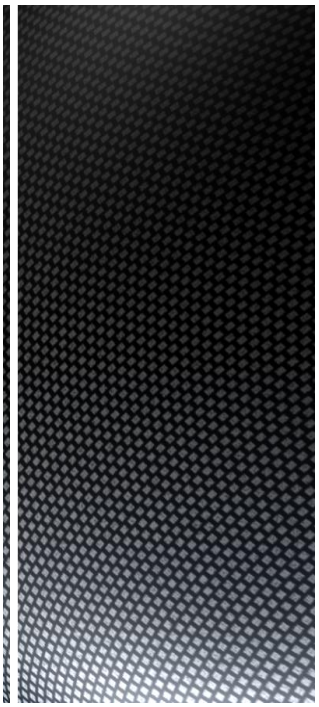
MIS
(Management Information System)
(21-972)

Department of Industrial Engineering
Sharif University of Technology

Session #13

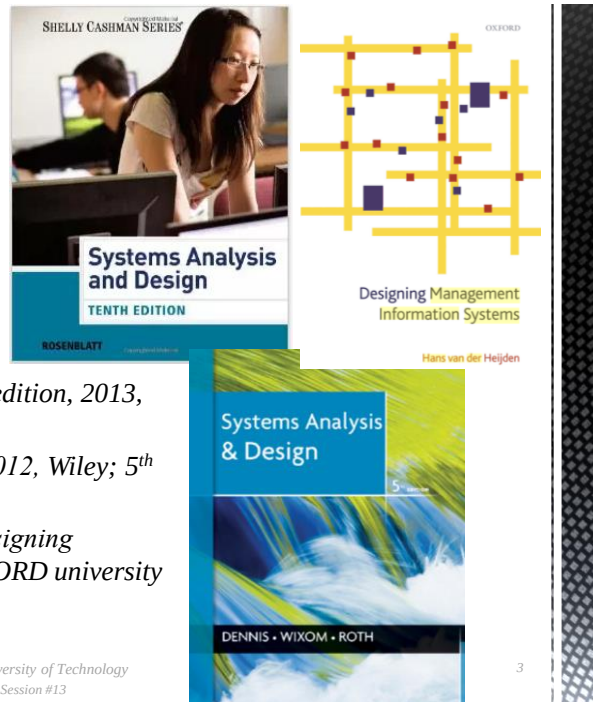


Course Description

- *Instructor*
  - *Omid Fatahi Valilai, Ph.D. Industrial Engineering Department, Sharif University of Technology*
  - *Email: Fvalilai@sharif.edu , Tel: 021-6616-5706*
  - *Website: http://sharif.edu/~fvalilai*
- *Class time*
  - *Saturday-Monday* *10:30~12:00*
- *Course evaluation*
  - *Mid-term* *(20%)*
  - *Final exam* *(20%)*
  - *Quiz* *(10%)*
  - *Exercise-Projects* *(30%)*

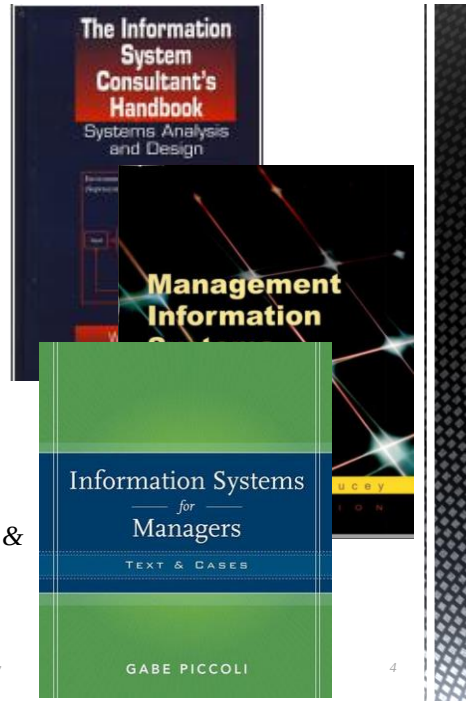
Course Description *(Continued …)*

- *Mid-term session:*
  - *Saturday, 7th, Azar 1394*
- *Final session:*
  - *Monday, 28th, Dey 1394*
- *Reference:*
  - *Rosenbalt, "System Analysis and Design", 10th edition, 2013, Course Technology*
  - *Dennis, Lan; "Systems Analysis and Design", 2012, Wiley; 5th edition*
  - *Johannes Govardus Maria van der Heijde; "Designing Management Information Systems", 2009, OXFORD university press*



Course Description *(Continued …)*

- *Reference:*
  - *William S. Davis, David C. Yen, "The information system consultant's handbook: system analysis and design", 2010, Taylor and Francis*
  - *Terence Lucey; "Management Information Systems", 2004, Cengage Learning EMEA*
  - *Gabriele Piccoli; "Information systems for managers: texts & cases ", 2007, John Wiley & Sons Inc*



