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1MM2

# TT1964 DATABASE

## TUTORIAL 2

## Normalization

**Instruction**: Please answer all of the following questions BEFORE your tutorial session. Then you can have some discussion regarding the questions during your tutorial session. (You can refer flipped material Normalization *http://myftsm.wixsite.com/database-flipped*)

**Section A**

1. Given the dependency diagram shown in the following Figure 1, answer the following questions.

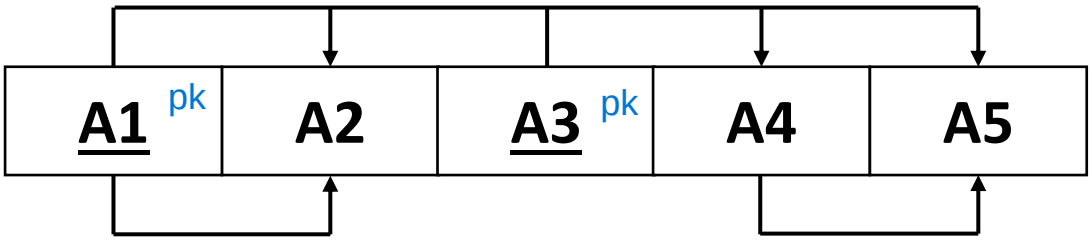



Figure 1: The Dependency Diagram

a) Identify and describe each of the indicated dependencies.

| | |
|---|---|
| A1, A3, --> A2, A4, A5 | Fully FD |
| A1 --> A2 | Partial FD |
| A4 --> A5 | Transitive FD |

2. The following table 1 shows some sample of student and courses data record from FTSM UKM (with *Matric*, *CourseCode* being the primary key).

UNF --> 1NF isi tempat kosong, pastikan takde data yg 0

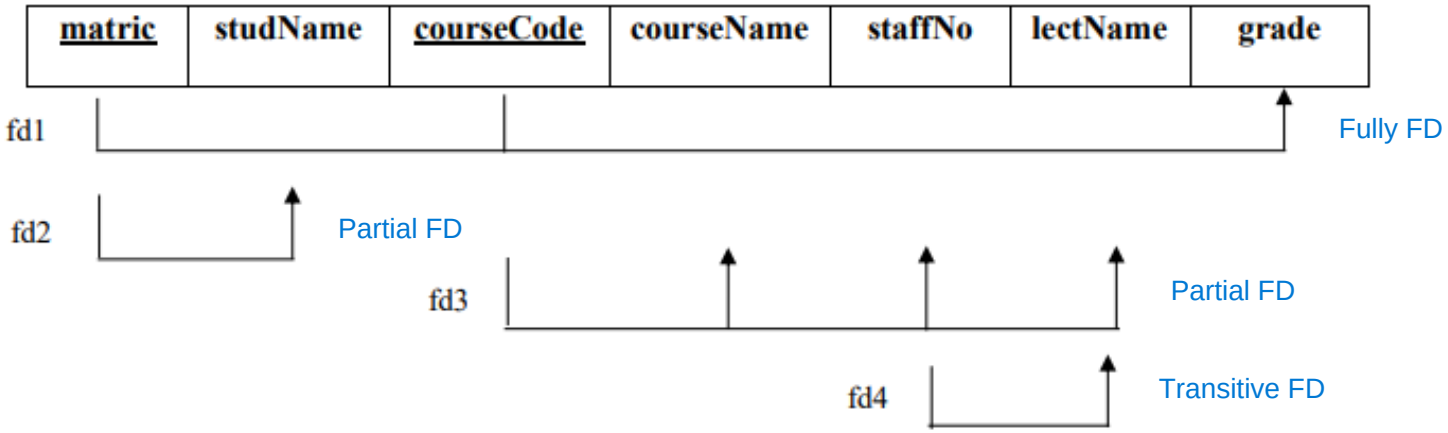
| matric | studName | courseCode | courseName | staffNo | lectName | grade |
|---|---|---|---|---|---|---|
| A124321 | AMIRUL | TT1964 | DATABASE | 4532 | AKMAL | A |
| A124321 | AMirul | TK1143 | JAVA | 6721 | SYAHANIM | A- |
| A138871 | WIN LEON | TT1964 | DATABASE | 4532 | AKMAL | A |
| A138871 | Win Leon | TP2543 | WEB | 5665 | JUNAIDAH | B+ |
| A176612 | SASIKUMAR | TP2543 | WEB | 5665 | JUNAIDAH | A- |
| A192231 | FARAH | TR1413 | MATH III | 6721 | RUZZAKIAH | C |

