Lecture 10

# Entity Relationship Diagram(E-RD) and DFD

E-RD

- Proposed by Chen 1976

  - Analysis of system static data

  - Data modeling

  - Represent major data objects and relationship between them

  - Removing redundancies

- Major abstraction to represent data are :

  1. Entity (each individual objects, noun)

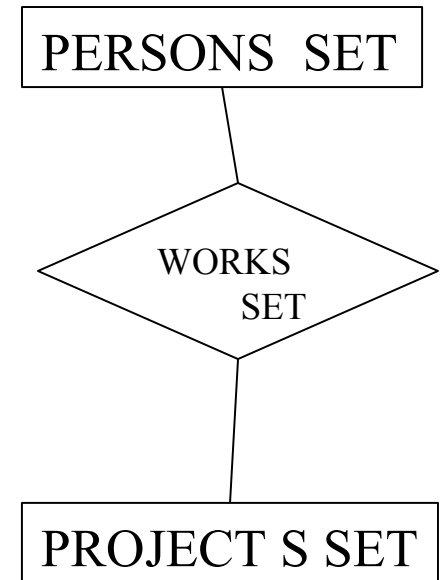 2. Relationship(verb, preposition)

  3. Attribute

E-RD

E1

R1   R2

E2

N-array

E1

R1   E1

E1

E1

R1   R2   R3

E2   E3   E4
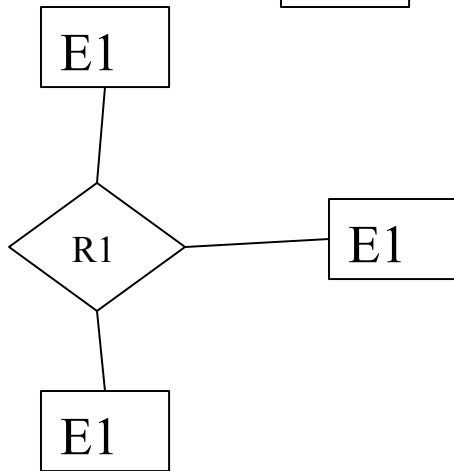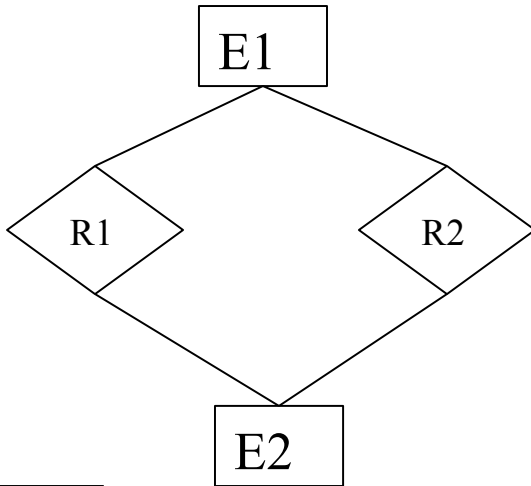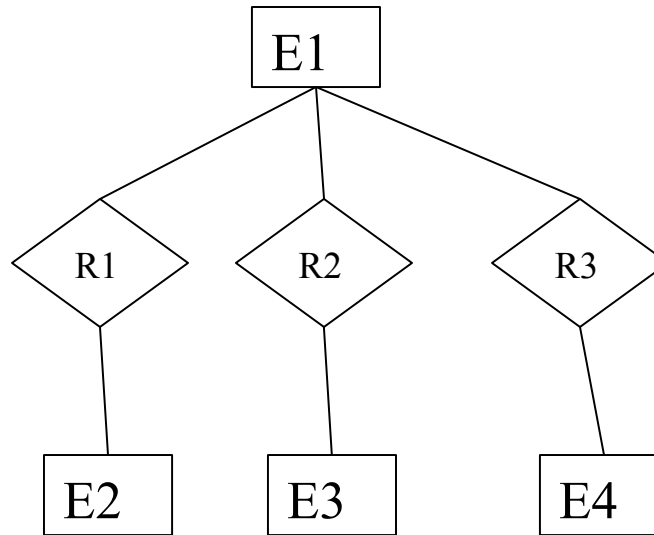
Binary relationship

