

A dark blue vertical bar on the left side of the page. A blue arrow points to the right from the bar, containing the date.

1-6-2022

Database

Design 2 / 2

Several thin, curved lines in dark blue and light grey originate from the bottom left and curve upwards and to the right.

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UNIVERSIDAD POLITECNICA DE AGUASCALIENTES

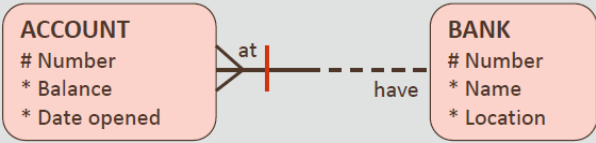
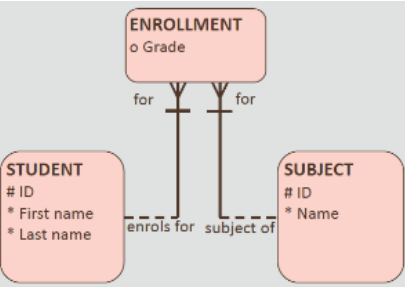
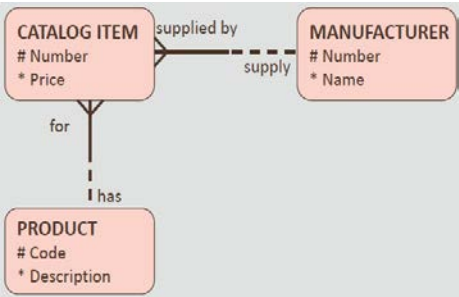
Contenido

| | |
|---|----|
| Section 6 – UUIDs and Normalization | 2 |
| 6-1 Artificial, Composite, and Secondary UUIDs..... | 2 |
| 6-2 Normalization and First Normal Form..... | 3 |
| 6-3 Second Normal Form..... | 4 |
| 6-4 Third Normal Form | 5 |
| Section 7 – Arcs, Hierarchies, and Recursive Modeling | 6 |
| 7-1 Arcs | 6 |
| 7-2 Hierarchies and Recursive Relationships | 7 |
| Section 8 – Changes and Historical Modeling | 8 |
| 8-1 Modeling Historical Data | 8 |
| 8-2 Modeling Change: Time | 8 |
| 8-3 Modeling Change: Price | 9 |
| 8-4 Drawing Conventions for Readability..... | 10 |
| Section 9 – Mapping | 11 |
| 9-1 Introduction to Relational Database Concepts | 11 |
| 9-2 Basic Mapping: The Transformation Process | 12 |
| 9-3 Relationship Mapping | 12 |
| 9-4 Subtype Mapping | 13 |
| Section 10 – Creating Database Projects..... | 15 |
| 10-1 System Development Life Cycle | 15 |
| 10-2 Project Overview and Getting Started | 15 |
| 10-3 Presentation Project Management..... | 15 |
| 10-4 Final Presentation Components..... | 15 |

Section 6 – UUIDs and Normalization

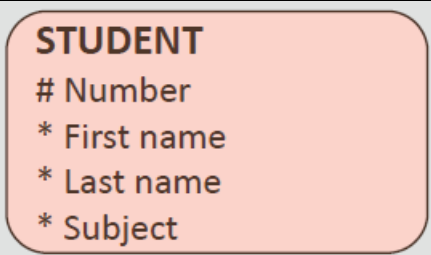
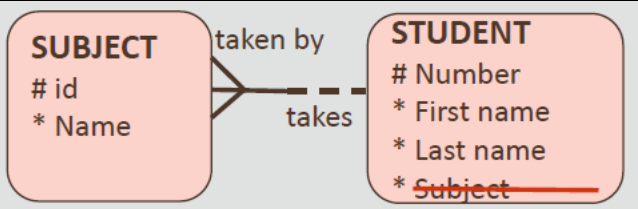
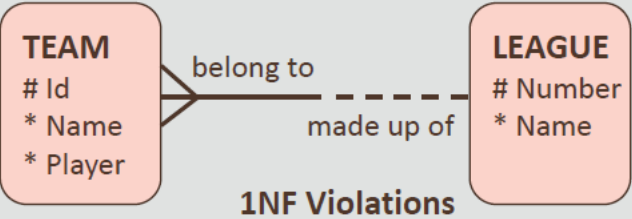
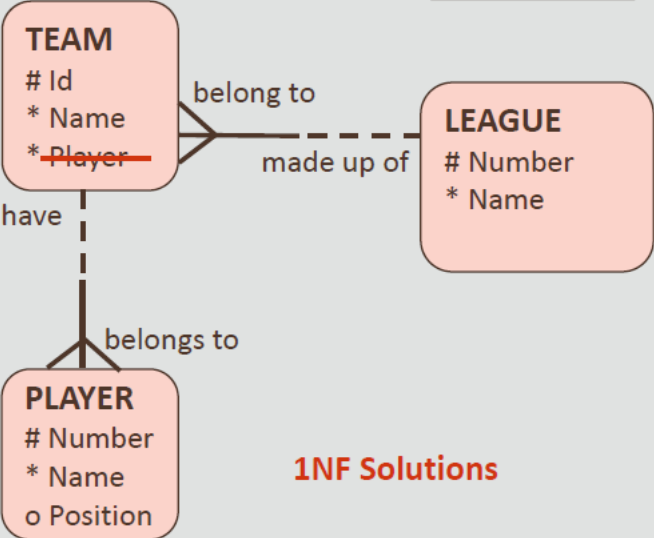
6-1 Artificial, Composite, and Secondary UUIDs

| | |
|----------------|---|
| UID | Unique identifier |
| Simple UID | A UID that is a single attribute |
| Composite UID | A UID that is a combination of attributes |
| Artificial UID | A UID that does not occur in the natural world but is created for identification purposes in a system |
| Candidate UID | One of several UUIDs that could identify something |
| Primary UID | A candidate UID that is the primary identifier of something |
| Secondary UID | A candidate UID that also identifies something, but is not the primary UID |

| | |
|---|--|
| <p>UIDs from Barred Relationships</p>  | <p>ACCOUNT</p> <p>Key Bank.Number Account.Number</p> |
| <p>UID from Barred Relationship Intersection Entity</p>  <p><u>Enrollment</u> key IdStudent IdSubject</p> | <p>Artificial UID Intersection Entity</p>  <p><u>CatalogItem</u> key Number</p> |