**TABLE 1:** STUDENT_COURSES

a) Take a look at the table above and provide examples of insertion, deletion and update anomalies.

insertion : there is a new student enroll the course // lecturer baru masuk
deletion : Farah drop the course Math
update : Sasikumar change his course from Web to Database

b) Illustrate, list and label all the functional dependencies diagram contained in this table.




fd1 : matric, courseCode → grade fully Dependancy
fd2 : matric → studName partial Dependancy
fd3 : courseCode → courseName, staffNo, lectName partial Dependancy
fd4 : staffNo → lectName

c) Draw a complete ERD after Normalization

3. Table 2 below is The CLIENT_RENTAL table.

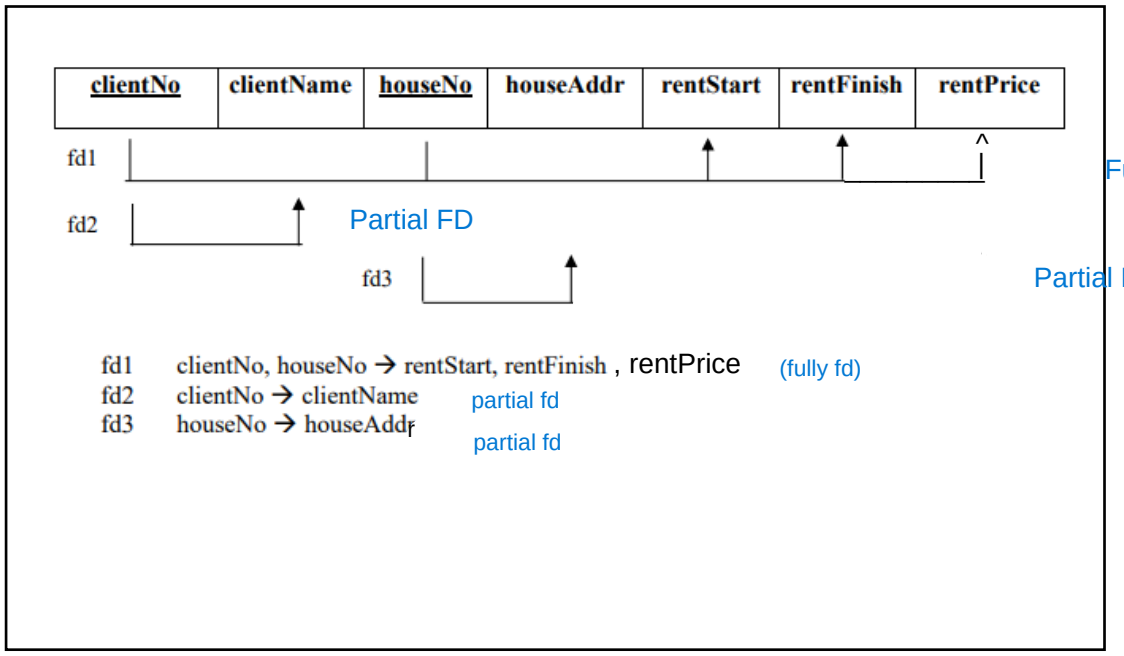
| clientNo | clientName | houseNo | houseAddr | rentStart | rentFinish | rentPrice |
|---|---|---|---|---|---|---|
| CR76 | Aimy | PG4 | 6 Jln Cerdik | 1-Sep-19 | 1-Sep-20 | 550.00 |
| | | PG16 | 5 Jln Tropika | 1-Jan-20 | 28-Feb-21 | 650.00 |
| CR56 | Hayfa | PG4 | 6 Jln Cerdik | 1-Sep-11 | 10-Jun-12 | 550.00 |
| | | PG36 | 2 Jln Pintar | 10-Oct-12 | 1-Dec-13 | 575.00 |
| | | PG16 | 5 Jln Tropika | 1-Nov-14 | 10-Aug-15 | 650.00 |

**TABLE 2:** CLIENT_RENTAL

a) State the related Primary Key in this table?

clientNo, houseNo

b) Illustrate, list and label all the functional dependencies diagram contained in this table.




c) Is there any transitive dependency exist? Justify your answer.

