



# DATABASE MANAGEMENT SYSTEM (IT214)

Title: Advanced Crime Examination (ACE)

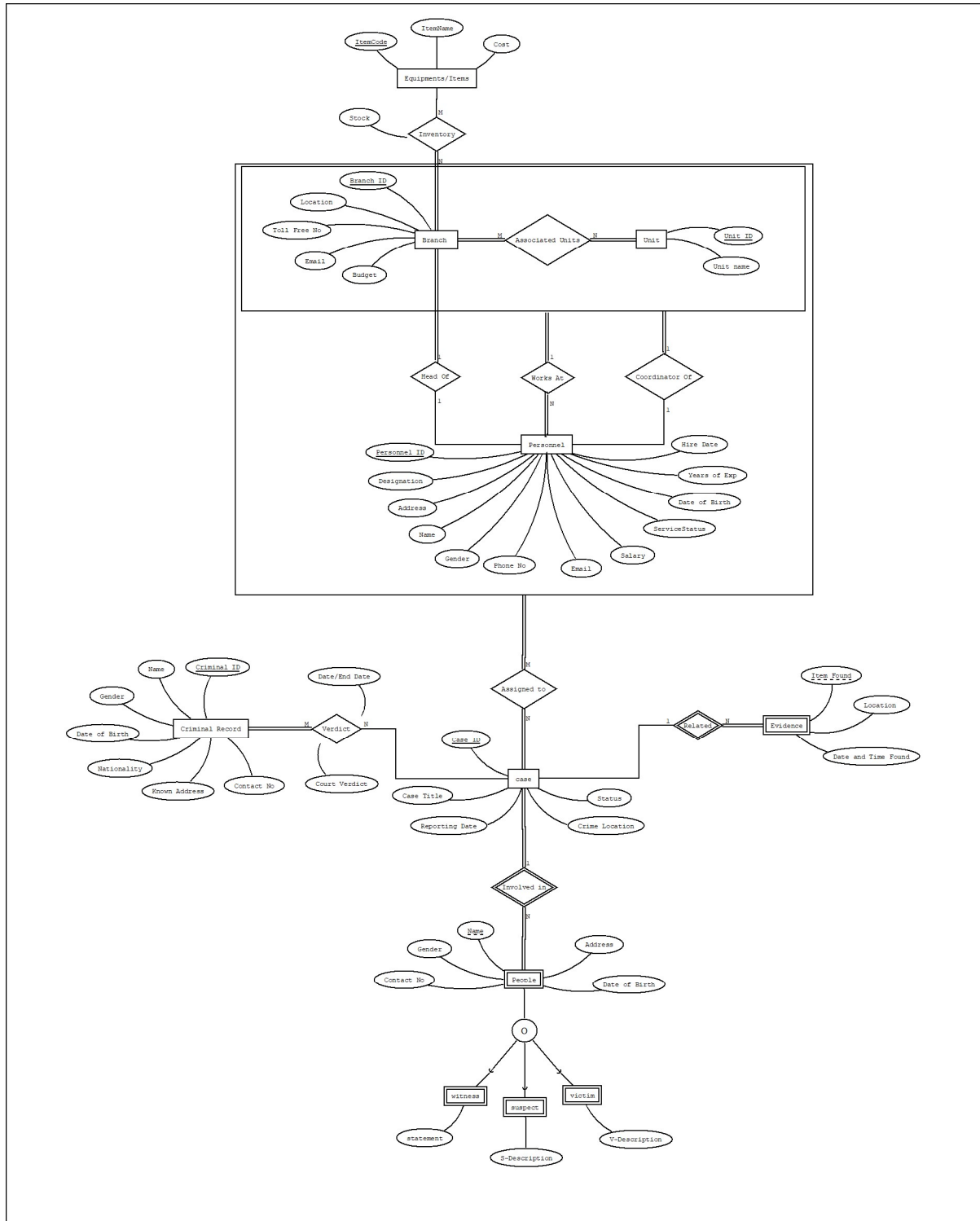
Group Representative: Divyakumar M Tandel (2022014769)

Contact number: 6353159795

Team members:

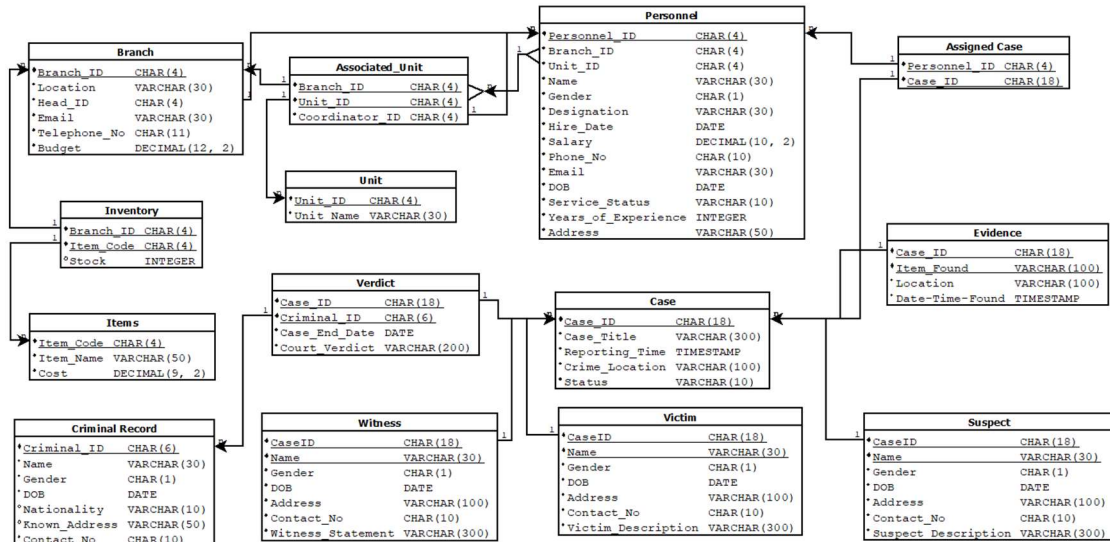
Name	Student ID
Divyakumar M. Tandel	202201469
Kaushik R. Prajapati	202201472
Jeet M. Desai	202201474
Kishan D. Pansuriya	202201504
Tirth K. Modi	202201513
Vidhan Chavda	202201133

## ➤ Entity Relationship Diagram:



## ➤ Relational Schema:

ACE RELATIONAL SCHEMA



## ➤ Normalization Proofs

### • Branch Relation

#### ○ FD Set

Branch\_ID → {Location, Head\_ID, Email, Telephone\_No, Budget}

#### ○ Minimal FD Set

Branch\_ID → Location

Branch\_ID → Head\_ID

Branch\_ID → Email

Branch\_ID → Telephone\_No

Branch\_ID → Budget

#### ○ Key

Branch\_ID

#### ○ Normal Form

“Branch” Relation’s all functional dependencies (FDs) have the key on the left side.

Additionally, the right side of each FD is irreducible. Therefore, the “Branch” relation is in BCNF.

- **Unit Relation**

- **FD Set**

- Unit\_ID  $\rightarrow$  Unit\_Name

- **Minimal FD Set**

- Unit\_ID  $\rightarrow$  Unit\_Name

- **Key**

- Unit\_ID

- **Normal Form**

- “Unit” relation has only one FD with key having on the left side. Thus, it is in BCNF.

- **Item Relation**

- **FD Set**

- Item\_Code  $\rightarrow$  {Item\_Name, Cost}

- **Minimal FD Set**

- Item\_Code  $\rightarrow$  Item\_Name

- Item\_Code  $\rightarrow$  Cost

- **Key**

- Item\_Code

- **Normal Form**

- “Item” Relation has two functional dependencies (FDs) with key having on the left side. Additionally, the right side of these two FDs is irreducible. Therefore, the “Item” relation is in BCNF.

- **Inventory Relation**

- **FD Set**

- {Branch\_ID, Item\_Code}  $\rightarrow$  Stock

- **Minimal FD Set**

- {Branch\_ID, Item\_Code}  $\rightarrow$  Stock

- **Key**

- {Branch\_ID, Item\_Code}

- **Normal Form**

- “Inventory” relation has only one FD with key having on the left side. Thus, it is in BCNF.

