Database Management System (IT615)

Normalization and Schema Refinement
for
Sustainable Agriculture Resource Management

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Functional Dependency

1. Farmer (<u>FarmerID</u>, Name, FarmSize, ContactInfo)
    Primary Key (PK): FarmerID
    Functional Dependencies (FDs):
    FarmerID -> Name, FarmSize, ContactInfo

2. Crop (<u>CropID</u>, Name, Type, GrowthPeriod, Yield)
    Primary Key (PK): CropID
    Functional Dependencies (FDs):
    CropID -> Name, Type, GrowthPeriod, Yield

3. Technology (<u>TechnologyID</u>, Name, Type, Purpose)
    Primary Key (PK): TechnologyID
    Functional Dependencies (FDs):
    TechnologyID -> Name, Type, Purpose

4. Soil (<u>SoilID</u>, Type, NutrientContent, pHLevel, MoistureLevel)
    Primary Key (PK): SoilID
    Functional Dependencies (FDs):
    SoilID -> Type, NutrientContent, pHLevel, MoistureLevel

5. Fertilizer (<u>FertilizerID</u>, Name, Type, NutrientContent, ApplicationMethod)
    Primary Key (PK): FertilizerID
    Functional Dependencies (FDs):
    FertilizerID ->Name, Type, NutrientContent, ApplicationMethod

6. TrainingProgram (<u>ProgramID</u>, Title, Duration, TargetAudience, Content)
    Primary Key (PK): ProgramID
    Functional Dependencies (FDs):
    ProgramID -> Title, Duration, TargetAudience, Content

7. Visitor (<u>VisitorID</u>, Name, Role, ContactInfo)

Primary Key (PK): VisitorID
Functional Dependencies (FDs):
VisitorID -> Name, Role, ContactInfo

8. Policy (<u>PolicyID</u>, Name, Type, ImplementationDate)
Primary Key (PK): PolicyID
Functional Dependencies (FDs):
PolicyID -> Name, Type, ImplementationDate

9. Aid (<u>AidID</u>, Type, Amount, Beneficiary, Date)
Primary Key (PK): AidID
Functional Dependencies (FDs):
AidID -> Type, Amount, Beneficiary, Date

10. CropDisease (<u>DiseaseID</u>, Name, AffectedCrops, Symptoms, Treatment)
Primary Key (PK): DiseaseID
Functional Dependencies (FDs):
DiseaseID -> Name, AffectedCrops, Symptoms, Treatment

11. CropRotation (<u>RotationID</u>, CropSequence, Duration, Benefits)
Primary Key (PK): RotationID
Functional Dependencies (FDs):
RotationID -> CropSequence, Duration, Benefits

12. Investment (<u>InvestmentID</u>, Amount, Purpose, Beneficiary, Date)
Primary Key (PK): InvestmentID
Functional Dependencies (FDs):
InvestmentID -> Amount, Purpose, Beneficiary, Date

13. Weather (<u>WeatherID</u>, Date, Temperature, Precipitation, Conditions)
Primary Key (PK): WeatherID
Functional Dependencies (FDs):
WeatherID -> Date, Temperature, Precipitation, Conditions

14. SustainablePractice (<u>PracticeID</u>, Name, Description, Benefits, ImplementationLevel)

Primary Key (PK): PracticeID
Functional Dependencies (FDs):
PracticeID -> Name, Description, Benefits, ImplementationLevel
Relational Schemas (Dependencies)

15. FarmingTool (**ToolID**, Name, Type, Usage, Manufacturer, FarmerID)
Primary Key (PK): ToolID
Foreign Key (FK):
FarmerID -> Farmer(FarmerID)
Functional Dependencies (FDs):
ToolID -> Name, Type, Usage, Manufacturer

16. Irrigation (**IrrigationID**, Type, CoverageArea, Efficiency, InstallationDate, FarmerID)
Primary Key (PK): IrrigationID
Foreign Key (FK):
FarmerID -> Farmer(FarmerID)
Functional Dependencies (FDs):
IrrigationID -> Type, CoverageArea, Efficiency, InstallationDate

1. **List of redundancies existing for every schema which is part of the database.**
2. **List of update, delete, and insert anomalies for every schema.**