No, rentStart and rentFinish cannot determine rentPrice / there is no attribute that depends on another attribute that is not primary key

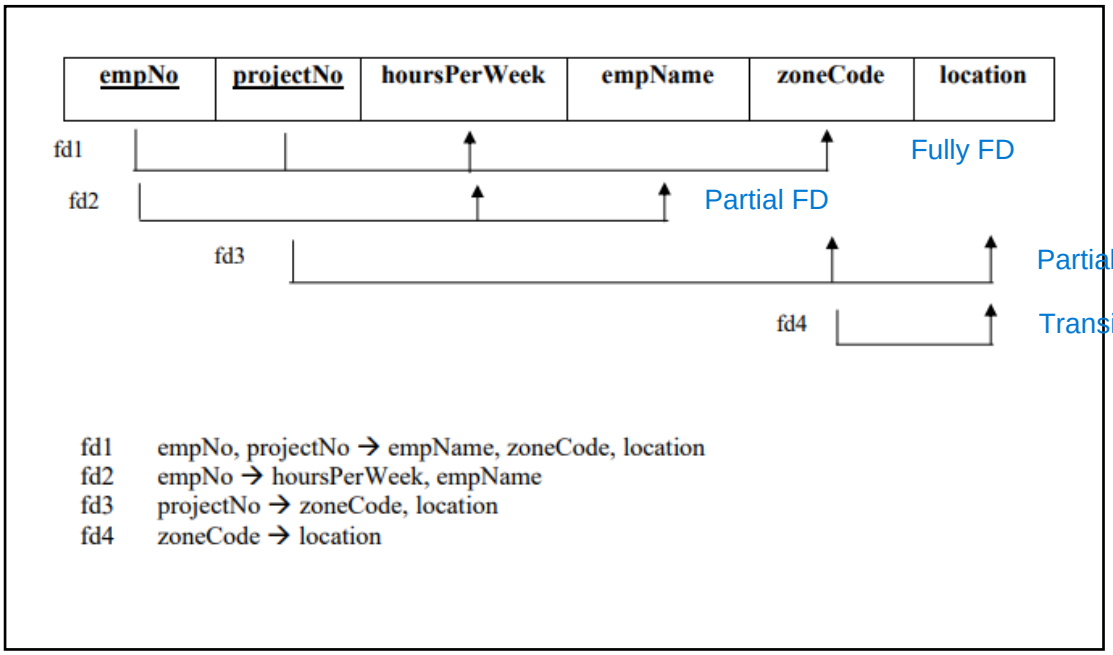
No, there is no potential primary key other than clientNo and houseNo

4. The following table lists the time spent by employees of Purple Print Agency and their project to work at two zones (with *empNo, projectNo* being the primary key). .

| empNo | projectNo | hoursPerWeek | empName | zoneCode | location |
|---|---|---|---|---|---|
| K123 | C13 | 15 | Ali | Z12 | Bangi |
| A124 | C13 | 22 | Zara | Z12 | Bangi |
| A345 | C24 | 27 | Naim | Z5 | Kajang |
| K123 | C24 | 15 | Ali | Z5 | Kajang |

**TABLE 3:** EMPLOYEES _WORK _HOURS

a) Illustrate, list and label all the functional dependencies diagram contained in this table.




b) Is there any transitive dependency exist? Justify your answer.

