Q3. Name all the entities, relationships, and attributes involved in your system.

The entity set in out design:

Entities	**Attributes**
Beneficiary	● AadhaarId ● Name ● DOB ● Gender ● MaritalStatus ● Education ● Photo ● Employed
VillageProfile	● PinCode ● Name ● NoOfBeneficiaries ● NoOfPrimaryHealthCenter ● NoOfPrimarySchool ● Transport ● Infrastructure ● MajorOccupation ● TechnicalLiteracy ● Year
Trainer	● EmailId ● Fee ● Name ● Gender ● Age
Projects	● EventName ● StartDate ● Types ● Budget ● NoOfParticipants ● Duration ● Collection ● PhotosLinks ● TotalExpense
Venue	● VenueID ● Place ● PINCode ● District State

ProjectExpense	● EventName ● StartDate ● Amount ● Description
Volunteers	● EmailId ● Name ● PhoneNo ● DOB ● Gender
Funding	● EmailId ● Amount ● FunderName ● Date
Goods	● EventName ● StartDate ● ItemName ● Quantity ● Amount
Teams	● EmployID ● Name ● EmailID ● Salary ● Position ● YearOfJoining ● YearOfLeaving ● ReasonOfLeaving
EmployPhoneEntity	● PhoneNumber ● Location
TrainerPhoneEntity	● PhoneNumber ● EmailId
BeneficiaryPhoneEntity	● PhoneNumber ● AadhaarId

The relationship sets in our design are listed below:

Relations	Description
PhoneTrainer	Relating Trainer with TrainerPhoneEntity
TrainerBeneficiary	Relating Beneficiary with Trainer
Belongs	Relating Beneficiary with VillageProfile
PhoneBeneficiary	Relating BeneficiaryPhoneEntity with Beneficiary
Assessment, Participants	Relating Beneficiary with Projects
HeldAt	Relating Projects with Venue
Expense	Relating Projects with ProjectExpense
Volunteering	Relating Projects with Volunteers
Sponsors	Relating Projects with Funding
Inventory	Relating Project with Goods
Organize	Relating Teams with Projects
TeamPhone	Relating EmployPhoneEntity with Teams
Trains	Relating NEEV events with corresponding trainers
ItemsSold	Relating items manufactured and sold with the corresponding event they were manufactured in

Q4. Give examples and justification for points c to g in Design Requirements.

At least one primary key and one foreign key.

The *Belongs* relationship between the entities *Beneficiary* and *VillageProfile* can be represented as a relational schema, featuring a table of *Beneficiaries* with an *AadharId* column serving as the primary key and a *PinCode* column from the *VillageProfile* table as the foreign key.

At least one one-to-one relationship.

The *TrainerBeneficiary* relationship between the entities *Trainer* and *Beneficiary* is a one-to-one relationship, as per the NEEV context. In this scenario, a *Trainer* could also be a *Beneficiary* who has completed a specific event previously.

At least any/both of (one-to-many, many-to-one) relationships.

The *PhoneTrainer* relationship, a weak entity, between the entities *Trainer* and *TrainerPhoneEntity*, is a one-to-many relationship, with the many side on *TrainerPhoneEntity*. This relationship is characterized by a one-to-many cardinality on the *TrainerPhoneEntity* side, as there may exist multiple *PhoneNumbers* for a single Trainer.

At least one many-to-many relationship.

There are numerous *many to many* relationships present in our ER diagram. One example of such is the *Beneficiary* to *Projects* relation. *Participants* is the relationship set that exists between these two entity sets. There exists a *many to many* relationships between these entities as any one beneficiary may participate in many projects as well as any one project may have many beneficiaries participating in it.

At least one of each (total & partial) participation constraint.

We have used five total participation constraints in the ER diagram. One such example of total participation constraint is on the *ProjectExpense* weak entity set. It has a *many to one* relationship with *Projects* entity set. The relationship set between them is *Expense* and it is a weak entity set. The *ProjectExpense* weak entity set has a total participation constraint on it as all the instances present in this set must participate in a relation with the instances of *Projects* entity set. This is because, there cannot exist any instance of an amount that is not expended on any one of the projects.