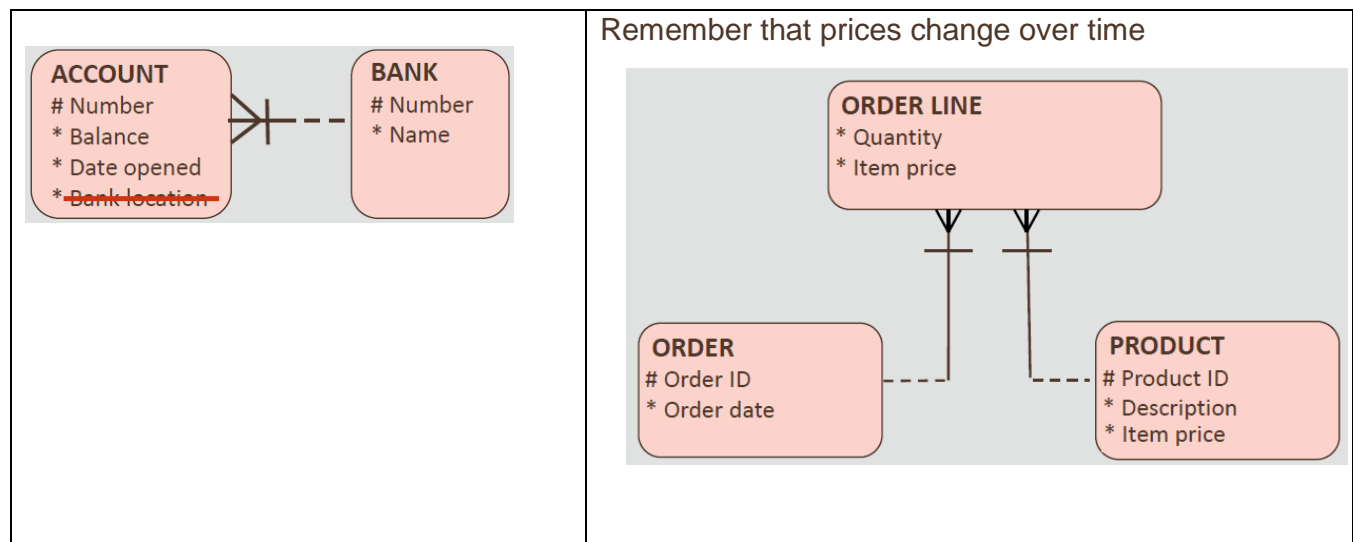
6-2 Normalization and First Normal Form

| | |
|-------------------------|--|
| Normalization | A series of steps followed to obtain a database design that allows for efficient access and storage of data in a relational database. These steps reduce data redundancy and the chances of data becoming inconsistent |
| First Normal Form (1NF) | <p>The outcome of the first step of database normalization. 1NF eliminates repeating groups by putting each into a separate table and connecting them with a 1:M relationship.</p> <p>First Normal Form requires that no multi-valued attributes exist.</p> <p>The attributes must be atomic, that is, it is forbidden to have attributes that can take more than one value.</p> |

| Wrong | Right |
|---|--|
|  |  |
|  |  |

6-3 Second Normal Form

| | |
|--------------------|---|
| Partial Dependency | Where an attribute of a table depends only on a part of the primary key and not on the entire key. |
| 2NF | <p>The outcome of the second step of database normalization</p> <ul style="list-style-type: none">• 2NF requires that any non-UID attribute be dependent on the entire UID.• Every attribute that is not part of the key has full dependency on the primary key.• All fields depend directly on the key.• Remove transitive dependencies |



6-4 Third Normal Form

| | |
|--------------------------|--|
| Transitive dependency | <ul style="list-style-type: none"> A condition that exists when any attribute in an entity is dependent upon any other non-UID attribute in that entity. A transitive dependency is one in which there are non-key columns that depend on other non-key columns. A transitive dependency exists when any attribute in an entity is dependent on any other non-UID attribute in that entity. |
| Third Normal Form or 3NF | <ul style="list-style-type: none"> All non-key fields are dependent on the key, the whole key, and nothing but the key. It states that all non-key columns are functionally completely dependent on the primary key and there are no transitive dependencies. |