no transitive, so kat 2NF dah habis normalize dah

there is one Transitive FD. Location depends on projectNo via zoneCode

**Section B**

**Draw the complete Normalization and final ERD for all of the questions.**

1. Based on the previous FDs **Question 2 - 4 (Part A)**, simplified the process of normalizing 1NF-3NF table. Show the
    a. **FINAL completed table (3NF)** with the related data given in previous tutorial.
    b. **ERD after** normalization process

**Q2 (Section A)**

answer provided below :)

UNF → 1NF :

Result(matric, studName, courseCode, courseName, staffNo, lectName, grade)

Result

| matric | studName | courseCode | courseName | staffNo | lectName | grade |
|---|---|---|---|---|---|---|
| A124321 | AMIRUL | TT1964 | DATABASE | 4532 | AKMAL | A |
| A124321 | AMIRUL | TK1143 | JAVA | 6721 | SYAHANIM | A- |
| A138871 | WIN LEON | TT1964 | DATABASE | 4532 | AKMAL | A |
| A138871 | WIN LEON | TP2543 | WEB | 5665 | JUNAIDAH | B+ |
| A176612 | SASIKUMAR | TP2543 | WEB | 5665 | JUNAIDAH | A- |
| A192231 | FARAH | TR1413 | MATH III | 6721 | RUZZAKIAH | C |

fd1 : matric, courseCode → grade (fully dependency)

fd2 : matric → studName (partial dependency)

fd3 : courseCode → courseName, staffNo, lectName (partial dependency)

fd4 : staffNo → lectName (transitive dependency)

1NF → 2NF (remove partial dependency)

Result(matric, courseCode, grade)

Student(matric, studName)

Course(courseCode, courseName, staffNo, lectName)

Result

| matric | courseCode | grade |
|---|---|---|
| A124321 | TT1964 | A |
| A124321 | TK1143 | A- |
| A138871 | TT1964 | A |
| A138871 | TP2543 | B+ |
| A176612 | TP2543 | A- |
| A192231 | TR1413 | C |

Student

| matric | studName |
|---|---|
| A124321 | AMIRUL |
| A138871 | WIN LEON |
| A176612 | SASIKUMAR |
| A192231 | FARAH |

Course

| courseCode | courseName | staffNo | lectName |
|---|---|---|---|
| TT1964 | DATABASE | 4532 | AKMAL |
| TK1143 | JAVA | 6721 | SYAHANIM |
| TP2543 | WEB | 5665 | JUNAIDAH |
| TR1413 | MATH III | 6721 | RUZZAKIAH |

2NF → 3NF (remove transitive dependency)

Result(matric, courseCode, grade)

Student(matric, studName)

Course(courseCode, courseName, staffNo)

Lecturer(staffNo, lectName)

Result

| matric | courseCode | grade |
|---|---|---|
| A124321 | TT1964 | A |
| A124321 | TK1143 | A- |
| A138871 | TT1964 | A |
| A138871 | TP2543 | B+ |
| A176612 | TP2543 | A- |
| A192231 | TR1413 | C |

Student

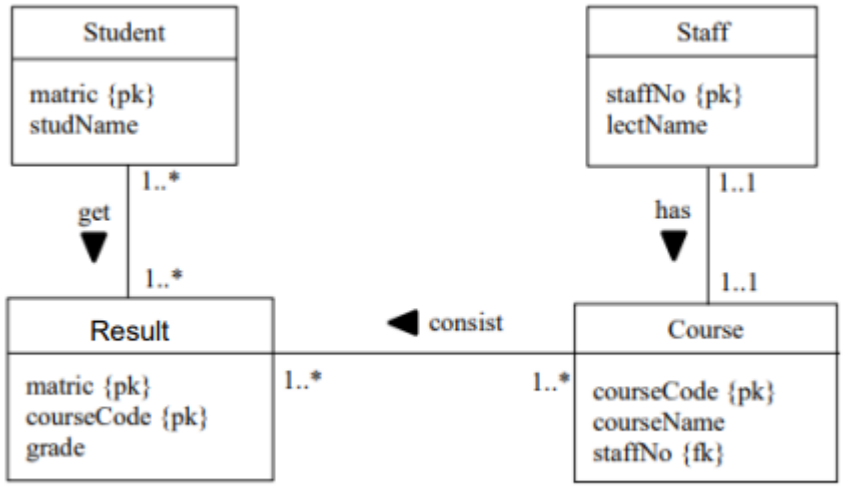
| matric | studName |
|---|---|
| A124321 | AMIRUL |
| A124321 | AMIRUL |
| A138871 | WIN LEON |
| A138871 | WIN LEON |
| A176612 | SASIKUMAR |
| A192231 | FARAH |