There are many partial participation constraints used in the ER diagram. The relationship between *Volunteers* and *Projects* entity set is one such example. There exist *a many to many* relation between these entity sets and these are related by the *Volunteering* relationship set. These entity sets have partial participation constraints since all the volunteers might not be associated with any one of the projects at a time. Similarly, not all the projects need to be associated with the volunteers at a time.

Converting ER Diagram entities to relational schemas

Here, the Purple colour denotes Foreign Key

Red colour denotes Attributes of Weak Entity

- TeamPhone - (Phone Number, Employ ID, Location)
- Organize - (Event_Name, Start_Date, Employee_ID, Role)
- ItemSold - (Item name, Quantity, Amount, Event_Name, Start_Date)
- Trains - (Email_id, EventName, Start_Date)
- Volunteering - (Email_id, EventName, Start_Date)
- Expense - (Amount, Event_Name, Start_Date, Description)
- Participants - (Event_Name, StartDate , Aadhar id)
- Sponsors - (Email_id, Event_Name, Start_Date)
- Belongs - (Aadhaar_id, PINCode)
- PhoneBeneficiary - (PhoneNumber, Aadhar_id)
- HeldAt - Event_Name, Start_Date, Venue_id)
- PhoneTrainer - (PhoneNumber, Email_ID)
- TrainerBeneficiary - (AadharID, EMailID)
- Assessment - (Event_Name, Start_Date, Aadhar_id, Date, PresentOrAbsent)

Representing Relationship set and Entity as Relational Schemas

Here, Purple colour denotes Foreign Key

Red colour denotes Attributes of Weak Entity

- In the relationship set **Trains**: It is a many to many relationship. There will be 3 schemas possible: Trains, Trainer, Projects
  - Trains - (Email_id, EventName, Start_Date)
  - Trainer - (Email_id, Fee, Name, Gender, Age)
  - Projects - (Event_name, Start_Date, Types, Budget, NoOfParticipants, Duration, Collection, PhotosLink, TotalExpense)
- In the relationship set **Volunteering**: It is a many to many relationship. There will be 3 schemas possible:
  - Volunteering - (EmailID, EventName, Start_Date)
  - Volunteers - (Email_id, Name, PhoneNo, DOB, Gender)
  - Projects - (Event_name, Start_Date, Types, Budget, NoOfParticipants, Duration, Collection, PhotosLink, TotalExpense)
- In the relationship set **PhoneTrainer**: It is a many(**TrainerPhoneEntity**) to one (Trainer) relationship. There will be 2 schemas possible:
  - PhoneTrainer - (PhoneNumber, Email_ID)
  - Trainer - (Email_id, Fee, Name, Gender, Age)
- In the relationship set **Organize**: It is a many(Projects) to many (Teams) relationship. There will be 3 schemas possible:
  - Organize - (EventName, StartDate, EmployID, Role)
  - Projects - (Event_name, Start_Date, Types, Budget, NoOfParticipants, Duration, Collection, PhotosLink, TotalExpense)
  - Teams - (Employ_ID, Name, EmailID, Salary, Position, YearOfJoining, YearOfLeaving, ReasonOfLeaving)
- In the relationship set **PhoneBeneficiary**: It is a many(**BeneficiaryPhoneEntity)** to one(**Beneficiary**) relationship. There will be 2 schemas possible:
  - PhoneBeneficiary - (PhoneNumber, Aadhar_id)

  - Beneficiary- (Aadhar_id, Name, DOB, Gender, MaritalStatus, Education, Photo, Employed)
- In the relationship set **TeamPhone**: It is a many(**EmployPhoneEntity**) to one (Teams) relationship. There will be 2 schemas possible:
  - TeamPhone - (Phone No, EmployID, Location)
  - Teams - (EmployID, Name, EmailID, Salary, Position, YearOfJoining, YearOfLeaving, ReasonOfLeaving.)