- **Associated\_Unit Relation**

- **FD Set**

$\{\text{Branch\_ID}, \text{Unit\_ID}\} \rightarrow \text{Coordinator\_ID}$

- **Minimal FD Set**

$\{\text{Branch\_ID}, \text{Unit\_ID}\} \rightarrow \text{Coordinator\_ID}$

- **Key**

$\{\text{Branch\_ID}, \text{Unit\_ID}\}$

- **Normal Form**

“Associated Unit” relation has only one FD with key having on the left side. Thus, it is in BCNF.

- **Personnel Relation**

- **FD Set**

$\text{Personnel\_ID} \rightarrow \{\text{Branch\_ID}, \text{Unit\_ID}, \text{Name}, \text{Gender}, \text{Designation}, \text{Hire\_Date}, \text{Salary}, \text{Phone\_No}, \text{Email}, \text{DOB}, \text{Service\_Status}, \text{Years\_of\_Experience}, \text{Address}\}$

- **Minimal FD Set**

$\text{Personnel\_ID} \rightarrow \text{Branch\_ID}$

$\text{Personnel\_ID} \rightarrow \text{Unit\_ID}$

$\text{Personnel\_ID} \rightarrow \text{Name}$

$\text{Personnel\_ID} \rightarrow \text{Gender}$

$\text{Personnel\_ID} \rightarrow \text{Designation}$

$\text{Personnel\_ID} \rightarrow \text{Hire\_Date}$

$\text{Personnel\_ID} \rightarrow \text{Salary}$

$\text{Personnel\_ID} \rightarrow \text{Phone\_No}$

$\text{Personnel\_ID} \rightarrow \text{Email}$

$\text{Personnel\_ID} \rightarrow \text{DOB}$

$\text{Personnel\_ID} \rightarrow \text{Service\_Status}$

$\text{Personnel\_ID} \rightarrow \text{Years\_of\_Experience}$

$\text{Personnel\_ID} \rightarrow \text{Address}$

- **Key**

$\text{Personnel\_ID}$

- **Normal Form**

In the “Personnel” Relation, every functional dependency (FD) has its key on the left side, with the right side being irreducible. Hence, the “Personnel” relation meets the BCNF criteria.

- **Case Relation**

- **FD Set**

$\text{Case\_ID} \rightarrow \{\text{Case\_Title}, \text{Reporting\_Time}, \text{Crime\_Location}, \text{Status}\}$

- **Minimal FD Set**

Case\_ID  $\rightarrow$  Case\_Title  
Case\_ID  $\rightarrow$  Reporting\_Time  
Case\_ID  $\rightarrow$  Crime\_Location  
Case\_ID  $\rightarrow$  Status

- **Key**

Case\_ID

- **Normal Form**

All FDs in the “Case” Relation have their key on the left side and an irreducible right side, which places “Case” relation BCNF.

- **Assigned\_Case Relation**

- **Key**

{Personnel\_ID, Case\_ID}

- **Normal Form**

“Assigned Case” relation has no FD and thus nothing on right side. Thus, it is in BCNF.

- **Evidence Relation**

- **FD Set**

{Case\_ID, Item\_Found}  $\rightarrow$  {Location, Date\_Time\_Found}

- **Minimal FD Set**

{Case\_ID, Item\_Found}  $\rightarrow$  Location

{Case\_ID, Item\_Found}  $\rightarrow$  Date\_Time\_Found

- **Key**

{Case\_ID, Item\_Found}

- **Normal Form**

“Evidence” Relation has two functional dependencies (FDs) with key having on the left side. Additionally, the right side of these two FDs is irreducible. Therefore, the “Evidence” relation is in BCNF.