Course

| courseCode | courseName | staffNo |
|---|---|---|
| TT1964 | DATABASE | 4532 |
| TK1143 | JAVA | 6721 |
| TT1964 | DATABASE | 4532 |
| TP2543 | WEB | 5665 |
| TP2543 | WEB | 5665 |
| TR1413 | MATH III | 6721 |

Lecturer

| staffNo | lectName |
|---|---|
| 4532 | AKMAL |
| 6721 | SYAHANIM |
| 4532 | AKMAL |
| 5665 | JUNAIDAH |
| 6721 | RUZZAKIAH |



**Q3 (Section A)**

answer provided below :)

UNF→1NF

Rental (clientNo, clientName, houseNo, houseAddr, rentStart, rentFinish, rentPrice)

| clientNo | clientName | houseNo | houseAddr | rentStart | rentFinish | rentPrice |
|---|---|---|---|---|---|---|
| CR76 | Aimy | PG4 | 6 Jln Cerdik | 1-Sep-19 | 1-Sep-20 | 550.00 |
| CR76 | Aimy | PG16 | 5 Jln Tropika | 1-Jan-20 | 1-Sep-20 | 650.00 |
| CR56 | Hayfa | PG4 | 6 Jln Cerdik | 1-Sep-11 | 1-Sep-20 | 550.00 |
| CR56 | Hayfa | PG36 | 2 Jln Pintar | 10-Oct-12 | 1-Dec-13 | 575.00 |
| CR56 | Hayfa | PG16 | 5 Jln Tropika | 1-Nov-14 | 10-Aug-15 | 650.00 |

fd1 : clientNo, houseNo → rentStart, rentFinish, rentPrice (fully dependency)

fd2 : clientNo → clientName (partial dependency)

fd3 : houseNo → houseAddr (partial dependency)

1NF → 2NF (remove partial dependency)

Rental (clientNo, houseNo, rentStart, rentFinish, rentPrice)

Client (clientNo, clientName)

House (houseNo, houseAddr)

Rental

| clientNo | houseNo | rentStart | rentFinish | rentPrice |
|---|---|---|---|---|
| CR76 | PG4 | 1-Sep-19 | 1-Sep-20 | 550.00 |
| CR76 | PG16 | 1-Jan-20 | 1-Sep-20 | 650.00 |
| CR56 | PG4 | 1-Sep-11 | 1-Sep-20 | 550.00 |
| CR56 | PG36 | 10-Oct-12 | 1-Dec-13 | 575.00 |
| CR56 | PG16 | 1-Nov-14 | 10-Aug-15 | 650.00 |