Course Description *(Continued..)*

- *Contents:*
  - *Introduction to Systems Analysis and Design*
  - *Analyzing the Business Case*
  - *Managing Systems Projects*
  - *Requirements Modeling*
  - *Data and Process Modeling*
  - *Object Modeling*
  - *Development Strategies*
  - *User Interface Design*
  - *Data Design*
  - *System Architecture*
  - *Managing Systems Implementation*

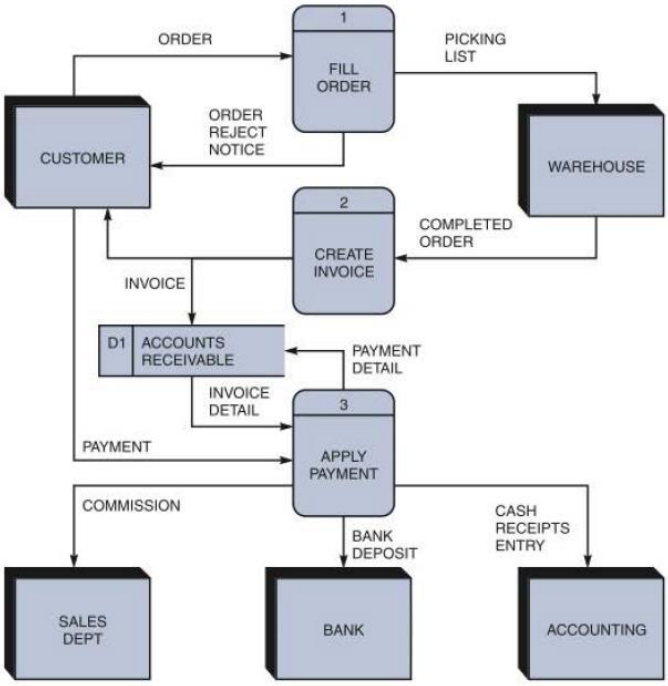
Course Description *(Continued..)*

- *Contents:*
  - *Data and Process Modeling*
    - *Data Flow Diagrams*
    - *Creating a Set of DFDs*
    - *Data Dictionary*
    - *Using CASE Tools for Documentation*
    - *Process Description Tools*
    - *Logical versus Physical Models*

Data and Process Mode

- *Data Flow Diagrams*
  - *DFD*
    - *DFD 0 Diagram*

    (Level 1)



Data and Process Modeling

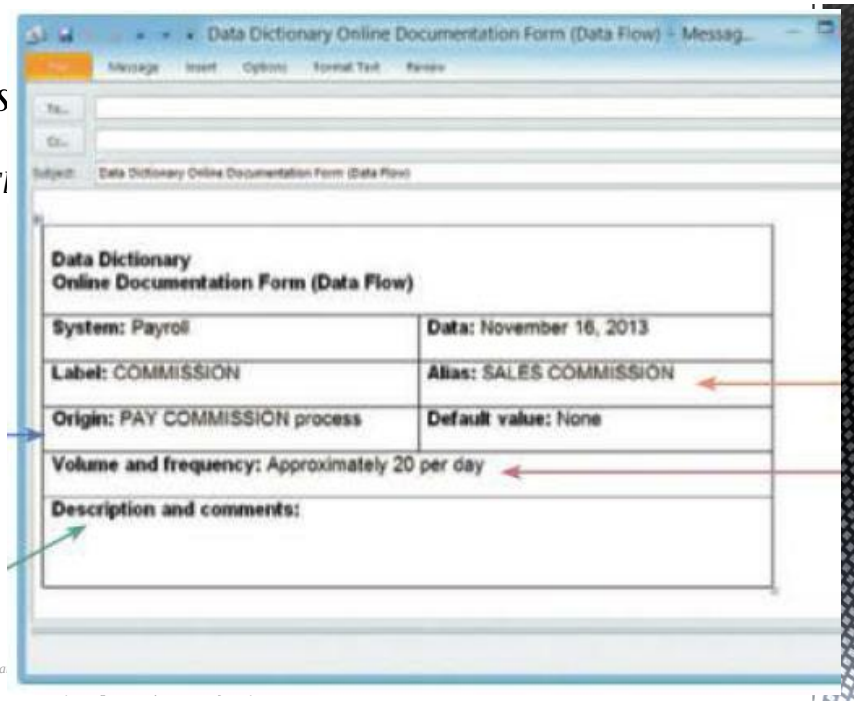
- *Documenting the Data Flows*
  - *In addition to documenting each data element, you must document all data flows in the data dictionary.*
    - *Data flow name or label. The data flow name as it appears on the DFDs.*
    - *Description. Describes the data flow and its purpose.*
    - *Alternate name(s). Aliases for the DFD data flow name(s).*
    - *Origin. The DFD beginning, or source, for the data flow; the origin can be a process, a data store, or an entity.*