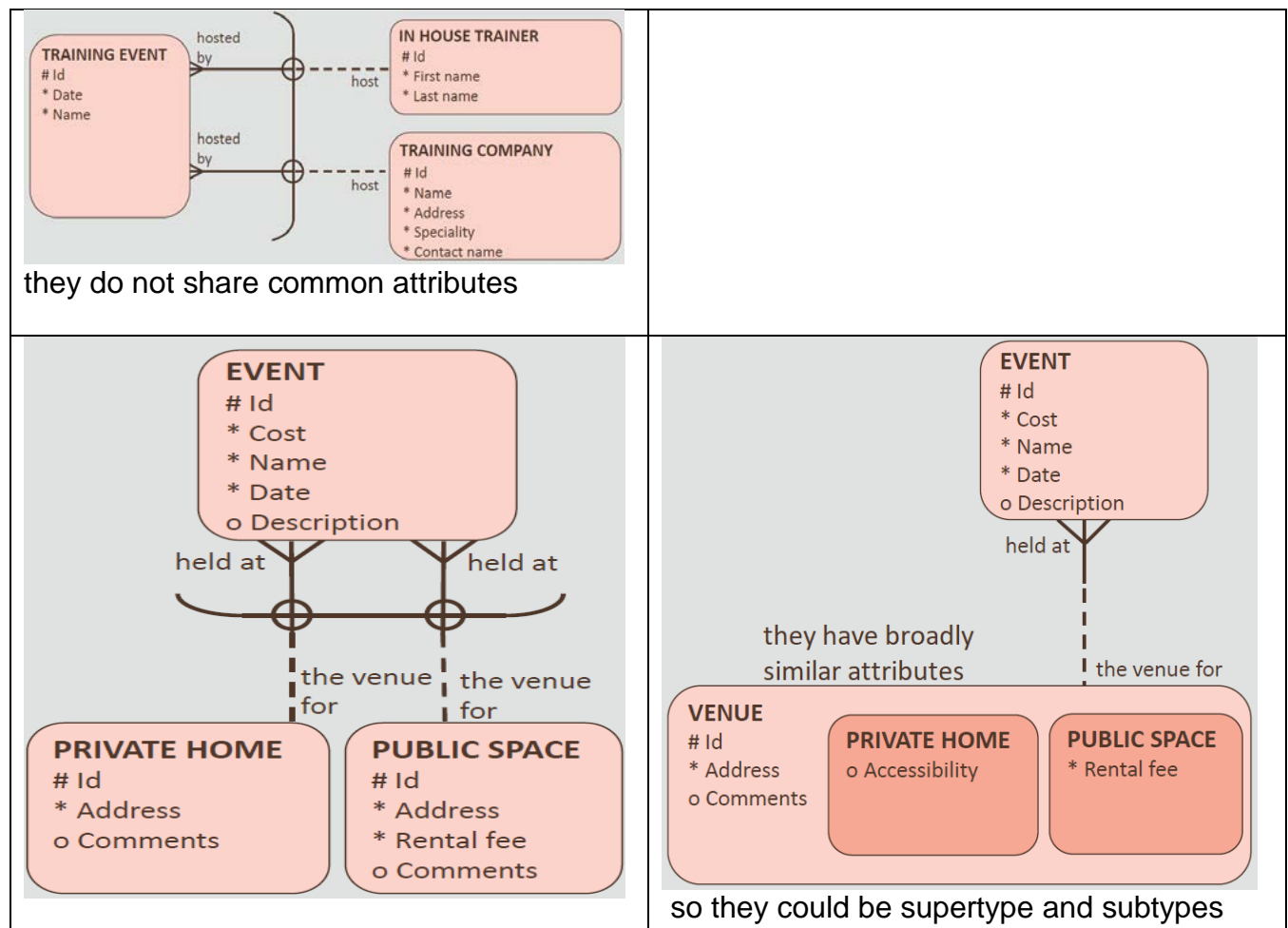
| Wrong | Right |
|--|---|
| <p>The diagram shows two entities: EMPLOYEE and DEPARTMENT. EMPLOYEE has attributes: # Id (primary key), * Name, * Address, * Birth place, o Partner name, and o Partner birth date. DEPARTMENT has attributes: # Number (primary key), * Name, and * Budget. A solid arrow points from EMPLOYEE to DEPARTMENT with the label "part of". A dashed arrow points from DEPARTMENT back to EMPLOYEE with the label "composed of". This represents a transitive dependency where non-key attributes of EMPLOYEE depend on non-key attributes of DEPARTMENT.</p> | <p>The diagram shows three entities: EMPLOYEE, DEPARTMENT, and PARTNER. EMPLOYEE has attributes: # Id (primary key), * Name, * Address, * Birth place, o Partner name, and o Partner birth date. DEPARTMENT has attributes: # Number (primary key), * Name, and * Budget. PARTNER has attributes: # Number (primary key), * Name, and * Birth date. A solid arrow points from EMPLOYEE to DEPARTMENT with the label "part of". A dashed arrow points from DEPARTMENT back to EMPLOYEE with the label "composed of". A dashed arrow points from PARTNER to EMPLOYEE with the label "have". A dashed arrow points from PARTNER to DEPARTMENT with the label "the dependent of". This structure correctly represents the dependencies without transitive dependencies.</p> |

Section 7 – Arcs, Hierarchies, and Recursive Modeling

7-1 Arcs

| | |
|---|---|
| Arc | A curved line used to represent an exclusive relationship in an entity-relationship diagram |
| Exclusive OR | A logical operator that returns a true value if one, but not both, of its operands is true |
| Mutually Exclusive relationship / Exclusive Or relationship | A relationship between one entity and two (or more) other entities when only one of the relationships can exist at a time |
| Constraint | A restriction that applies to data, which is often dictated by the business rules |