Occurrence diagram

PERSONS SET

WORKS SET

PROJECT S SET
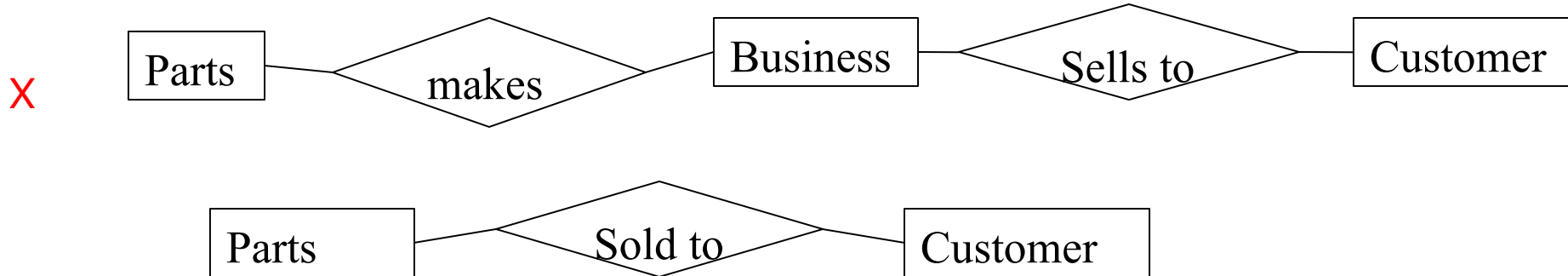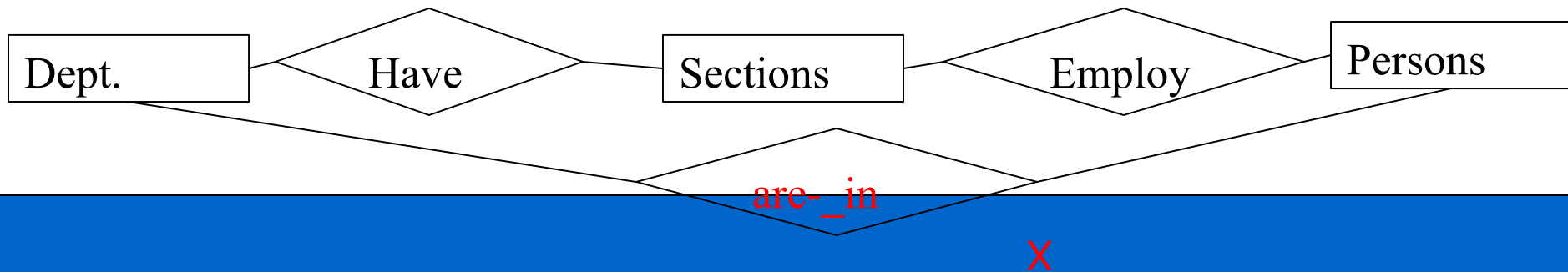
E-RD

- N-array relationship should be avoided because they include more than one concept

- Avoid :