- **Criminal\_Record Relation**

- **FD Set**

Criminal\_ID  $\rightarrow$  {C\_Name, Gender, DOB, Nationality, Contact\_No, Known\_Address}

- **Minimal FD Set**

Criminal\_ID  $\rightarrow$  C\_Name

Criminal\_ID  $\rightarrow$  Gender

Criminal\_ID  $\rightarrow$  DOB

Criminal\_ID  $\rightarrow$  Nationality

Criminal\_ID  $\rightarrow$  Contact\_No

Criminal\_ID  $\rightarrow$  Known\_Address

- **Key**  
Criminal\_ID
- **Normal Form**  
“Criminal\_Record” Relation’s all functional dependencies (FDs) have the key on the left side. Additionally, the right side of each FD is irreducible. Therefore, the “Criminal” relation is in BCNF.

- **Verdict Relation**

- **FD Set**  
 $\{\text{Criminal\_ID}, \text{Case\_ID}\} \rightarrow \{\text{Case\_End\_Date}, \text{Court\_Verdict}\}$
- **Minimal FD Set**  
 $\{\text{Criminal\_ID}, \text{Case\_ID}\} \rightarrow \text{Case\_End\_Date}$   
 $\{\text{Criminal\_ID}, \text{Case\_ID}\} \rightarrow \text{Court\_Verdict}$
- **Key**  
 $\{\text{Criminal\_ID}, \text{Case\_ID}\}$
- **Normal Form**  
“Verdict” Relation has two functional dependencies (FDs) with key having on the left side. Additionally, the right side of these two FDs is irreducible. Therefore, the “Verdict” relation is in BCNF.

- **Suspect Relation**

- **FD Set**  
 $\{\text{Case\_ID}, \text{S\_Name}\} \rightarrow \{\text{Gender}, \text{DOB}, \text{Contact\_No}, \text{Address}, \text{Suspect\_Description}\}$
- **Minimal FD Set**  
 $\{\text{Case\_ID}, \text{S\_Name}\} \rightarrow \text{Gender}$   
 $\{\text{Case\_ID}, \text{S\_Name}\} \rightarrow \text{DOB}$   
 $\{\text{Case\_ID}, \text{S\_Name}\} \rightarrow \text{Contact\_No}$   
 $\{\text{Case\_ID}, \text{S\_Name}\} \rightarrow \text{Address}$   
 $\{\text{Case\_ID}, \text{S\_Name}\} \rightarrow \text{Suspect\_Description}$
- **Key**  
 $\{\text{Case\_ID}, \text{S\_Name}\}$
- **Normal Form**  
“Suspect” Relation’s all functional dependencies (FDs) have the key on the left side. Additionally, the right side of each FD is irreducible. Therefore, the “Suspect” relation is in BCNF.

- **Witness Relation**

- **FD Set**

- $\{Case\_ID, W\_Name\} \rightarrow \{Gender, DOB, Contact\_No, Address, Witness\_Statement\}$

- **Minimal FD Set**

- $\{Case\_ID, W\_Name\} \rightarrow Gender$

- $\{Case\_ID, W\_Name\} \rightarrow DOB$

- $\{Case\_ID, W\_Name\} \rightarrow Contact\_No$

- $\{Case\_ID, W\_Name\} \rightarrow Address$

- $\{Case\_ID, W\_Name\} \rightarrow Witness\_Statement$

- **Key**

- $\{Case\_ID, W\_Name\}$

- **Normal Form**

- “Witness” Relation’s all functional dependencies (FDs) have the key on the left side. Additionally, the right side of each FD is irreducible. Therefore, the “Witness” relation is in BCNF.

- **Victim Relation**

- **FD Set**

- $\{Case\_ID, V\_Name\} \rightarrow \{Gender, DOB, Contact\_No, Address, Victim\_Description\}$

- **Minimal FD Set**

- $\{Case\_ID, V\_Name\} \rightarrow Gender$

- $\{Case\_ID, V\_Name\} \rightarrow DOB$

- $\{Case\_ID, V\_Name\} \rightarrow Contact\_No$

- $\{Case\_ID, V\_Name\} \rightarrow Address$

- $\{Case\_ID, V\_Name\} \rightarrow Victim\_Description$

- **Key**

- $\{Case\_ID, V\_Name\}$

- **Normal Form**

- “Victim” Relation’s all functional dependencies (FDs) have the key on the left side. Additionally, the right side of each FD is irreducible. Therefore, the “Victim” relation is in BCNF.