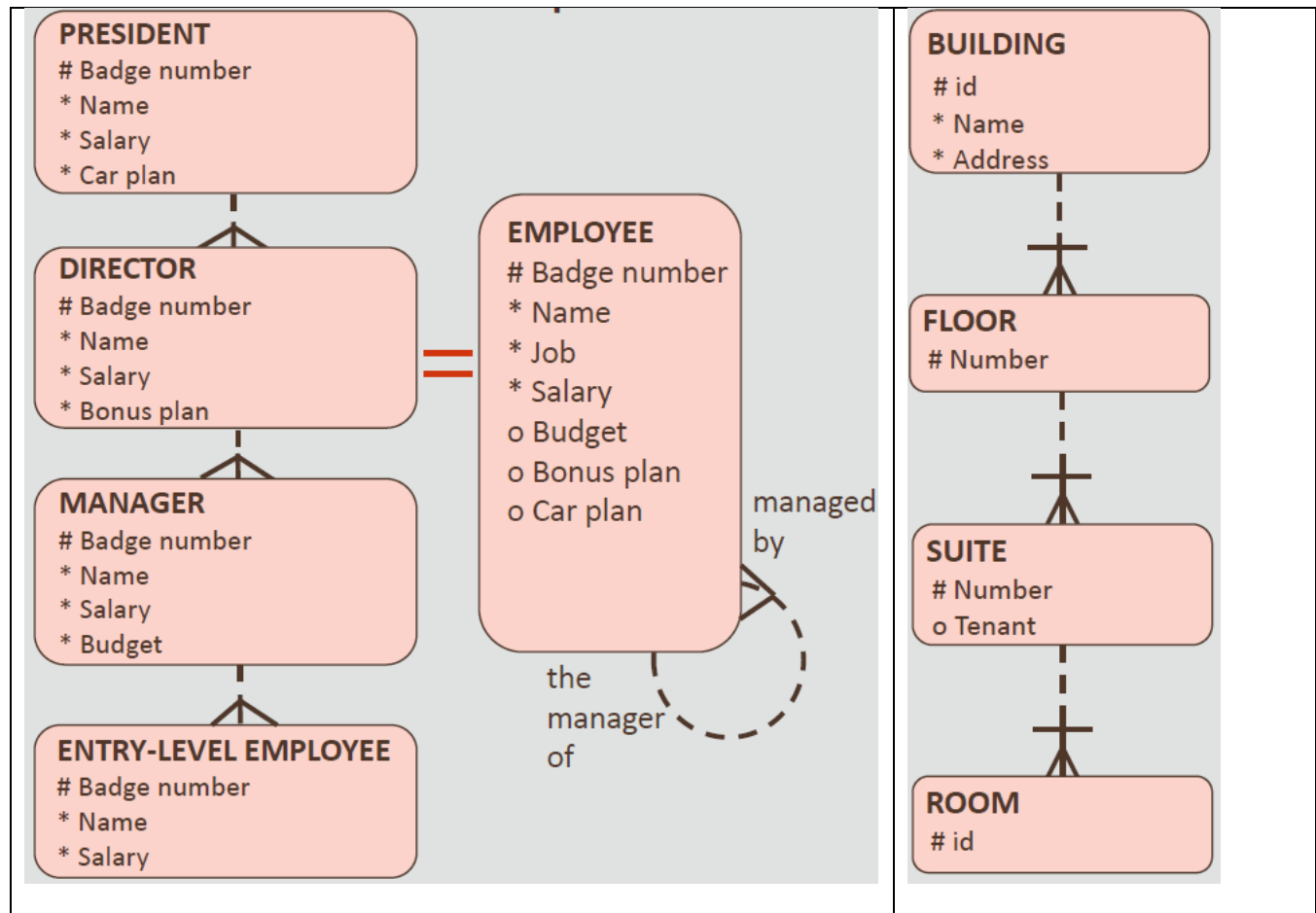
Arcs and Super/subtypes both model mutual exclusiveness



7-2 Hierarchies and Recursive Relationships

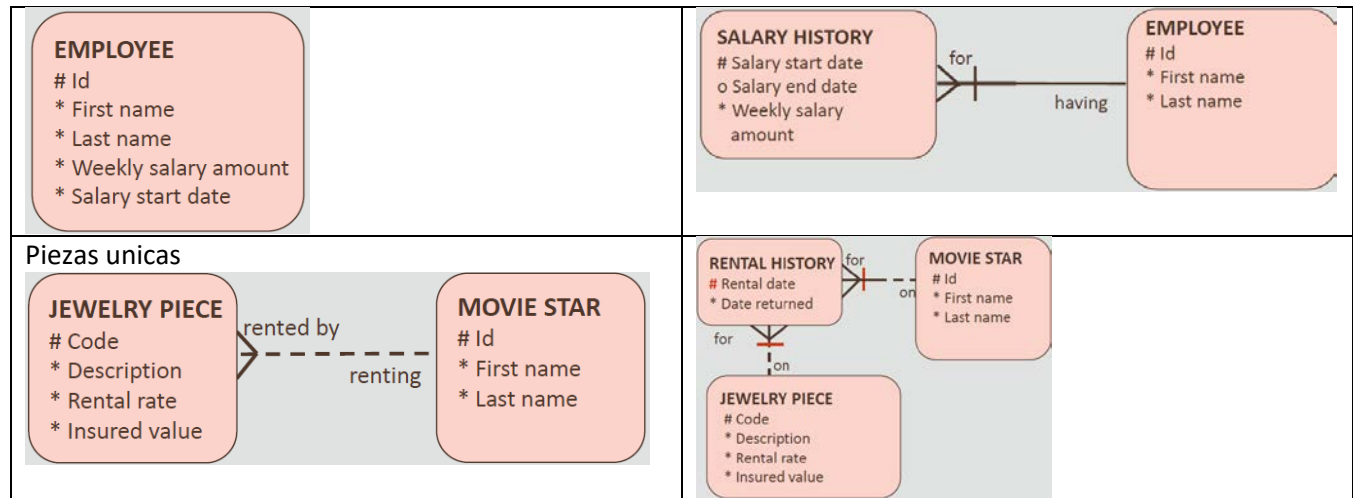
| | |
|---------------------------|--|
| Recursive relationship | A relationship between an entity and itself |
| Hierarchical relationship | A series of relationships that reflect entities organized into successive levels |