  1. System itself should not appear

  X

  | Parts | — makes — | Business | — Sells to — | Customer |

  | Parts | — Sold to — | Customer |

  2. Derived relationship sets

  | Dept. | — Have — | Sections | — Employ — | Persons |

  are-_in

  X

E-RD

- <u>Attributes :</u>

Persons — Works — Projects

Persion_id

Name

Persion_id

Project_id

Project_id

Start_date
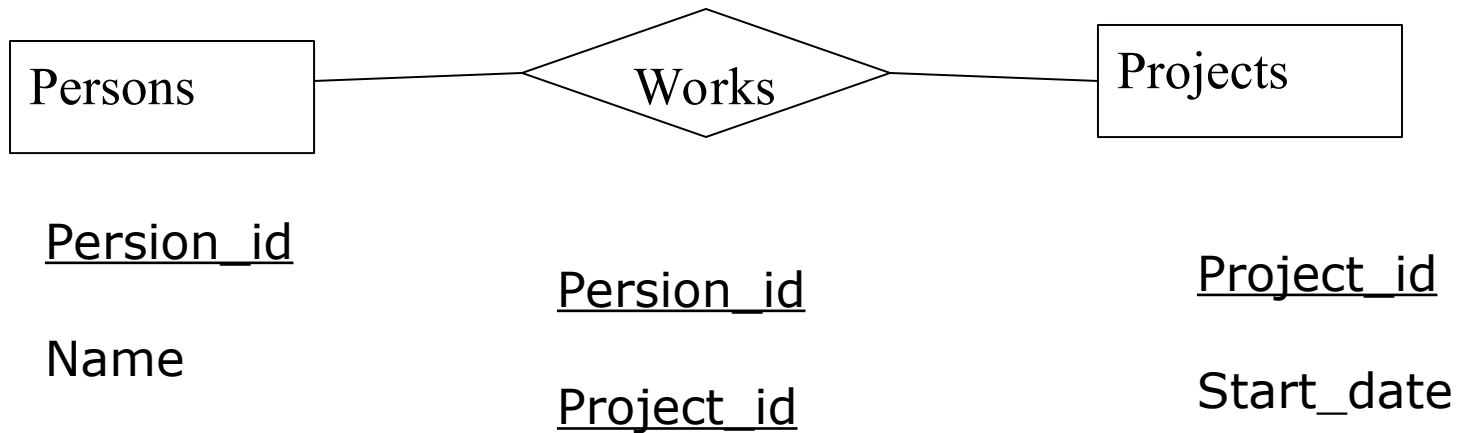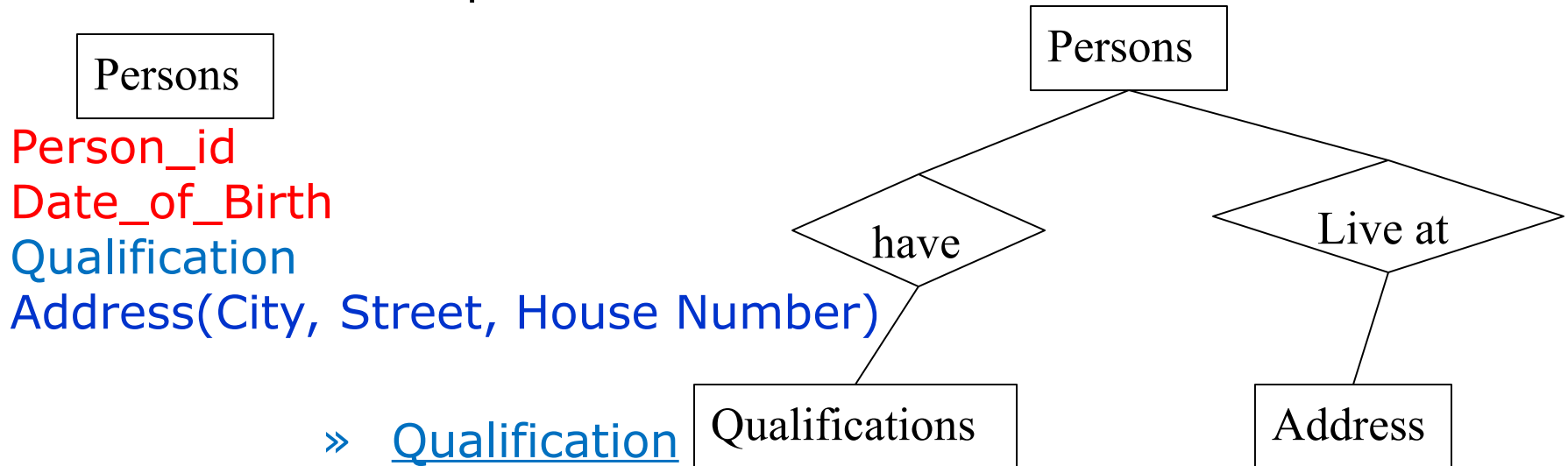
- <u>Cardinality</u> :   Number of relationships in which an entity can appear   (i) 1:1, (ii) 1:N   (iii) N:M

- <u>Participation :</u> Participation of entities in a relationship set can be (i) Mandatory, (ii) Optional, (iii) Conditional

E-RD

- Mandatory : All persons work on project

- Optional : one person need not work on project (represented by ○)