Data and Process Modeling

- *Documenting the Data Flows*
  - *Destination. The DFD ending point(s) for the data flow; the destination can be a process, a data store, or an entity.*
  - *Record. Each data flow represents a group of related data elements called a record or data structure. In most data dictionaries, records are defined separately from the data flows and data stores.*
    - *When records are defined, more than one data flow or data store can use the same record, if necessary.*
  - *Volume and frequency. Describes the expected number of occurrences for the data flow per unit of time.*
    - *For example, if a company has 300 employees, a TIME CARD data flow would involve 300 transactions and records each week as employees submit their work hour data.*

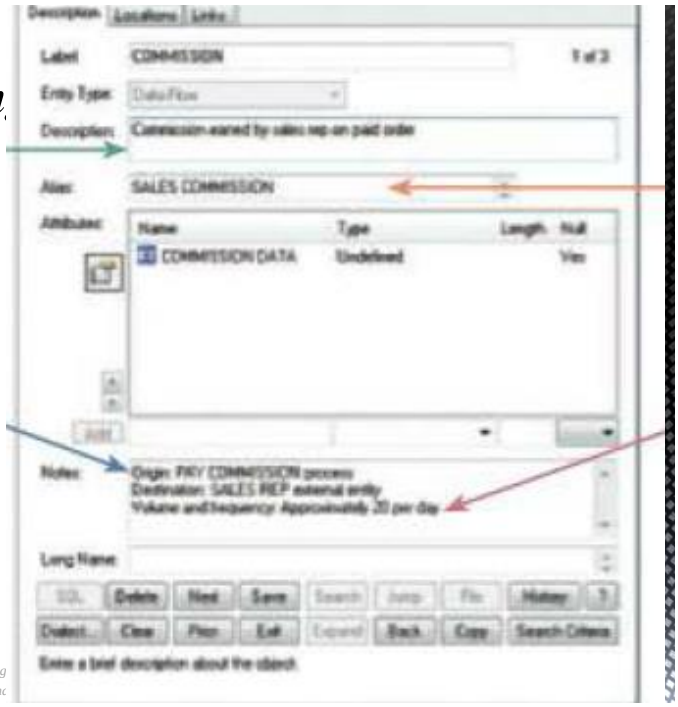
Data and Process

- *Documenting the Data Fl*



Data and Process Modelin

- *Documenting the Data Flows*



Data and Process Modeling

- *Documenting the Data Stores*
  - *Typical characteristics of a data store are as follows:*
  - *Data store name or label. The data store name as it appears on the DFDs.*
  - *Description. Describes the data store and its purpose.*
  - *Alternate name(s). Aliases for the DFD data store name.*
  - *Attributes. Standard DFD names that enter or leave the data store.*
  - *Volume and frequency. Describes the estimated number of records in the data store and how frequently they are updated.*

Data and Process Modeling

- *Documenting the Processes*
  - *Your documentation includes a description of the process's characteristics and, for functional primitives, a process description, which is a model that documents the processing steps and business logic.*
  - *The following are typical characteristics of a process:*
    - *Process name or label. The process name as it appears on the DFDs.*
    - *Description. A brief statement of the process's purpose.*
    - *Process number. A reference number that identifies the process and indicates relationships among various levels in the system.*
    - *Process description. This section includes the input and output data flows. For functional primitives, the process description also documents the processing steps and business logic.*

Data and Process Modeling

- *Documenting the Entities*
  - *Typical characteristics of an entity include the following:*
    - *Entity name. The entity name as it appears on the DFDs.*
    - *Description. Describe the entity and its purpose.*
    - *Alternate name(s). Any aliases for the entity name.*
    - *Input data flows. The standard DFD names for the input data flows to the entity.*
    - *Output data flows. The standard DFD names for the data flows leaving the entity.*

Data and Process Modeling

- *Documenting the DFDs*
  - *Decision Tables*
  - *A decision table is a logical structure that shows every combination of conditions and outcomes.*
  - *Analysts often use decision tables to describe a process and ensure that they have considered all possible situations.*
  - *TABLES WITH ONE CONDITION*
    - *If a process has a single condition, there only are two possibilities - yes or no.*
    - *Either the condition is present or it is not, so there are only two rules.*

Data and Process Modeling

- *Documenting the DFDs*
  - *Decision Tables*
  - *A decision table is a logical structure that shows every combination of conditions and outcomes.*
  - *Analysts often use decision tables to describe a process and ensure that they have considered all possible situations.*
  - *TABLES WITH TWO CONDITIONS*

VERIFY ORDER Business Process with Two Conditions

- An order will be accepted only if the product is in stock and the customer's credit status is OK.
- All other orders will be rejected.