Hierarchy Versus Recursive Relationship



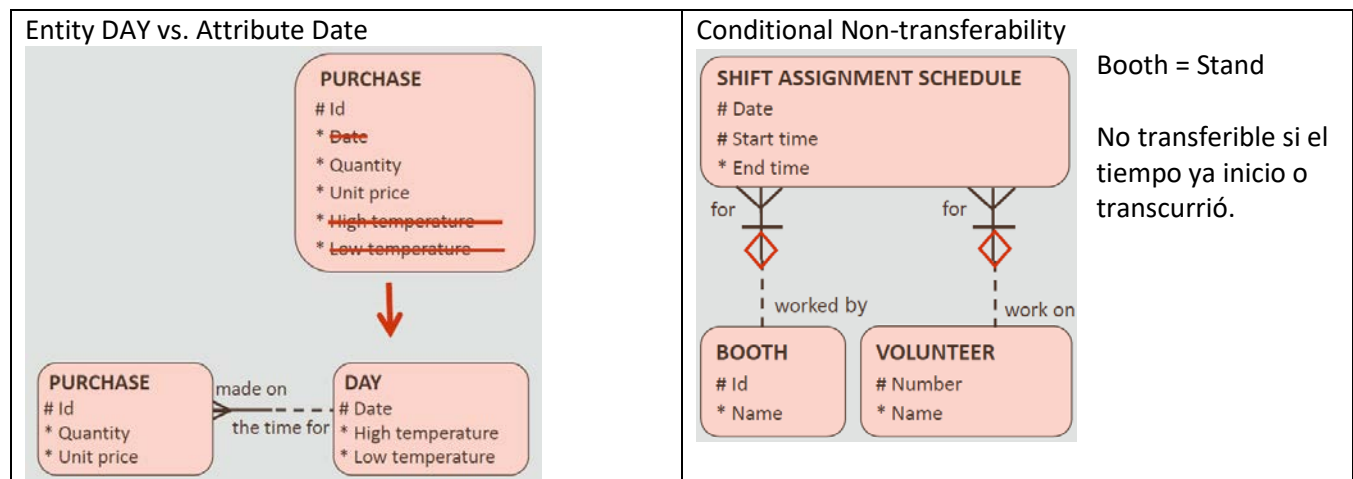
Section 8 – Changes and Historical Modeling

8-1 Modeling Historical Data



8-2 Modeling Change: Time

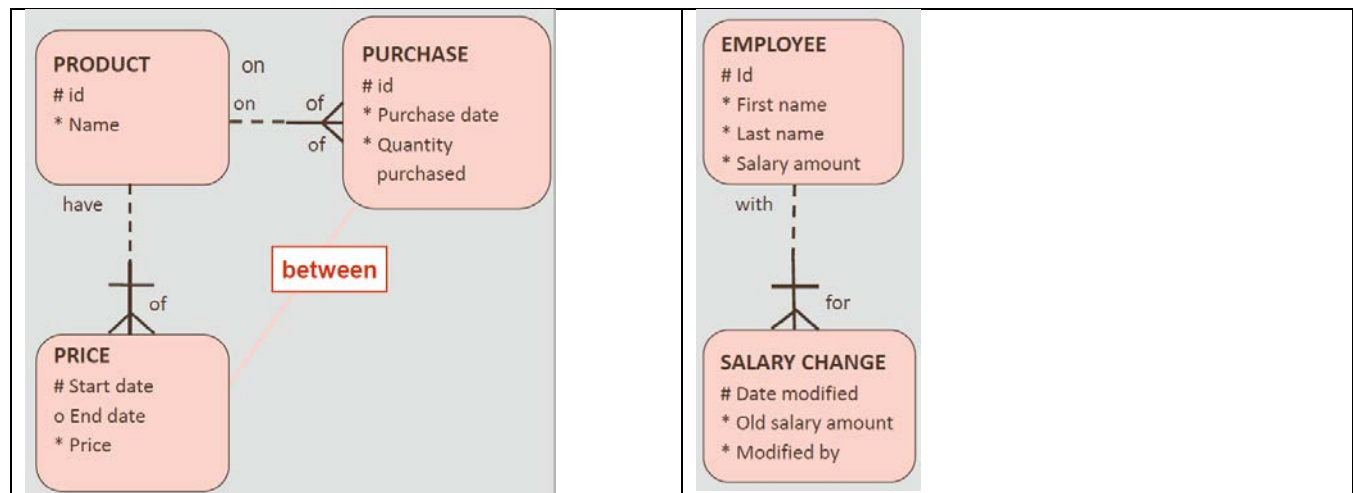
| | |
|---|--|
| Time-related constraint | A constraint or data restriction that results from the time dimension. |
| Conditional nontransferability | Refers to a relationship that may or may not be transferable, depending on time. (Si ya pasó o estar por pasar) |
| Nontransferability (Intransferibilidad) | Property of a relationship where an instance of A is related to an instance of B, and the association cannot be moved to another instance of B |



8-3 Modeling Change: Price

| | |
|--|---|
| Journaling and/or logging (Diario y/o registro) | Keeping an on-going record of transactions On-going = continuo |
| Appreciation (Valorizacion) | A rise in value or price, especially over time |
| Depreciation (Amortizacion) | A decrease or loss in value, because of age, wear, or market conditions |