Client

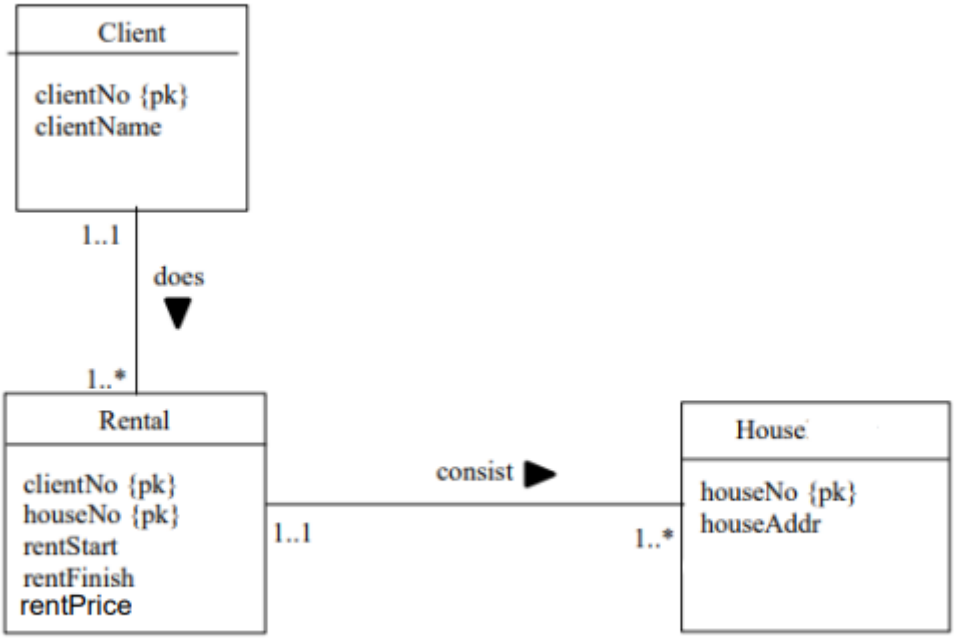
| clientNo | clientName |
|---|---|
| CR76 | Aimy |
| CR76 | Aimy |
| CR56 | Hayfa |
| CR56 | Hayfa |
| CR56 | Hayfa |

House

| houseNo | houseAddr |
|---|---|
| PG4 | 6 Jln Cerdik |
| PG16 | 5 Jln Tropika |
| PG4 | 6 Jln Cerdik |
| PG36 | 2 Jln Pintar |
| PG16 | 5 Jln Tropika |

3NF = 2NF since there is no transitive dependency

b. ERD



**Q4 (Section A)**

answer provided below :)

UNF → 1NF

Work (<u>empNo</u>, <u>projectNo</u>, hoursePerWeek, empName, zoneCode, location)

Work

| <u>empNo</u> | <u>projectNo</u> | hoursPerWeek | empName | zoneCode | location |
|---|---|---|---|---|---|
| K123 | C13 | 15 | Ali | Z12 | Bangi |
| A124 | C13 | 22 | Zara | Z12 | Bangi |
| A345 | C24 | 27 | Naim | Z5 | Kajang |
| K123 | C24 | 15 | Ali | Z5 | Kajang |

fd1 : <u>empNo</u>, <u>projectNo</u> → empName, zoneCode, location (fully dependency)

fd2 : <u>empNo</u> → hoursPerWeek, empName (partial dependency)

fd3 : <u>projectNo</u> → zoneCode, location (partial dependency)

fd4 : zoneCode → location (transitive dependency)

1NF → 2NF (remove partial dependency)

Work (<u>empNo</u>, <u>projectNo</u>, empName, zoneCode, location)

Employee (<u>empNo</u>, hoursPerWeek, empName)

Project (<u>projectNo</u>, zoneCode, location)

Work

| <u>empNo</u> | <u>projectNo</u> | empName | zoneCode | location |
|---|---|---|---|---|
| K123 | C13 | Ali | Z12 | Bangi |
| A124 | C13 | Zara | Z12 | Bangi |
| A345 | C24 | Naim | Z5 | Kajang |
| K123 | C24 | Ali | Z5 | Kajang |

Employee

| <u>empNo</u> | hoursPerWeek | empName |
|---|---|---|
| K123 | 15 | Ali |
| A124 | 22 | Zara |
| A345 | 27 | Naim |
| K123 | 15 | Ali |

Project

| projectNo | zoneCode | location |
|---|---|---|
| C13 | Z12 | Bangi |
| C13 | Z12 | Bangi |
| C24 | Z5 | Kajang |
| C24 | Z5 | Kajang |

2NF → 3NF (remove transitive dependency)

Work (empNo, projectNo, empName, zoneCode, location)

Employee (empNo, hoursPerWeek, empName)

Project (projectNo, zoneCode, location)

Zone (zoneCode, location)

Work

| empNo | projectNo | empName | zoneCode | location |
|---|---|---|---|---|
| K123 | C13 | Ali | Z12 | Bangi |
| A124 | C13 | Zara | Z12 | Bangi |
| A345 | C24 | Naim | Z5 | Kajang |
| K123 | C24 | Ali | Z5 | Kajang |