VERIFY ORDER Process

	1	2	3	4	
Credit status is OK	Y	Y	N	N	3
Product is in stock	Y	N	Y	N	
Accept order	X				4
Reject order		X	X	X	

Data and Process Modeling

- *Documenting the DFDs*
  - *Decision Tables*
  - *TABLES WITH THREE CONDITIONS*

VERIFY ORDER Business Process with Three Conditions

- An order will be accepted only if the product is in stock and the customer's credit status is OK.
- The credit manager can waive the credit status requirement.
- All other orders will be rejected.

VERIFY ORDER Process with Credit Waiver (initial version)

	1	2	3	4	5	6	7	8
Credit status is OK	Y	Y	Y	Y	N	N	N	N
Product is in stock	Y	Y	N	N	Y	Y	N	N
Waiver from credit manager	Y	N	Y	N	Y	N	Y	N
Accept order	X	X			X			
Reject order			X	X		X	X	X

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Data and Process Modeling

- *Documenting th DFDs*
  - *Decision Table*
  - *Rule Combination*

	1	2	3	4	5	6	7	8
Credit status is OK	Y	Y	-	-	N	N	-	-
Product is in stock	Y	Y	N	N	Y	Y	N	N
Waiver from credit manager	-	-	-	-	Y	N	-	-
Accept order	X	X			X			
Reject order			X	X		X	X	X

2

VERIFY ORDER Process with Credit Waiver (after rule combination and simplification)

	1 (COMBINES PREVIOUS 1, 2)	2 (PREVIOUS 5)	3 (PREVIOUS 6)	4 (COMBINES PREVIOUS 3, 4, 7, 8)
Credit status is OK	Y	N	N	-
Product is in stock	Y	Y	Y	N
Waiver from credit manager	-	Y	N	-
Accept order	X	X		
Reject order			X	X

Data and Process Modeling

- *Documenting the DFDs*
  - *Decision Tables*
  - *Multiple Outcomes*

SALES PROMOTION POLICY – Holiday Season, 2014

- Preferred customers who order $1,000 or more are entitled to a 5% discount, and an additional 5% discount if they use our charge card.
- Preferred customers who do not order $1,000 or more will receive a $25 bonus coupon.
- All other customers will receive a $5 bonus coupon.

Sales Promotion Policy (initial version)

	1	2	3	4	5	6	7	8
Preferred customer	Y	Y	Y	Y	N	N	N	N
Ordered $1,000 or more	Y	Y	N	N	Y	Y	N	N
Used our charge card	Y	N	Y	N	Y	N	Y	N
5% discount	X	X						
Additional 5% discount	X							
$25 bonus coupon			X	X				
$5 bonus coupon					X	X	X	X

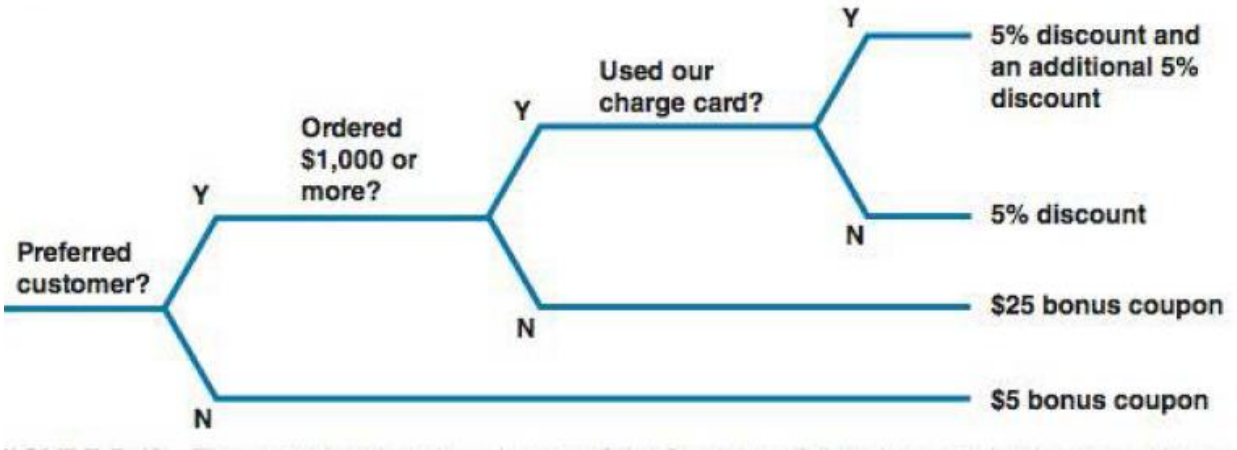
Data and Process Modeling

- *Documenting the DFDs*
  - *Decision Tables*
  - *Multiple Outcomes*

Sales Promotion Policy (final version)

	1	2	3	4	5	6	7	8
Preferred customer	Y	Y	Y	Y	N	N	N	N
Ordered $1,000 or more	Y	Y	N	N	-	-	-	-
Used our charge card	Y	N	-	-	-	-	-	-
5% discount	X	X						
Additional 5% discount	X							
$25 bonus coupon			X	X				
$5 bonus coupon					X	X	X	X