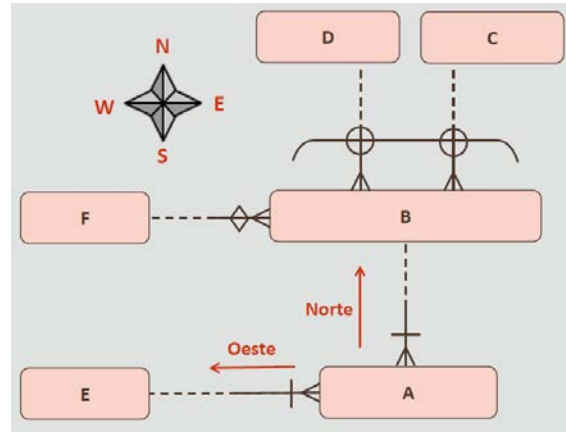
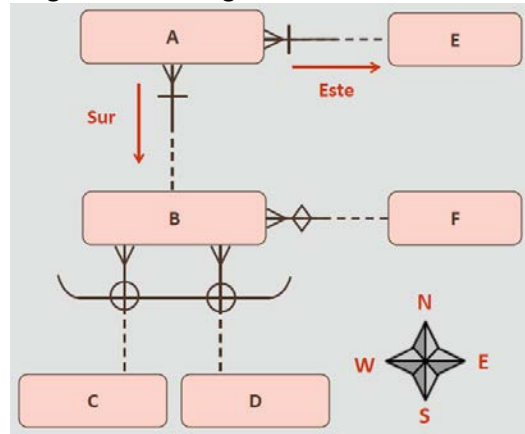
Refund = reembolso o devolución



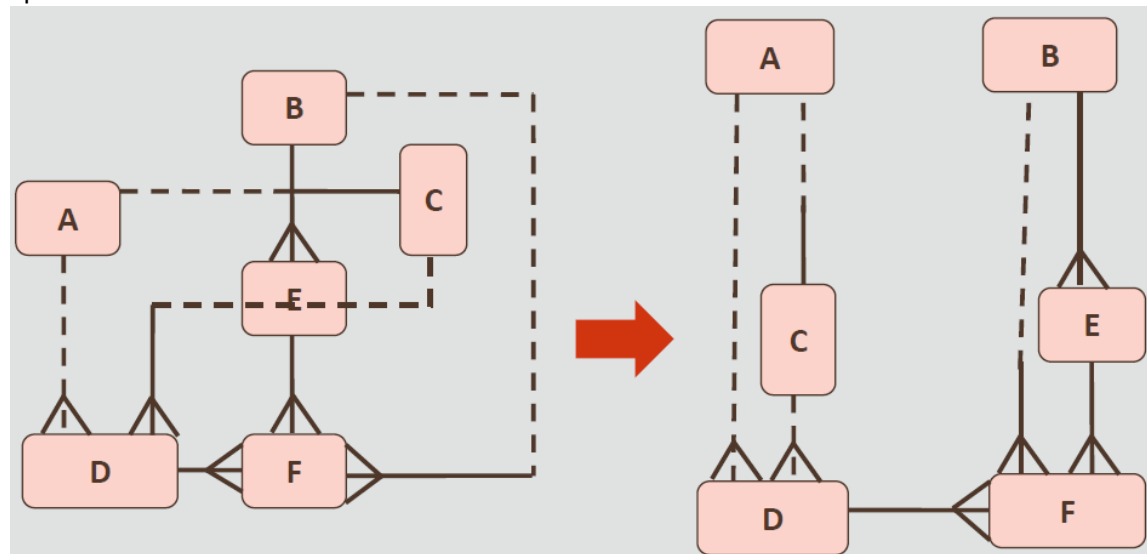
8-4 Drawing Conventions for Readability

| | |
|--------------------|---|
| White space | Space on a page or poster not covered by print or graphic matter. |
| High-volume entity | An entity that will have a large number of instances. |

Large ERD Drawing Conventions



Space is Needed



Section 9 – Mapping

9-1 Introduction to Relational Database Concepts

| | |
|---------------------|--|
| Primary key | A constraint which ensures that the column contains no null values and uniquely identifies each row of the table |
| Foreign key | A column or set of columns that refers to a primary key in the same table or another table |
| Row | An entry in a table, consisting of values for each appropriate column |
| Column | An implementation of an attribute or relationship in a table |
| Unique key | An integrity constraint that requires every value in a column or set of columns be unique. |
| Relational database | Collections of objects or relations set of operators to act on those relations, and data integrity for accuracy and consistency. |
| Candidate key | More than one column or combination of columns that could serve as the table's primary key |

| Constraint Type | Explanation | Example |
|--|---|--|
| Data-integrity rule (Constraints) | Define the relationally correct state for a database; they ensure that users can perform only those operations that leave the database in a correct, consistent state | |
| Entity Integrity | A primary key must be unique, and no part of the primary key can be null | The column emp_no in the EMPLOYEES table cannot be null |
| Referential Integrity | A foreign key must match an existing primary key value (or else be null if nulls are allowed) | The value in the dept_no column of the EMPLOYEES table must match a value in the dept_no column in the DEPARTMENTS table |
| Column Integrity | A column must contain only values consistent with the defined data format of the column | The value in the balance column of the ACCOUNTS table must be numeric |
| User-Defined Integrity | The data stored in a database must comply with the rules of the business | If the value in the balance column of the ACCOUNTS table is below 1.00, we must send a letter to the account owner (this will need additional programming to enforce) |