- Conditional : Depending upon condition(s)

- Avoid relationship can be multivalued and structured

Persons

Person_id
Date_of_Birth
Qualification
Address(City, Street, House Number)

» Qualification

Persons

have

Live at

Qualifications

Address

E-RD

- Dependent Entity Set (weak entity set) :

```
┌──────────────────────┐
│ Invoice              │
└──────────────────────┘
           │
           ▼
┌──────────────────────┐
├──────────────────────┤
│ Invoice line         │
└──────────────────────┘
```
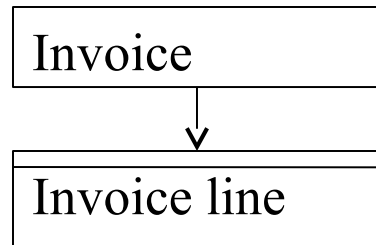
- Subsets:
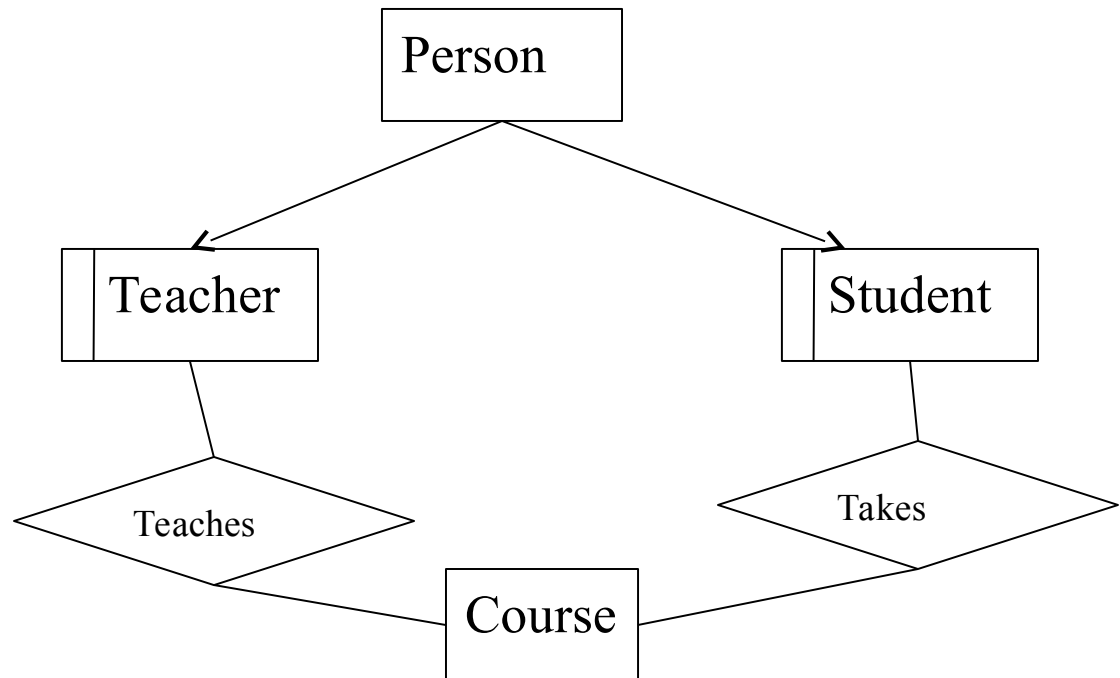
DFD (Data Flow Diagram)

- Both analysis and design tool for dynamic data of the system

- Popularized by DeMacro (1978), Yourdon, Gane & Sarson (1979)

- Definition : A DFD shows the flow of data through a system (a system may be an organization, a manual procedure, a s/w system, a mechanical system, a h/w system or any combination of these