Data and Process Modeling



Data and Process Modeling

- *Data Dictionary*
  - *A set of DFDs produces a logical model of the system, but the details within those DFDs are documented separately in a data dictionary.*
  - *A data dictionary, or data repository, is a central storehouse of information about the system's data.*
  - *An analyst uses the data dictionary to collect, document, and organize specific facts about the system, including the contents of data flows, data stores, entities, and processes.*
  - *The data dictionary also defines and describes all data elements and meaningful combinations of data elements.*

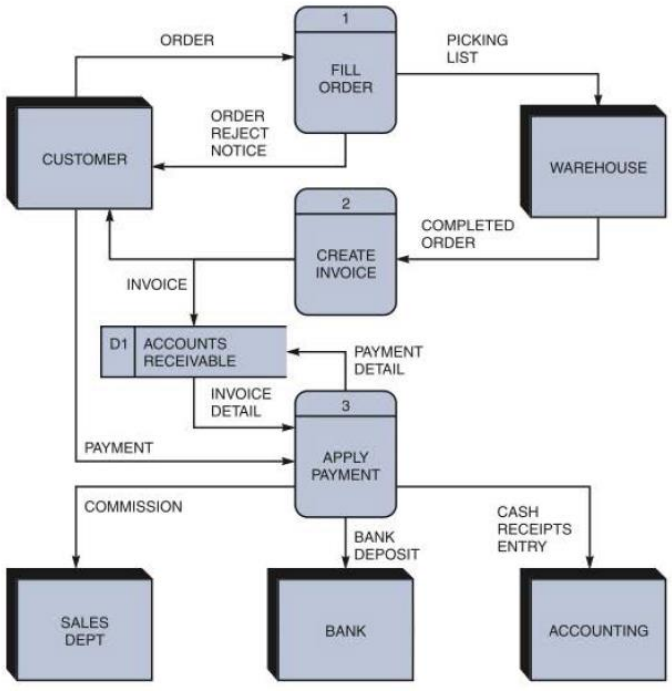
Data and Process Modeling

- *Data Dictionary*
  - *A data element, also called a data item or field, is the smallest piece of data that has meaning within an information system.*
  - *Examples of data elements are student grade, salary, Social Security number, account balance, and company name.*
  - *Data elements are combined into records, also called data structures.*
  - *A record is a meaningful combination of related data elements that is included in a data flow or retained in a data store.*
    - *An auto parts store inventory record might include part number, description, supplier code, minimum and maximum stock levels, cost, and list price.*

Data and Process Mode

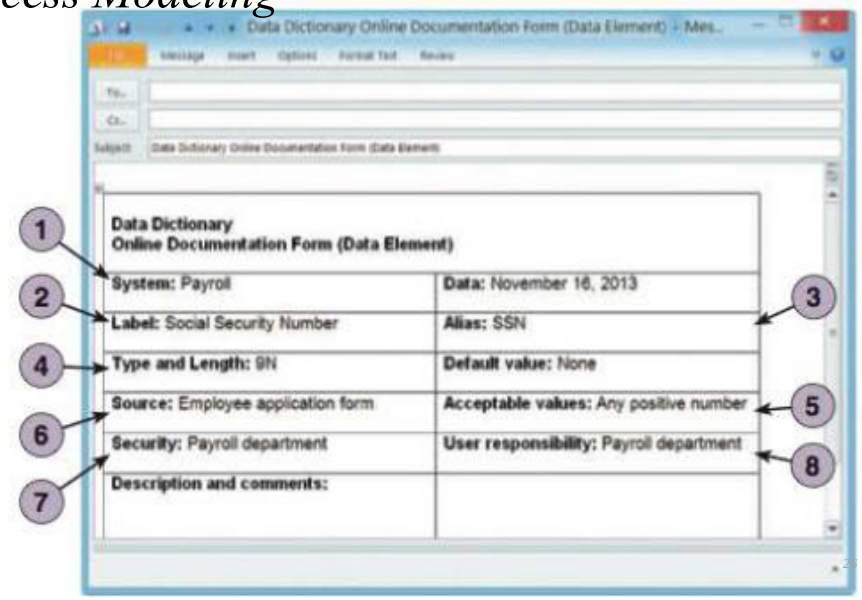
- *Data Flow Diagrams*
  - *DFD*
    - *DFD 0 Diagram*

(Level 1)