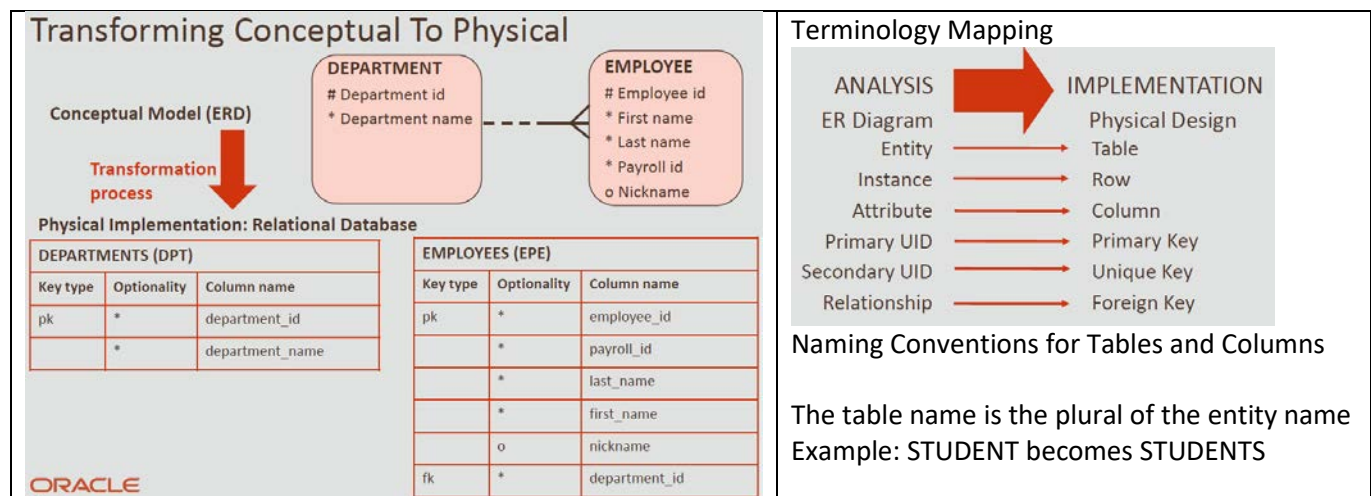
Structured query language (SQL) allows us to access data in relational databases in an efficient way

9-2 Basic Mapping: The Transformation Process

| | |
|-----------|--|
| Transform | To change the elements of an ERD into database elements |
| Map | To associate the elements of an ERD with database elements |

The conceptual model (ER diagram) is transformed into a physical model

The physical implementation will be a relational database

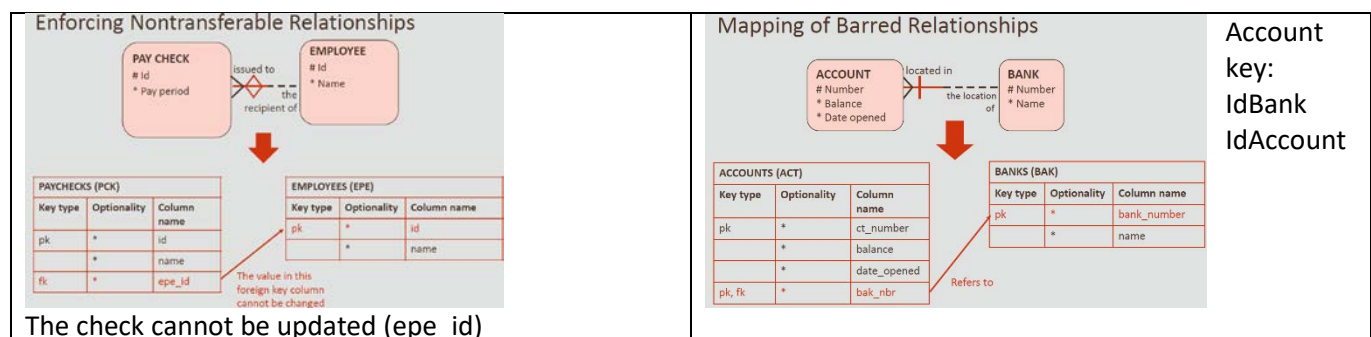


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9-3 Relationship Mapping

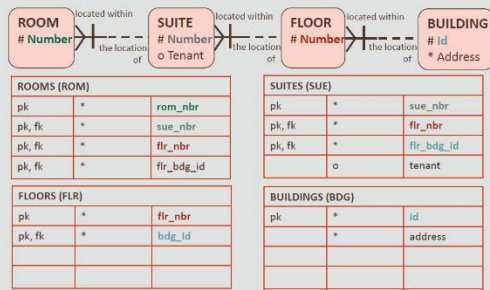
| | |
|---|---|
| Nontransferable relationship | A relationship in a database where the foreign key column in the database table cannot be updated |
| Cascade barred relationship (Relaciones Excluidas en Cascada) | A series of relationships implying that the unique identifier of each entity in the chain is carried down (descended) to the entity on the next level |
| Intersection entity (n:m) | The product of the resolution of a many to many relationship. |

Apply: 1:1, 1:n, n:m, arc



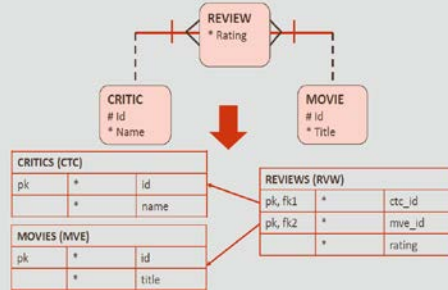
The check cannot be updated (epe_id)