Library System

Student

Query/Request

Answer query

& Issue books

Response/Book
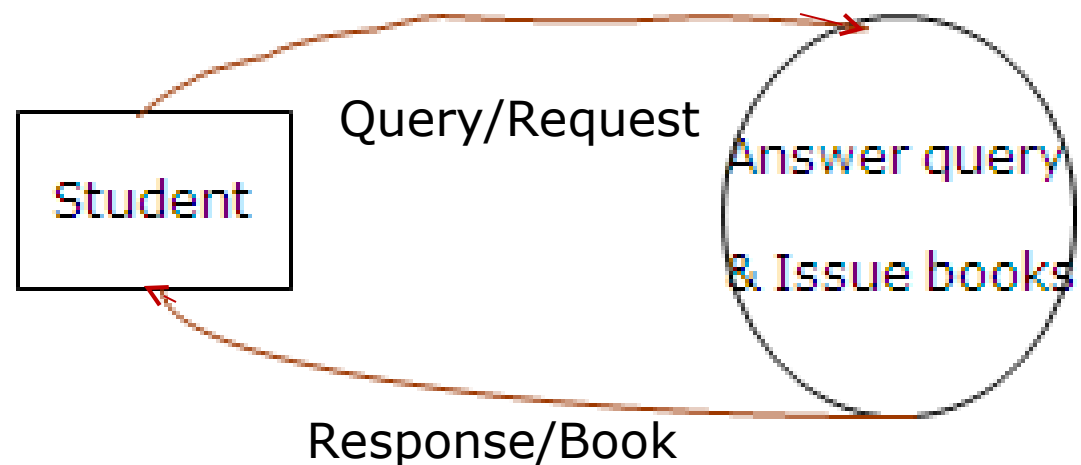
DFD

- System components : four kind

  1. Process (bubble) : What system do

     Each process has a unique name and number
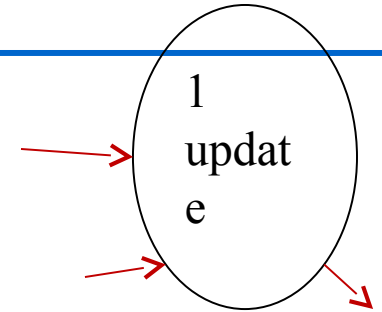
  2. External Entities (box) : Input data into the system or use system output.

     Source and sink

  3. Data store (//) : repository of data, unique name

  1. Data flows (⟶): arrows

DFD

- Example : Top level DFD

Query/Application

Applicant

Process loan

Query/Application
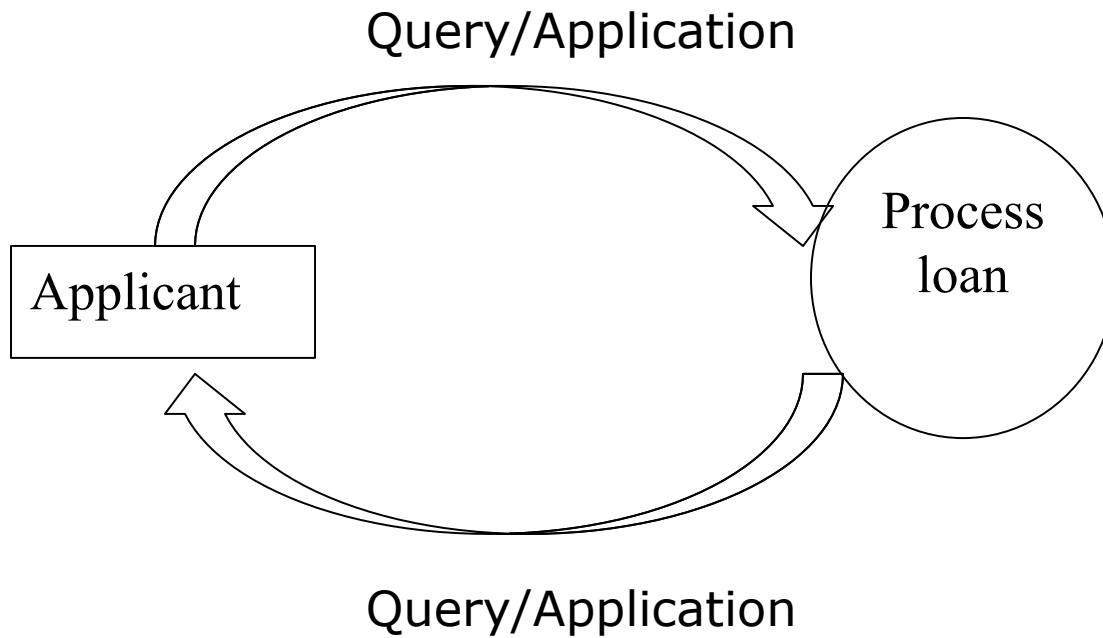
Context diagram (level 0)