Data and Process Modeling

- *Data Dictionary*



Data and Process Modeling

- *Data Dictionary*

Data and Process Modeling

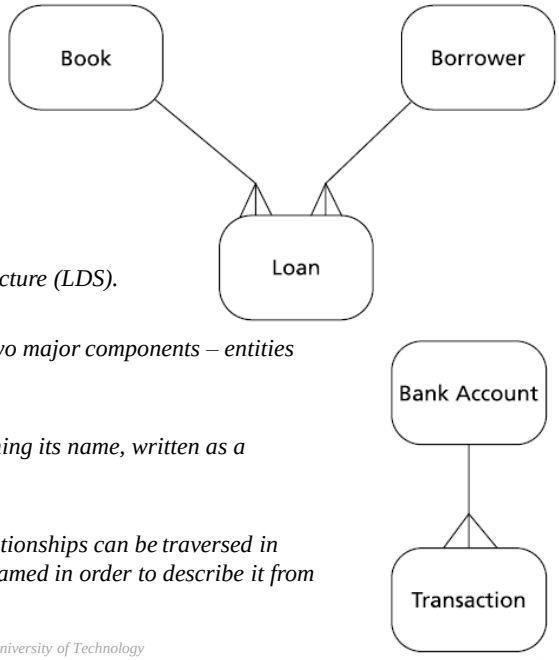
- System Analysis
  - Recording the information
    - Data flow Diagrams
    - Entity Models

The entity model in SSADM is called logical data structure (LDS).

LDSs are simpler than DFDs in that they have only two major components – entities and the relationships between them.

An entity is usually represented as a rectangle containing its name, written as a singular noun.

Relationships are shown as lines linking entities. Relationships can be traversed in both directions, and so each end of a relationship is named in order to describe it from the point of view of the entity at that end.



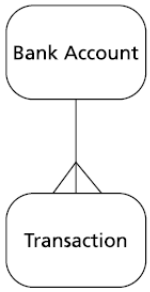
Data and Process Modeling

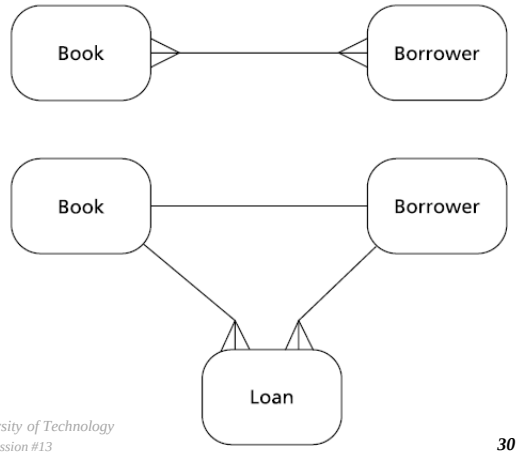
- System Analysis
  - Recording the information
    - Data flow Diagrams
    - Entity Models

- *Classification of relationships is known as the degree of the relationship*
- *Most relationships are between one master entity and many detail entities. <<one-to many relationship>>*
- *Relationships may also be <<many-to-many >> or <<one-to-one>>.*
- *One-to-one relationships are uncommon, as it is usually found that two entities that are linked in this way can be combined to give a single entity.*
- *Many-to-many relationships are more common, but it is usual to resolve them by introducing a new 'link' entity that is a detail of the two original entities*

Data and Process Modeling

- *System Analysis*
  - *Recording the information*
    - *Data flow Diagrams*
    - *Entity Models*



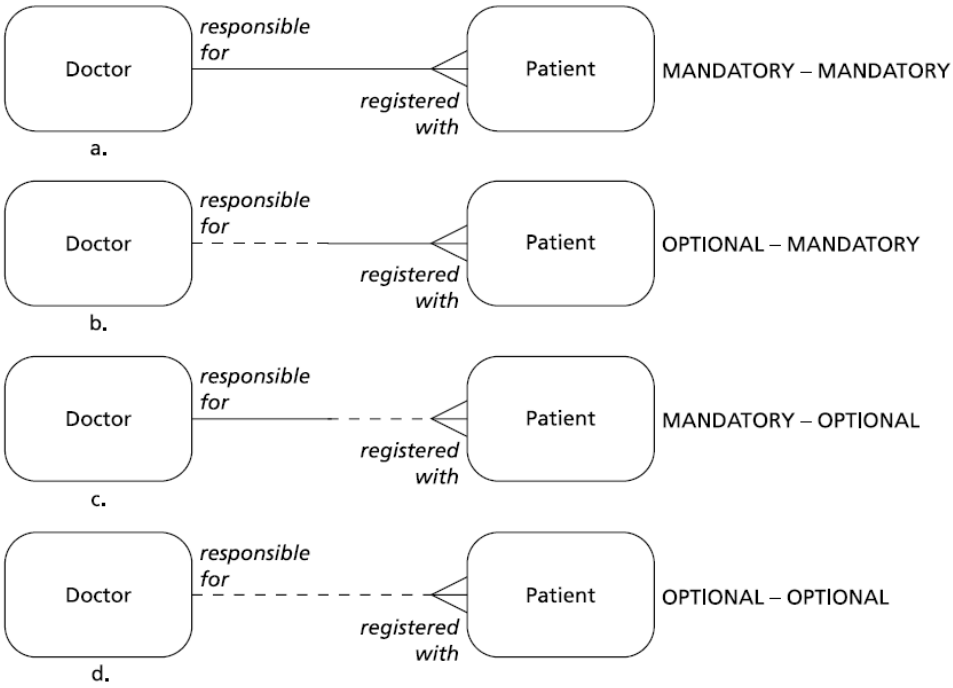


Data and Process Modeling

- *System Analysis*
  - *Recording the information*
    - *Data flow Diagrams*
    - *Entity Models*
    - *Relationships are also classified in terms of their optionality.*
    - *Relationships can be described as exclusive.*

One type of exclusivity occurs if a detail entity has two (or more) masters and an occurrence of the detail may be linked to only one of the masters but not both.