- In the relationship set **ItemSold**: It is a many(Goods) to one (Projects) relationship. There will be 2 schemas possible:
  - ItemSold - (Item name, Quantity, Amount, Event_Name, Start_Date)
  - Projects - (Event_name, Start_Date, Types, Budget, NoOfParticipants, Duration, Collection, PhotosLink, TotalExpense)

- In the relationship set **Expense**: It is a many(ProjectExpense) to one (Projects) relationship. There will be 2 schemas possible:
  - Expense - (Amount, Description, Event_Name, Start_Date)
  - Projects - (Event_name, Start_Date, Types, Budget, NoOfParticipants, Duration, Collection, PhotosLink(blob), TotalExpense)

- In the relationship set **Participants**: It is a many(Projects) to many (Beneficiary List) relationships. There will be 3 schemas possible:
  - Participants - (EventName, StartDate, AadharID)
  - Projects - (EventName, StartDate, Types, Budget, NoOfParticipants, Duration, Collection, PhotosLink, TotalExpense)
  - Beneficiary List - (AadharID, Name, DOB, Gender, MaritalStatus, Education, Photo, Employed)
- In the relationship set **Sponsors**: It is a many(Projects) to many (Funding) relationship. There will be 3 schemas possible:
  - Sponsors - (EmailID, Name, StartDate)

  - Projects - (EventName, StartDate, Types, Budget, NoOfParticipants, Duration, Collection, PhotosLink, TotalExpense)
  - Funding - (EmailID, Amount, FunderName, Date)

- In the relationship set **Belongs**: It is a many(Beneficiary) to one (VillageProfile) relationship. There will be 3 schemas possible:
  - Belongs - (Aadhaar_id, PINCode)
  - VillageProfile - (PINCode, Name, NoOfBeneficiaries, NoOfPrimaryHealthCenter, NoOfPrimarySchool, Transport, Infrastructure, MajorOccupation, TechnicalLiteracy, Year)
  - Beneficiary - (Aadhar_id, Name, DOB, Gender, MaritalStatus, Education, Photo, Employed)

- In the relationship set **HeldAt**: It is a many(Projects) to many (Venue) relationship. There will be 3 schemas possible:
  - HeldAt - (Event_Name, Start_Date, VenueID)
  - Projects - (Event_name, Start_Date, Types, Budget, NoOfParticipants, Duration, Collection, PhotosLink, TotalExpense, VenueID)
  - Venue - (VenueID, Place, PINCode, District, State, Event_name, Start_Date)

- In the relationship set **TrainerBeneficiary**: It is one to one relationship. There are three schemas possible:
  - TrainerBeneficiary - (Aadhar ID, EmailID)
  - Trainer - (Aadhar ID, Fee, Name, Gender, Age)
  - Beneficiary - (Aadhar_id, Name, DOB, Gender, MaritalStatus, Education, Photo, Employed)

- In the relationship set **Assessment**: It is a many(PhoneNumber) to one (Trainer) relationship
  - Assessment - (Event_Name, Start_Date, Aadhar_id, Date, PresentOrAbsent)

- Projects - (Event_name, Start_Date, Types, Budget, NoOfParticipants, Duration, Collection, PhotosLink, TotalExpense)
- Beneficiary - (Aadhar_id, Name, DOB, Gender, MaritalStatus, Education, Photo, Employed)

Q3.

Red color denotes Attributes of Weak Entity

For displaying the key constraints of all the attributes involved in our schema, we have displayed only attributes of entity sets (since the attributes of relationship sets are already present in entity sets as primary keys) and the descriptive attributes of relationship sets separately.