DFD

- Example : level 1 DFD
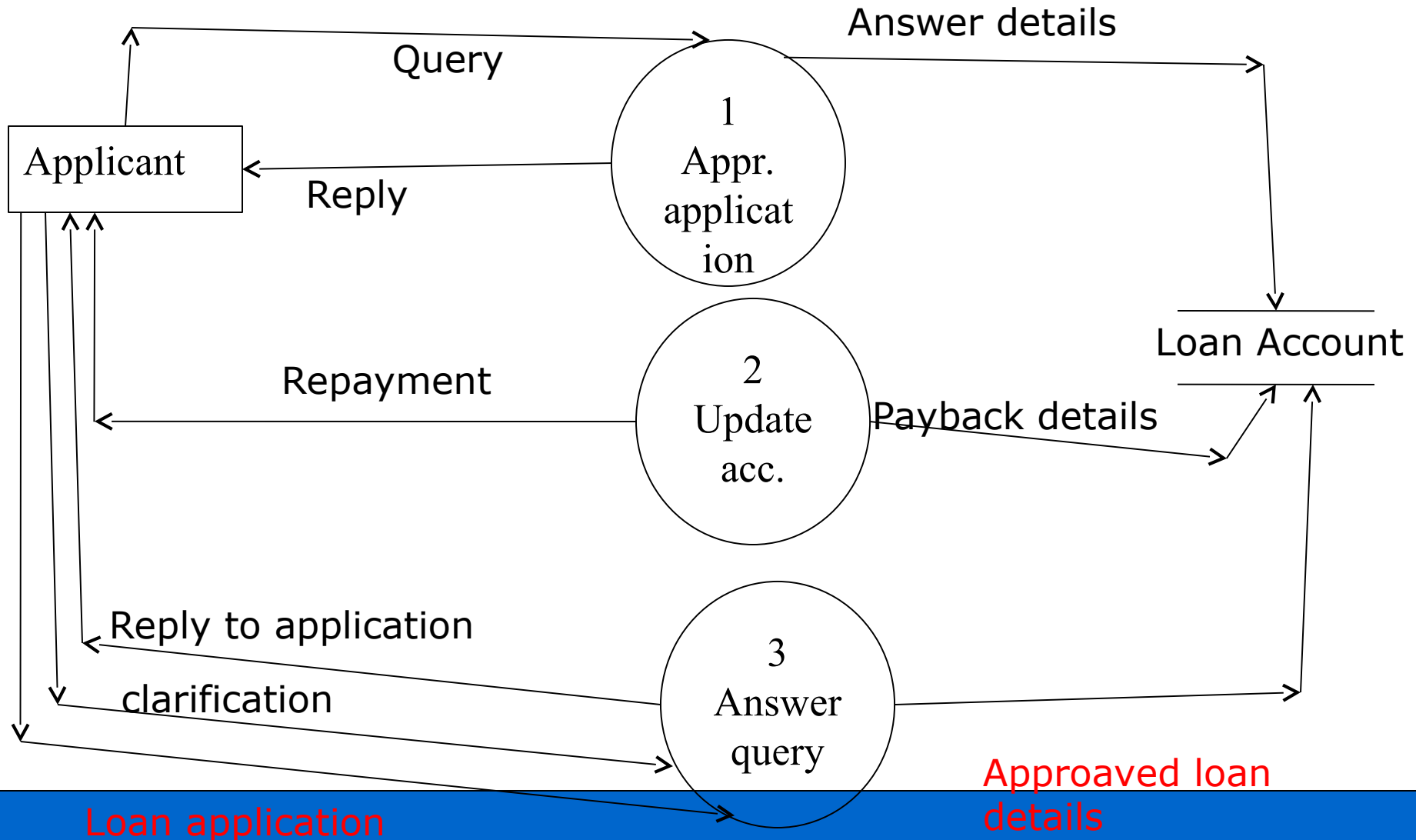
DFD

- <u>Process #</u>

Level 0	context diagram
Level 1	1, 2, 3
Level 2	1.1, 2.1, 3.1
	1.2, 2.2, 3.2
	1.3, 2.3, 3.3
	………………….
	………………….
Level 3	1.1.1
	1.1.2
	1.1.3
	………
	………