The other is the converse situation where a master may be linked to only one of two or more sets of details. Exclusive relationships are shown by drawing an exclusion arc to connect them



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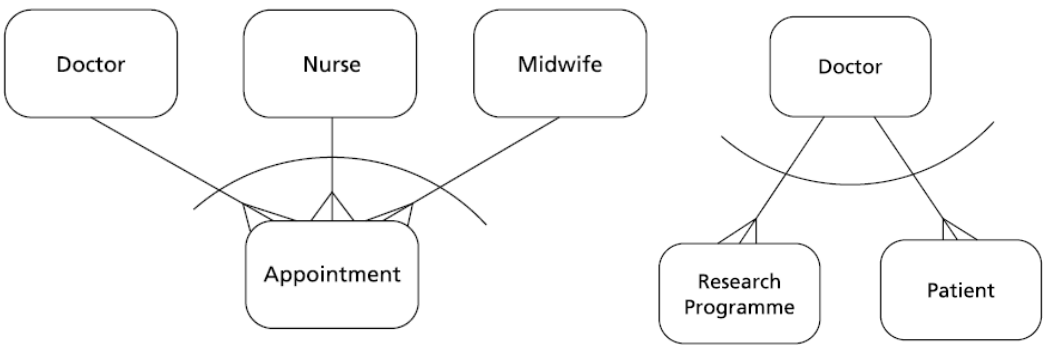
Data and Process Modeling

- *System Analysis*
  - *Recording the information*
    - *Data flow Diagrams*
    - *Entity Models*

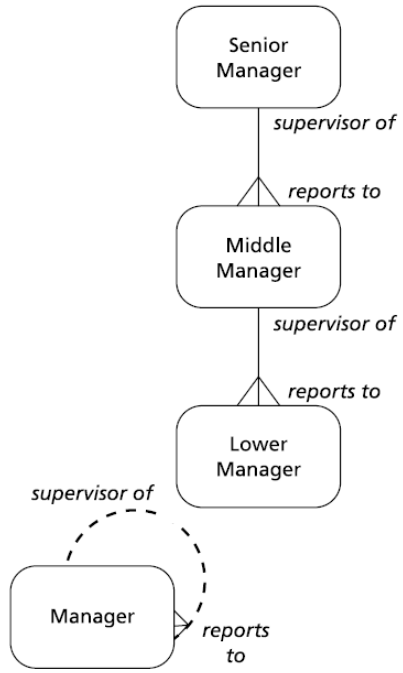


Data and Process Modeling

- System Analysis
  - Recording the information
    - Data flow Diagrams
    - Entity Models
    - <<Recursive relationships>>: In other words, individual occurrences of entities can be related to other occurrences of that entity.

There are two ways in which this can happen.

The first is where there is a one-to-many or hierarchical relationship between entity occurrences.



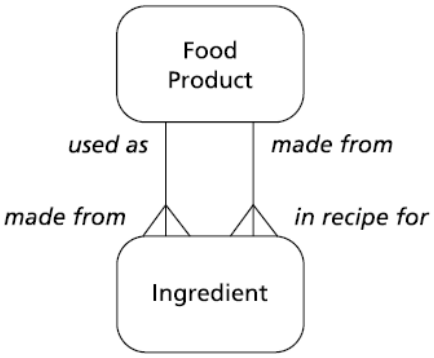
or by a single entity called manager, which has a recursive relationship with itself.

Data and Process Modeling

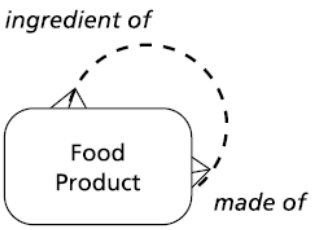
- System Analysis
  - Recording the information
    - Data flow Diagrams
    - Entity Models
    - <<Recursive relationships>>: The second way in which an entity can be related to itself is where there is a many-to-many relationship between occurrences, indicating a network structure.

There are two ways in which this can happen.

One way in which the structure can be shown is as a single entity linked to itself by a many-to-many relationship.



breaking the many-to-many relationship into two one-to-many relationships and creating a new entity that acts as a link between different occurrences of the original entity.