Projects

Event_name	PRIMARY KEY	Event name, along with date, uniquely identifies the event along with all details
Start_date	PRIMARY KEY	Event name, along with date uniquely identifies the event along with all details
Types	CHECK (workshop, courses, …), NOT_NULL	Event cannot fall into any other type Event falls into some type or other
Budget	NOT NULL	keeping data of budget important for financial decisions
Number of participants	NOT NULL	There must be some number
Duration	NOT NULL	NEEV must be collecting data on duration
Collection (entry fee, sales)	DEFAULT = NULL	Some events may not be done

		with the objective of collection
Photos Links	DEFAULT = NULL	Maybe They might not have photos of some events
Total expense	NOT NULL	NEEV must have collected data of expenses for a program

Beneficiary

	Key constraints	Reasons
Aadhaar ID	PRIMARY KEY	Aadhaar id can be used to identify a beneficiary along with its other details uniquely.
Name	NOT NULL	NEEV needs to keep track of the beneficiary name, so the field can not be NULL
Date of Birth	NOT NULL	If aadhaar card is there, DOB is mentioned there
Gender	NOT NULL	NEEV must keep data of gender of participants
Marital Status	NOT NULL	NEEV must keep data of the marital status of participants
Education	NOT NULL	NEEV must have data on the

	Key constraints	Reasons
Aadhaar ID	PRIMARY KEY	Aadhaar id can be used to identify a beneficiary along with its other details uniquely.
		educational status of participants
Photo	DEFAULT = NULL	In villages, there can be cases in which people could not produce their photo, so that field is replaced by NULL.
Employed	DEFAULT = NULL	Here a dichotomy of "employed vs unemployed" does not apply

Teams

Employ Id	PRIMARY KEY	Uniquely identifies an employee
Name	NOT NULL	Name can't be a null value
EmailId	UNIQUE	All employees has unique email address
Salary	NOT NULL	There should be some salary associated with an employ)(can be zero
Position	NOT NULL	Every employee has a particular position to work upon
YearOfJoining	NOT NULL	Year of joining needs to be specified

YearOfLeaving	DEFAULT: NULL	In case the employee is currently Working
ReasonOfLeaving	DEFAULT: NULL	Entry will be empty in case employee is working or leaves without explanation

Volunteers

Email Id	PRIMARY KEY	For volunteers, it would not change frequently and is useful in unique identification.
Name	NOT NULL	Each volunteer must have a name
PhoneNo	NOT NULL	Phone no. must be present for contact when necessary.
DOB	DEFAULT = NULL	It is not necessary but would be helpful to know
Gender	DEFAULT = NULL	It is not necessary but would be helpful to know.

Trainers

EmailId	PRIMARY KEY	For trainers, we can uniquely identify using it.
Name	NOT NULL	Everyone has a name
Age	NOT NULL	For checking their experience
Gender	NOT NULL	For some gender specific teachings
Fee	DEFAULT = NULL	Some trainers may work for free.

EmployPhoneEntity

PhoneNumber	NOT NULL	An employee must have some contact number
Location	NOT NULL	The employee must have some location whose record is kept by NEEV

Goods

ItemName	DEFAULT = Not applicable	Maybe nothing was manufactured
Quantity	DEFAULT = Not Applicable	In case nothing was manufactured
Amount	DEFAULT = Not Applicable	In case nothing was manufactured

Funding

Email Id	PRIMARY KEY	Email id uniquely identifies the donor
Amount	NOT NULL	NEEV must have data of amount donated
FunderName	NOT NULL	Someone must be funding NEEV
Date	NOT NULL	There must be some date of donation

ProjectExpense

Amount	NOT NULL	NEEV must have data of amount spent
Description	NOT NULL	It is important to have a description of money spent

Venue

Venue ID	PRIMARY KEY	Uniquely identifies a place
Place	NOT NULL	Venue must have an address
PINCode	NOT NULL	There must be PINCode related to venue
District	NOT NULL	Every village comes under some district
State	NOT NULL	A venue must be in some Indian state

TrainerPhoneEntity

PhoneNumber	NOT NULL	An Trainer must have some contact number to contact

BeneficiaryPhoneEntity

PhoneNumber	DEFAULT: NULL	An Trainer must have some contact number to contact

Following includes key constraints for the descriptive Attributes

Assessment

Date	NOT NULL	Attendance must be associated with a date
PresentOrAbsent	NOT NULL	Either you will be present or absent

Organize

Role	NOT NULL	He/she would have some post/role with NEEV

Q4. Mapping Cardinalities

The mapping cardinalities are shown in the ER Diagram. Below, we have mentioned the cardinalities:

Note: In many-to-many relationships, we have not mentioned which one it represents as it is simply Many to many.