DFD

- DFD vs. Flowchart

- Some common errors should be avoided :
  1. No process can acts as sink or a source
  2. Information required by a process is not available
  3. Some information is not being used in the process
  4. Missing process
  5. No unlabeled data flow
  6. Avoid criss-crossing flow
  7. Missing data flow
  8. Extraneous data flow
  9. Contain some control information, looping and decision
  10. Consistency not maintained during refinement

DFD

- Criteria of a good DFD :

  - Self explanatory, Complete and Unambiguous

- Features :

  I. Absence of flowchart structures

  II.Conservation of data

  III.Good naming conventions

Absence of flowchart structures

1. No splitting of data flows

2. No crossing lines

3. No control signal from a process

4. No looping

5. No input signals

6. Decision and iteration must be avoided

Conservation of data and Good naming conventions

- Conservation of data :

  - What comes out of the data store must first go in

  - It is not possible for data store to create new data elements

  - It is true for process also

- Good naming conventions :

  - Process :readable, avoid meaningless names. Single phrase/ describe a process in one sentence

  - Data store :

  - Data flow :one word (invoice, check) avoid

PDFD vs. LDFD

Physical DFD

1. During analysis

2. Use of physical agent/devices

3. How, by whom, when

4. Specific name of data flow and process

5. Objective world

Logical DFD

1. During design

2. Logical entity/ operation name

3. What uspects

4. Names of data flow and process by a sentence or a phrase

5. Subjective world

DFD

- E-RD vs. DFD

- Convert DFD to structure Chart

  - Transformed centered analysis
  - Transaction centered analysis

Data Dictionary

- Structured repository of data about data

- Information about different data elements and different layers

- Smallest element is fields/data elements, can't be further decomposed.
  - Ex. emp_no., emp_type

- Repository of various data flow in the system

- Define data structure of data in DFD : Notations
  1. Sequence or Composition (+)
     - Ex. Weekly timesheet = emp_name + emp_id
  2. Selection (|)
     - Pay rate = Hourly | Daily | Weekly

Data Dictionary

3. Repetition (*) (one or more)

- Hour = [regular_hours + Overtime_hours]*

Process Specifications (Pspecs)

1. N_S (Nassi_Shneiderman) Diagram

   1. Sequence
   2. Decision
   3. Looping

2. Structured English

   - Arithmetic operators : *, /, +, -, **
   - Relational operators : >, <, >=, <=, ∏
   - Boolean operators: and , or, not
   - Keywords : BEGIN END, REPEAT UNTIL, IF THEN ELSE, CASE OF, WHILE DO, FOR

3. Decision Tree

4. Decision Table

Process Specifications (Pspecs)

- Example : Conditions :

  1. Credit limit exceeded

  2. Good payment history

  3. Purchase above Rs. 200

  Structured English :

  If credit limit exceeded

     THEN IF customer has bad payment history

        THEN refuse credit

           ELSE IF Purchase is above Rs. 200

             THEN Refuse credit

              ELSE refer to manager

     ELSE Allow credit

Process Specifications (Pspecs)

- Decision Table :

Credit Limit exceeded	Y	Y	Y	Y	N	N	N	N
Customer good payment history	Y	Y	N	N	Y	Y	N	N
Purchase above Rs.200	Y	N	Y	N	Y	N	Y	N
Allow credit					X	X	X	X
Refuse credit	X		X	X				
Refer to manager		X						

Condition (rows 1–3), _Action_ (rows 4–6)

Process Specifications (Pspecs)

- Decision Tree :

```
                                                  Purchase
                                                  above Rs.  ── Refuse credit
                                                  200
                          Good payment
                          history                 Purchase
        Credit limit                              below Rs.  ── Refuse credit
        exceeded                                  200
                          Bad payment
                          history        ── Refuse credit

        Credit limit
        not exceeded          ── Allow credit
```