Data and Process Modeling

- *System Analysis*
  - *Recording the information*
    - *Data flow Diagrams*
    - *Entity Models-The Logical Data Model*
    - *A logical data model (LDM) consists of an LDS diagram and a set of entity descriptions and relationship descriptions, which give more detail about the diagram components.*
    - *Relationship are usually documented in both directions. In other words, they are described from the point of view of each of the two entities that make up the relationship.*

Data and Process Modeling

- *System Analysis*
  - *Recording the information*
    - *Data flow Diagrams*
    - *Entity Models-The Logical Data Model*
    - *For each relationship 'half', the following information should be recorded:*
      - *First entity name (the entity at this end of the relationship);*
      - *Second entity name (the entity at the other end);*
      - *Relationship name or phrase shown on the LDS;*
      - *Description of the relationship (in business terms);*
      - *Degree of the relationship (one to many, many to one, etc.);*
      - *Cardinality of the relationship (the number of second entities expected to be*
      - *Linked to each first entity – this may be an average or, better, a distribution);*
      - *Optionality of the relationship;*
      - *List of users and their access rights to the relationship (update, read, etc.).*

Data and Process Modeling

- *System Analysis*
  - *Recording the information*
    - *Data flow Diagrams*
    - *Entity Models-The Logical Data Model*
    - *Entity descriptions should contain at least the following information:*
      - *Entity name;*
      - *Alternative names (synonyms);*
      - *Description of the entity;*
      - *The owner (this is the user to whom the data in the entity belongs);*
      - *List of users and their access rights to the entity (update, read, etc.);*
      - *Expected number of occurrences of the entity and growth rates;*
      - *Rules for archiving and deleting entity occurrences.*

Data and Process Modeling

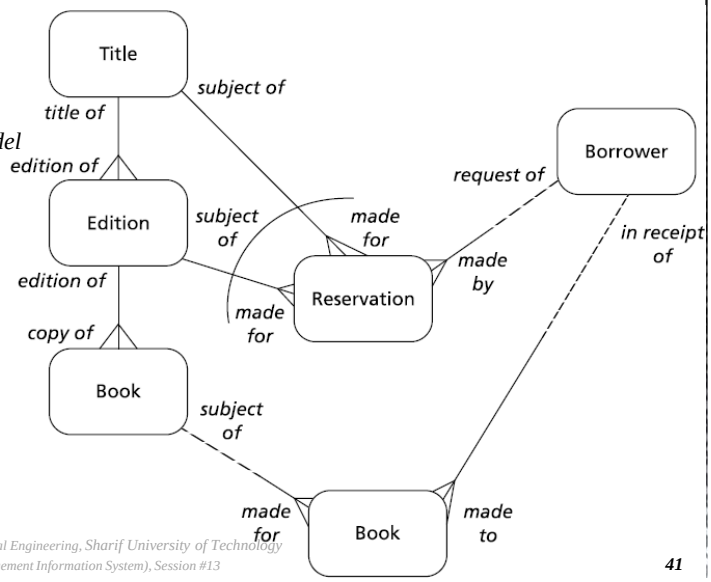
- *System Analysis*
  - *Recording the information*
    - *Data flow Diagrams*
    - *Entity Models-The Logical Data Model*
      - *One of the things we also need to record about an entity is the list of attributes it contains.*
      - *An attribute, or data item, is a piece of information that the system needs to record about an entity.*
      - *Attributes may be held by an entity purely as information, or they may play a role in relationships between entities, in which case they are known as key attributes or keys.*

Data and Process Modeling

- *System Analysis*
  - *Recording the information*
    - *Data flow Diagrams*
    - *Entity Models-The Logical Data Model*
      - *Keys are principally of two types: prime keys and foreign keys.*
        - *Prime keys are used to identify different occurrences of the same entity.*
        - *Foreign keys are attributes that are also present as prime keys on other entities.*

Data and Process Modeling

- *System Analysis*
  - *Recording the information*
    - *Data flow Diagrams*
    - *Entity Models-The Logical Data Model*



Data and Process Modeling

- System Analysis
  - Recording the information
    - Data catalogue
    - The data catalogue is a list of all the data items or attributes that have been identified as being required in the system.
    - Attributes are the individual items of data that are used to describe entities in the logical data model and which travel along data flows in DFMs, where they are listed on the I/O descriptions.
    - The data catalogue is in fact a subset of the data dictionary and is concerned with individual data items and the values they may take

Data and Process Modeling

- System Analysis
  - Recording the information
    - Data catalogue
    - The information that should be recorded about attributes includes:
      - Attribute name;
      - Alternative names (synonyms);
      - Description of the attribute;
      - Attribute location (entity or data flow);
      - Relationships to other attributes;
      - Format (including units and length);
      - Values (or ranges of values) the attribute is allowed to have;
      - Rules for deriving the value of attribute occurrences;
      - Optionality of the attribute;
      - The owner, i.e. the user to whom the data in the attribute belongs;
      - List of users and their access rights to the attribute (update, read, etc.).