Tables	Redundancies	Anomalies		
		Update	Delete	Insert
Farmer	ContactInfo could be redundant if multiple farmers share the same contact details (e.g., family members working on the same farm). If a farmer is involved in multiple activities or crops, repeating Name and FarmSize across	If a farmer's contact information changes, it needs to be updated in every record where the farmer is involved. Failure to update all records leads to inconsistencies	If a farmer is deleted and this table contains important information like farm size, deleting the farmer might result in the loss of crucial data about their farm.	If a new farmer is added without full details (e.g., missing contact info), the database would reject the insert or leave partial information

	different related tables could result in redundancy.			
Crop	Type, GrowthPeriod, and Yield might be redundant if the same crop is recorded multiple times (e.g., in crop-rotation cycles). This would lead to repeated data across different records.	If the growth period of a particular crop changes, all records for that crop must be updated. Failing to do so will lead to inconsistencies.	If a crop is deleted, relevant data on its yield and growth characteristics might be lost.	If a new crop is added with missing yield or growth period data, the insert may fail or lead to incomplete records.
Technology	Repetition of Type and Purpose across records of the same technology can create redundancy, especially if the same technology is used by multiple farmers or in multiple locations.	If the purpose or type of a technology is updated, all related records must be updated. Otherwise, inconsistent technology information may exist in the database.	Deleting a technology record could result in the loss of valuable information on how and why that technology was used.	If a new technology is inserted without its purpose or type, the entry might be incomplete, leading to a less useful record.
Soil	If multiple records refer to the same Soil Type, the attributes like NutrientContent, pHLevel, and MoistureLevel might be repeated unnecessarily.	If the soil's nutrient content or moisture level changes, it needs to be updated across multiple records. Failure to update all records causes inconsistencies.	If a soil type is deleted, critical data about its composition and suitability for farming might be lost.	Missing values for key attributes like nutrient content could prevent the insertion of a complete soil record.
Fertilizer	Repeating NutrientContent and ApplicationMethod for the same type of fertilizer in multiple records can create redundancy.	If the application method for a specific fertilizer changes, every related record needs to be updated to avoid inconsistencies.	Deleting a fertilizer entry may lead to the loss of important data on its usage and nutrient composition.	Inserting a new fertilizer record without specifying its type or application method could result in an incomplete entry.
TrainingProgram	Repetition of TargetAudience and	If the duration or content of a	If the duration or content of a	If a new training program is

	Content in multiple records of the same program may result in redundancy.	program changes, all records for that program need to be updated, which can lead to inconsistencies if not handled properly.	program changes, all records for that program need to be updated, which can lead to inconsistencies if not handled properly.	inserted without specifying the target audience or content, the record would be incomplete.
Visitor	ContactInfo could be redundant if multiple visitors share the same role or contact information (e.g., a group of people with the same representative contact).	If a visitor's contact information changes, all related records need to be updated. Failure to do so will lead to inconsistencies.	Deleting a visitor might lead to the loss of information about their role or contact info.	Inserting a visitor without contact info may result in incomplete records.
Policy	Repeated Type or ImplementationDate for multiple policies of the same name could result in redundancy.	If the implementation date of a policy is updated, it must be updated in all related records, or inconsistencies may occur.	Deleting a policy could result in losing valuable information about its type and implementation date.	Inserting a policy without providing the implementation date may lead to an incomplete record.
Aid	If the same Type of aid is repeatedly provided, the Amount and Date might be redundant across multiple records.	If the aid amount or date is changed, all related records must be updated to avoid inconsistencies.	Deleting an aid record might lead to the loss of important data regarding the beneficiary and the aid provided.	Inserting a record without specifying the aid amount or beneficiary might lead to incomplete data.
CropDisease	Repetition of Symptoms and Treatment for diseases affecting multiple crops could result in redundancy.	If the symptoms or treatment for a disease are updated, all related records must be updated. Otherwise, inconsistencies	Deleting a disease record might result in the loss of critical information about its symptoms and treatment.	Inserting a new disease without providing its symptoms or treatment may result in an incomplete record.

		will arise.		
CropRotation	Duration and Benefits might be redundant if the same crop sequence is repeated in multiple records.	If the benefits or duration of a rotation scheme are updated, all related records must be updated to avoid inconsistencies.	Deleting a rotation entry could result in the loss of information about its benefits and duration.	Inserting a new rotation record without specifying the benefits could result in an incomplete entry.
Investment	Repeated Purpose and Amount for the same type of investment might result in redundancy.	If the purpose or amount of an investment is updated, all related records must be updated to avoid inconsistencies.	Deleting an investment record could lead to the loss of important data about the beneficiary and the purpose of the investment.	Inserting a new investment without specifying the beneficiary or amount could lead to an incomplete record.
Weather	Temperature and Precipitation might be redundant if recorded repeatedly for the same Date across different areas.	If the temperature or precipitation for a specific date changes, all related records must be updated.	Deleting a weather record could result in the loss of important weather-related data.	Inserting a new weather record without providing key information like temperature or conditions could lead to an incomplete record.