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Classtest -1- 17MA20053
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1) i) The entity sets and their attributes are :-
Student - Key - Student number

Attributes :- Name, number, address, phone, DOB, sex, class, degree

Department :- Key - Name and code

Attributes - Name, code, office no, phone

Course :- key - Course number

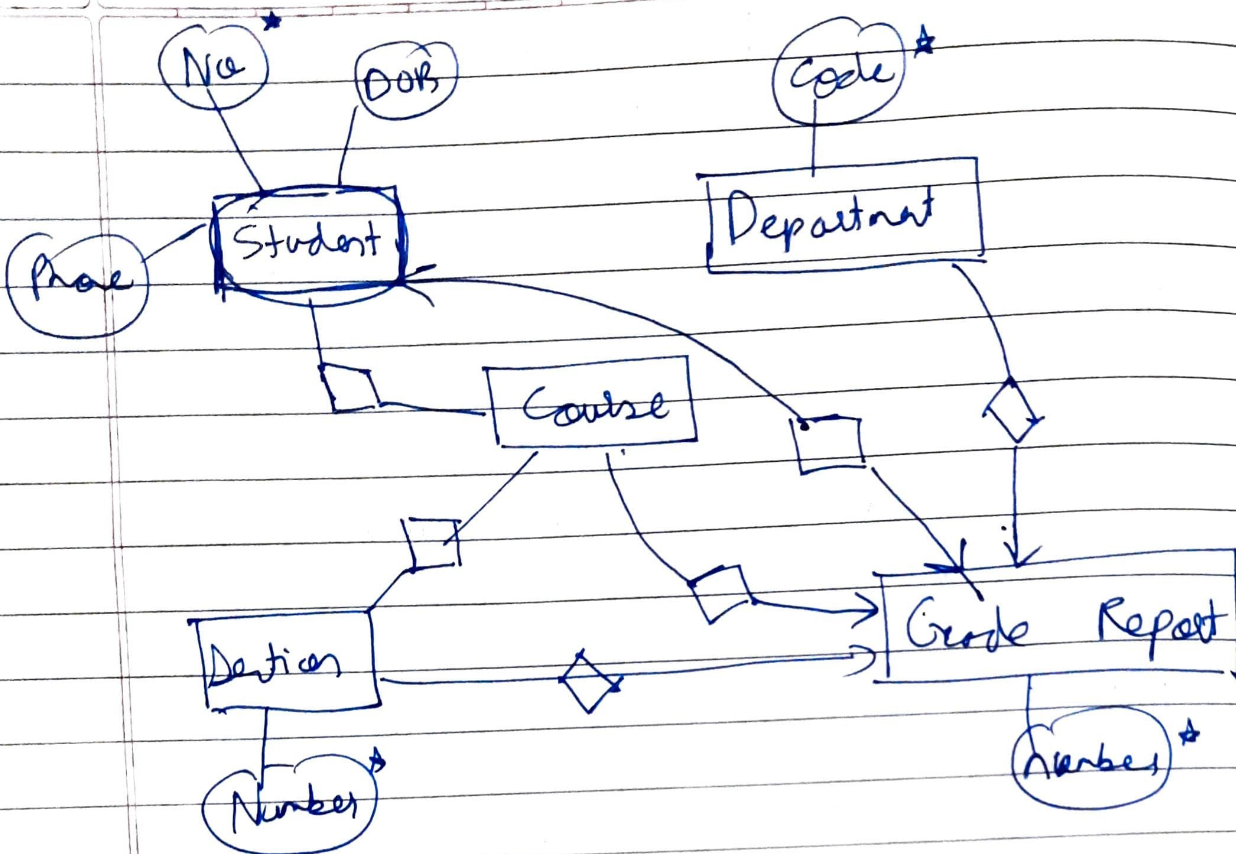
Attributes - Number, description, semester hours, level, Department.

~~Instruct~~
Section : Key - Section number

Number, instructor, semester, year, course,

Grade Report : Key - Student number

Name, number, section, letter grade.


No
DOB
Code
Student
Department
Phone
Course
Section
Grade Report
Number
Number

E-R Diagram.

2) a) R has one key, then BCNF $\Leftrightarrow$ 3NF

We already know that BCNF $\rightarrow$ 3NF

Let F (F^+) denote closure of set of FDs satisfied by, R, which is assumed 3NF.

We need to show for each nontrivial $X \rightarrow A$ in F^+, X is a super key.

~~To~~ ~~this~~ Let X not be a super key if possible,

3NF guarantees that A is part of key.

Since all keys are simple by assumption, we have A is key. This with $X \rightarrow A$ implies X is a super key which is contradiction.

$\therefore$ 3NF $\rightarrow$ BCNF thus 3NF $\Leftrightarrow$ BCNF

2b) i) The statement is False.

$X \rightarrow Y$, $W \rightarrow Z$, $Y \subseteq W$

$W \supseteq Y$ ∴ $W \rightarrow Y$

$X \rightarrow Y$, $W \rightarrow Y$

$W \rightarrow Z$

$W \rightarrow YZ$

∴ False

ii) $XZ \rightarrow Y$, $X \rightarrow W$ and $Z \subset W$ then $X \rightarrow Y$

$\Rightarrow$ We have $X \rightarrow W$ & $Z \subseteq W$

thus $X \rightarrow Z$ by decomposition.

∴ $X \rightarrow XZ$ & $XZ \rightarrow Y$ (Augmentation)

∴ By transitivity

$X \rightarrow Y$

Hence proved.

c) $R(A, B, C, D, E, X, Y)$

Reduce to 3NF

Step 1 ~~D→A, XD~~ All F.Ds already have one attribute on right.

Step 2 We get B, C, and D as equivalent keys

i.e. $B \to D$, $D \to B$, $C \to B$, $D \to X$.

$R_1(\underline{B}, \underline{C}, \underline{D}, B)$ $R_2(\underline{C}, B)$ $R_3(\underline{A}, X)$

$R_4(\underline{Y}, B)$, $R_5(\underline{E}, Y)$

Key attributes are underlined.

This is a 3NF relation, has lossless join property.

It is required decomposition.

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3) a) R(A, B, C) and S(A, B, D).

Naturala Join of R & S , $R \cap S \neq \Phi$

Result - (A, B, C, D)

Result of $R \bowtie S$ is

3b) Supplier (s_id, s_name, s_address)

Book (acc_no, year, title)

User (card_no, u_name, address)

Supply ( )

Borrow ( )

i) Name of user with no issue

$$\pi_{u.name}(USER) - \pi_{u.name}\left(\sigma_{user.card\_no = Borrow.card\_no}(USER \times BORROW)\right)$$

ii)

$$\pi_{s\_name}\left(\sigma_{card\_no='A11'}\left(Supplier \bowtie Supply \bowtie Borrow\right)\right)$$

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4) $R(A, B, C, D, E)$ with FDs
$\{A \to BC, CD \to E, B \to D, E \to A\}$

$R_1\{A, B, C\}$ & $R_2\{A, D, E\}$

i) $R_1 \cap R_2 = \{A\}$
$R_1 - R_2 = \{BC\}$

$A \to BC$ exists in given FD set.

$\therefore R_1 \cap R_2 \to R_1 - R_2$

$\therefore$ Decomposition is a lossless join decomposition

ii) For R_1 consider dependencies
R_1, $F_1 = \{A \to BC\}$

For R_2 $F_2 = \{E \to A\}$

$F =$ given FD set

$F_1 \cup F_2 \neq F$ as $CD \to E$ & $B \to D$
are not in $F_1 \cup F_2$

$\therefore$ Decomposition does not preserve dependency.