- TeamPhone: Many(EmployPhoneEntity) to One(Teams)
- Organize: Many(Teams) to Many(Projects)
- ItemSold: Many(Goods) to One(Projects)
- Trains: Many(Trainer) to Many(Projects)
- Volunteering: Many(Volunteers) to Many(Projects)
- Expense: Many(ProjectExpense) to One(Projects)
- Participants: Many(Beneficiary) to Many(Projects)
- Sponsors: Many(Funding) to Many(Projects)
- Belongs: Many(Beneficiary) to One(VillageProfile)
- PhoneBeneficiary: Many(BeneficiaryPhoneEntity) to One(Beneficiary)
- HeldAt: Many(Venue) to Many(Projects)
- PhoneTrainer: Many (TrainerPhoneEntity) to one (Trainer)
- Assessment: Many(Beneficiary) to One(Projects)
- TrainerBeneficiary: One(Trainer) to One(Beneficiary)

Q5. Redundant sets

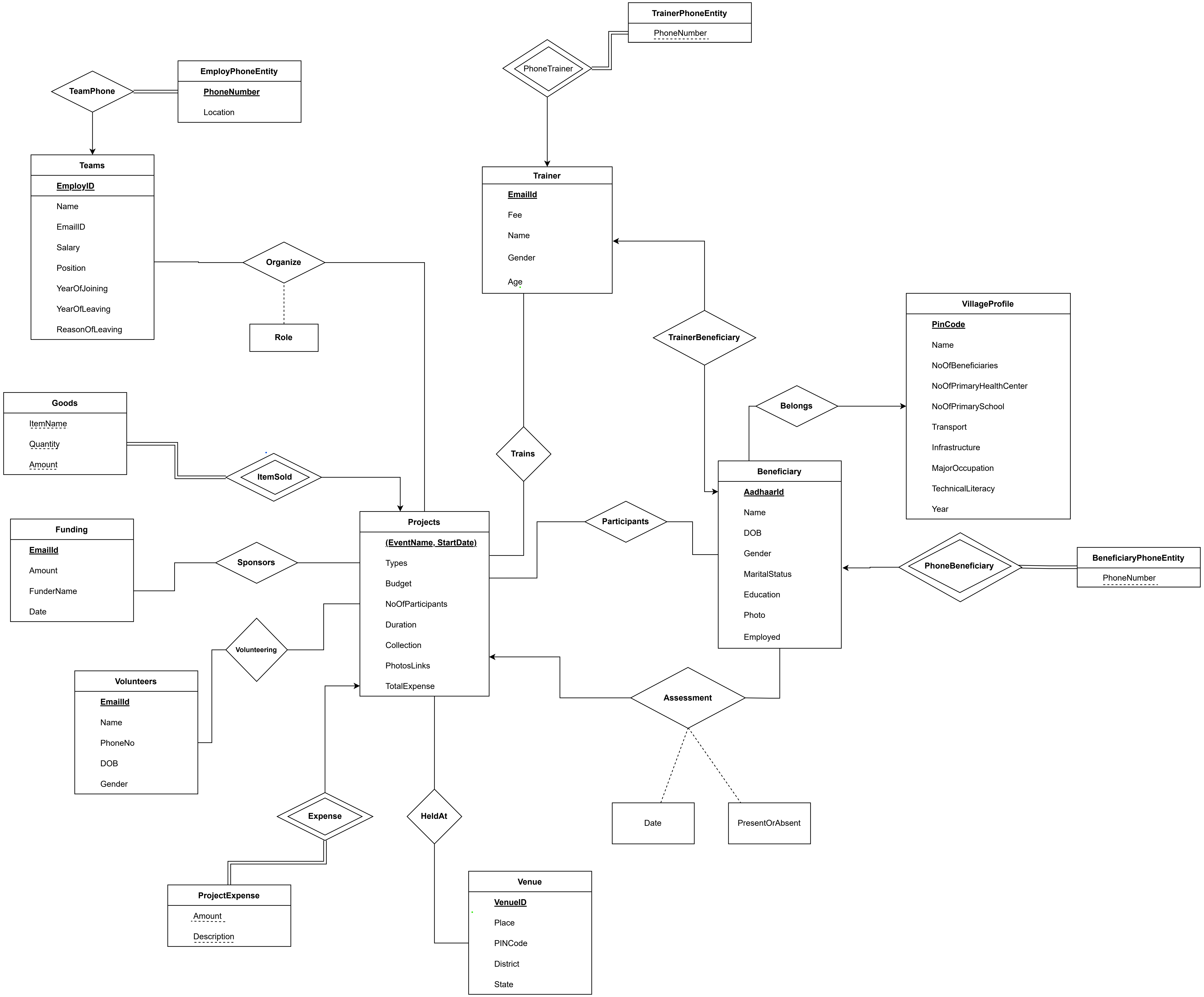
In the relationship set **ItemSold**, the relational schema for weak entity set **Goods** will be redundant as it is serving as a weak entity and it does not have a primary key of its own. If we make a relational schema for this weak entity, we cannot extract any information about the event, to which the goods belong to.

