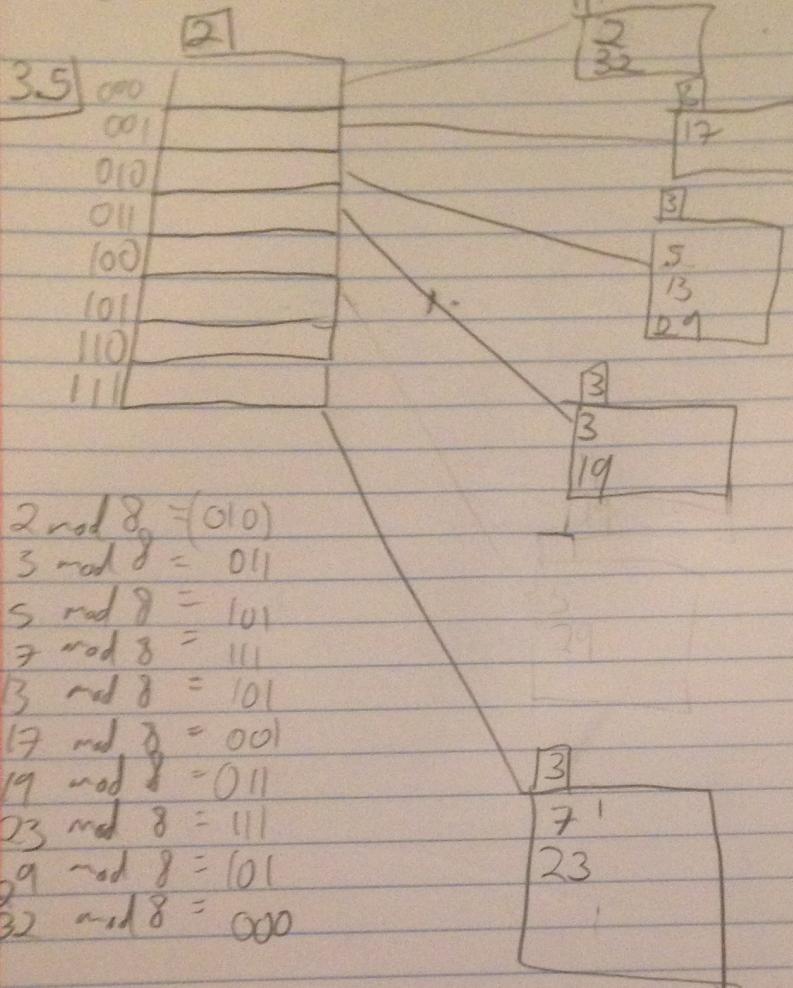


3.4 a) Primary index (B-tree) on std\_ID , not date  
from (1 and 2) SQL code

b) Secondary index (B-tree) ranking , std\_ID  
This is for sqq3

Insert #: [2, 3, 5, 7, 13, 19, 23, 29, 32]

Given arr



$$2 \bmod 8 = (010)$$

$$3 \bmod 8 = 011$$

$$5 \bmod 8 = 101$$

$$7 \bmod 8 = 111$$

$$13 \bmod 8 = 101$$

$$17 \bmod 8 = 001$$

$$19 \bmod 8 = 011$$

$$23 \bmod 8 = 111$$

$$29 \bmod 8 = 101$$

$$32 \bmod 8 = 000$$