Employee

| empNo | hoursPerWeek | empName |
|---|---|---|
| K123 | 15 | Ali |
| A124 | 22 | Zara |
| A345 | 27 | Naim |
| K123 | 15 | Ali |

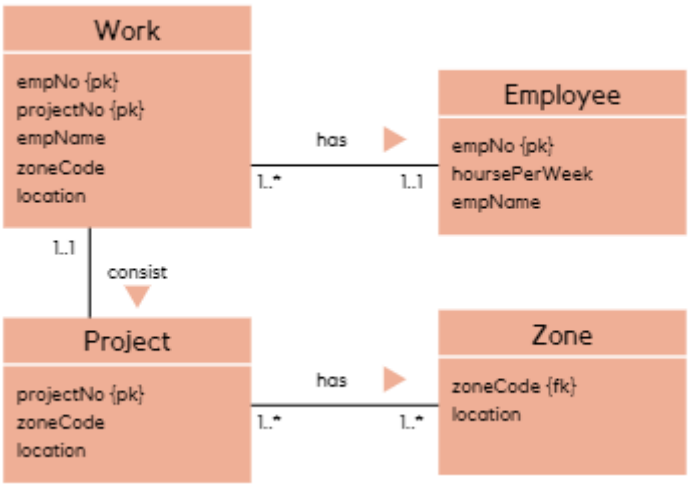
Project

| projectNo | zoneCode | location |
|---|---|---|
| C13 | Z12 | Bangi |
| C13 | Z12 | Bangi |
| C24 | Z5 | Kajang |
| C24 | Z5 | Kajang |

Zone

| zoneCode | location |
|---|---|
| Z12 | Bangi |
| Z12 | Bangi |
| Z5 | Kajang |
| Z5 | Kajang |

ERD


Work
empNo {pk}
projectNo {pk}
empName
zoneCode
location
has
1..*
1..1
Employee
empNo {pk}
hoursePerWeek
empName
1..1
consist
Project
projectNo {pk}
zoneCode
location
has
1..*
1..*
Zone
zoneCode {fk}
location

2. The figure 1 below is about card visit of Azue's Pet Veterinary Clinic. Each pet must have a specific card and the owner have to bring the card for the treatment. Each visit is limited for only ONE PROCEDURE. You as a Database Analyst have to design a database system for the clinic. Find all the possible FDs and normalize the table in 1NF to 3NF. Show the final completed table (3NF) and Final ERD after normalization

**AZUE'S PET VETERINARY CLINIC**

Pet ID : 541 Owner: Mr. Sani Aris
Name: Sweetie
Type: Cat
Age: 5

| No. | Visit Date | Procedure |
|---|---|---|
| 1 | 23-Jan-15 | 03 - Rabbies Vaccination |
| 2 | 12-Apr-15 | 07 - Heart Worm Test |

**AZUE'S PET VETERINARY CLINIC**

Pet ID : 256 Owner: Mr. Leong Sam
Name: Tweety
Type: Dog
Age: 12

| No. | Visit Date | Procedure |
|---|---|---|
| 1 | 13-Jan-15 | 07 - Heart Worm Test |
| 2 | 22-Aug-15 | 03 - Rabbies Vaccination |
| 3 | 15-Jan-16 | 12 - Tetanus Vaccination |

**AZUE'S PET VETERINARY CLINIC**

Pet ID : 324 Owner: Mr. Leong Sam
Name: Love
Type: Cat
Age: 3

| No. | Visit Date | Procedure |
|---|---|---|
| 1 | 19-May-15 | 15 - Eye Wash |
| 2 | 1-Feb-16 | 22 - Annual Checkup |

**AZUE'S PET VETERINARY CLINIC**

Pet ID : 552 Owner: Mr. Sani Aris
Name: Honey
Type: Hamster
Age: 2

| No. | Visit Date | Procedure |
|---|---|---|
| 1 | 23-Sep-15 | 03 - Rabbies Vaccination |