In the relationship set **PhoneTrainer**, the relational schema for the entity set **TrainerPhoneEntity** is redundant because it is a connected entity between the relationship set PhoneTrainer and entity Trainer. PhoneTrainer will contain its primary key {PhoneNumber} and Foreign Key Email_id. From the relationship set schema, we could extract the phoneNumber as we have {PhoneNumber} as a Primary Key. Therefore a separate relational table for Entity TrainerPhoneEntity is redundant.

In the **Expense** relationship set, connecting Projects and ProjectExpense, here Expense is a weak entity set. Therefore, it does not have a primary key of its own. To represent the Expense relationship set, we are using the primary key {EventName, StartDate} and {Amount, Description}. Here we will not be having a separate relational schema for ProjectExpense as it is a weak entity. We could not retrieve any information about the Project Expense without knowing the EventName. Therefore a separate relational table for Entity Project Expense is redundant.

In the relationship set **TeamPhone, the** relational schema fothe r entity set **EmployPhoneEntity** is considered redundant because it is connected withthe relationship set TeamPhone and entity set Teams. Its primary key {PhoneNumber} will be present in the relationship set along with {EmployID} as Foreign Key. Therefore a separate schema for **EmployPhoneEntity** is redundant.

In the relationship set **PhoneBeneficiary**, a separate relational schema for **BeneficiaryPhoneEntity** is redundant because the relationship set **PhoneBeneficiary** contains primary key {PhoneNumber} and foreign key **AadharId.** Therefore, a separate schema for **BeneficiaryPhoneEntity** is not required as we can extract the beneficiary phone number from its relationship set.


TrainerPhoneEntity
PhoneNumber
PhoneTrainer
EmployPhoneEntity
PhoneNumber
Location
TeamPhone
Teams
EmployID
Name
EmailID
Salary
Position
YearOfJoining
YearOfLeaving
ReasonOfLeaving
Organize
Role
Trainer
EmailId
Fee
Name
Gender
Age
TrainerBeneficiary
VillageProfile
PinCode
Name
NoOfBeneficiaries
NoOfPrimaryHealthCenter
NoOfPrimarySchool
Transport
Infrastructure
MajorOccupation
TechnicalLiteracy
Year
Belongs
Goods
ItemName
Quantity
Amount
ItemSold
Trains
Beneficiary
AadhaarId
Name
DOB
Gender
MaritalStatus
Education
Photo
Employed
Participants
Projects
(EventName, StartDate)
Types
Budget
NoOfParticipants
Duration
Collection
PhotosLinks
TotalExpense
Funding
EmailId
Amount
FunderName
Date
Sponsors
Volunteering
PhoneBeneficiary
BeneficiaryPhoneEntity
PhoneNumber
Volunteers
EmailId
Name
PhoneNo
DOB
Gender
Assessment
Expense
HeldAt
Date
PresentOrAbsent
ProjectExpense
Amount
Description
Venue
VenueID
Place
PINCode
District
State