Figure 1

fd1: PetID → VisitDate, procedureCode, Procedure (Fully Dependency)

fd2 : PetID → Owner, Name, Type, Age (Partial Dependency)

fd3 : procedureCode → Procedure (Transitive Dependency)

**UNF>1NF**

| PetID | Owner | Name | Type | Age | VisitDate | procedureCode | Procedure |
|---|---|---|---|---|---|---|---|
| 541 | Mr. Sani Aris | Sweetie | Cat | 5 | 23-Jan-15 | 03 | Rabies Vaccination |
| 541 | Mr. Sani Aris | Sweetie | Cat | 5 | 12-Apr-15 | 07 | Heart Worm Test |
| 256 | Mr.Leong Sam | Tweety | Dog | 12 | 12-Jan-15 | 07 | Heart Worm Test |
| 256 | Mr.Leong Sam | Tweety | Dog | 12 | 22-Aug-15 | 03 | Rabies Vaccination |
| 256 | Mr.Leong Sam | Tweety | Dog | 12 | 16-Jan-16 | 12 | Tetanus Vaccination |
| 324 | Mr.Leong Sam | Love | Cat | 3 | 19-May-15 | 15 | Eye Wash |
| 324 | Mr.Leong Sam | Love | Cat | 3 | 1-Feb-16 | 22 | Annual Checkup |
| 552 | Mr. Sani Aris | Honey | Hamster | 2 | 23-Sep-15 | 03 | Rabies Vaccination |

**1NF>2NF (remove Partial Dependency)**

fd1: PetID → VisitDate, procedureCode, Procedure (Fully Dependency)

fd2 : PetID → Owner, Name, Type, Age (Partial Dependency)

Treatment

| PetID | VisitDate | procedureCode | Procedure |
|---|---|---|---|
| 541 | 23-Jan-15 | 03 | Rabies Vaccination |
| 541 | 12-Apr-15 | 07 | Heart Worm Test |
| 256 | 12-Jan-15 | 07 | Heart Worm Test |
| 256 | 22-Aug-15 | 03 | Rabies Vaccination |
| 256 | 16-Jan-16 | 12 | Tetanus Vaccination |
| 324 | 19-May-15 | 15 | Eye Wash |
| 324 | 1-Feb-16 | 22 | Annual Checkup |
| 552 | 23-Sep-15 | 03 | Rabies Vaccination |

Pet Info

| PetID | Owner | Name | Type | Age |
|---|---|---|---|---|
| 541 | Mr. Sani Aris | Sweetie | Cat | 5 |
| 256 | Mr.Leong Sam | Tweety | Dog | 12 |
| 324 | Mr.Leong Sam | Love | Cat | 3 |
| 552 | Mr. Sani Aris | Honey | Hamster | 2 |

**2NF>3NF (remove Transitive Dependency)**

fd1: PetID ⟶ VisitDate, procedureCode, Procedure (Fully Dependency)

fd2 : PetID ⟶ Owner, Name, Type, Age (Partial Dependency)

fd3 : procedureCode ⟶ Procedure (Transitive Dependency)

Visit

| PetID | VisitDate | procedureCode |
|---|---|---|
| 541 | 23-Jan-15 | 03 |
| 541 | 12-Apr-15 | 07 |
| 256 | 12-Jan-15 | 07 |
| 256 | 22-Aug-15 | 03 |
| 256 | 16-Jan-16 | 12 |
| 324 | 19-May-15 | 15 |
| 324 | 1-Feb-16 | 22 |
| 552 | 23-Sep-15 | 03 |

Pet Info

| PetID | Owner | Name | Type | Age |
|---|---|---|---|---|
| 541 | Mr. Sani Aris | Sweetie | Cat | 5 |
| 256 | Mr.Leong Sam | Tweety | Dog | 12 |
| 324 | Mr.Leong Sam | Love | Cat | 3 |
| 552 | Mr. Sani Aris | Honey | Hamster | 2 |

Procedure

| procedureCode | Procedure |
|---|---|
| 03 | Rabies Vaccination |
| 07 | Heart Worm Test |
| 12 | Tetanus Vaccination |
| 15 | Eye Wash |
| 22 | Annual Checkup |

ERD