Cascade Barred Relationships

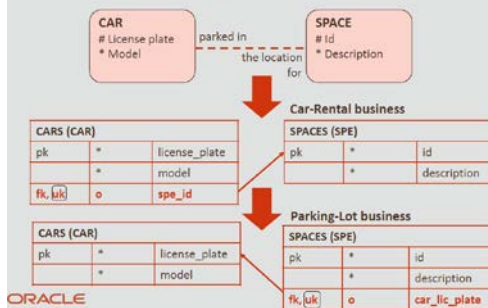


ROOM:
IdBdg
IdFlr
IdSue
IdRom

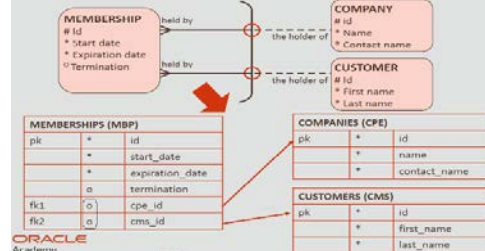
Mapping Many-to-Many Relationships



Business Rules for Optional One-to-One



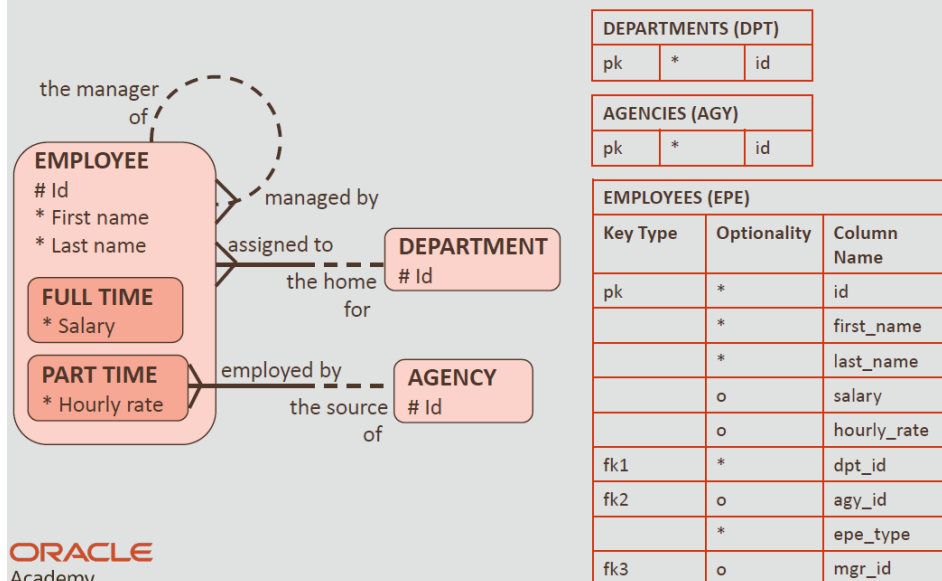
Mapping Arcs



programming or Create Table
CHECK (pse_idis not null AND phe_idis null)
OR (pse_idis null AND phe_idis not null)

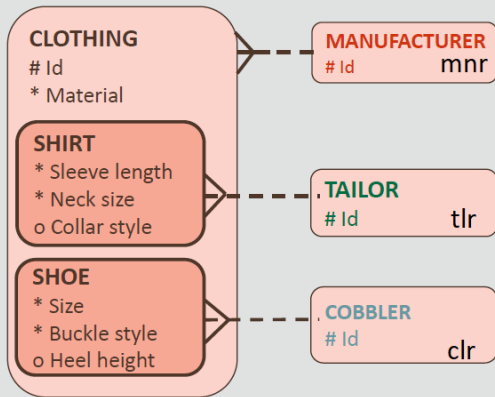
9-4 Subtype Mapping

Supertype Implementation: Single Table



CHECK (epe_type = 'FTE' and salary is not null and hourly_rate is null and agy_id is null)
OR (epe_type = 'PTE' and salary is null and hourly_rate is not null and agy_id is not null)

Subtype Implementation: Two Table

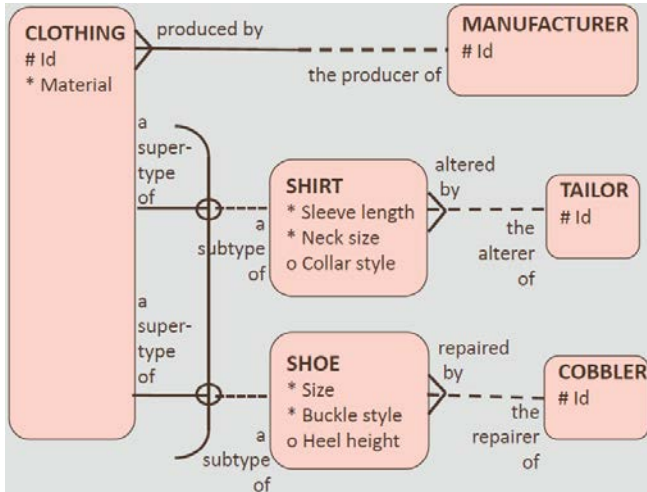


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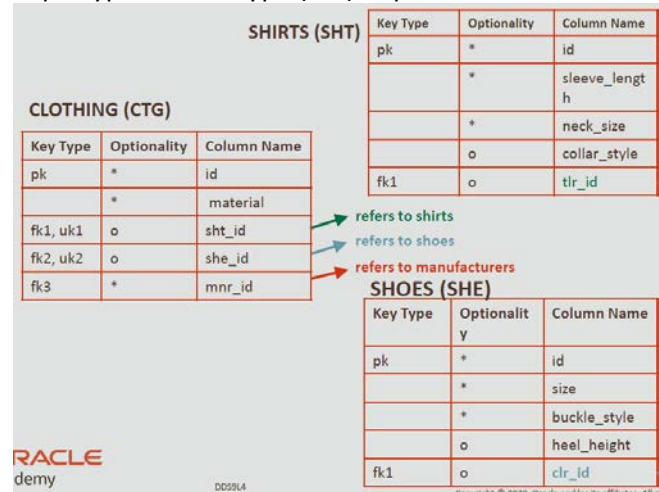
| SHIRTS (SHT) | | |
|--------------|---|---------------|
| pk | * | id |
| | * | material |
| | * | sleeve_length |
| | * | neck_size |
| | o | collar_style |
| fk1 | o | tlr_id |
| fk2 | * | mnr_id |

| SHOES (SHE) | | |
|-------------|---|--------------|
| pk | * | id |
| | * | material |
| | * | size |
| | * | buckle_style |
| | o | heel_height |
| fk1 | o | clr_id |
| fk2 | * | mnr_id |

Model an Arc Illustrated



Supertype and Subtype (Arc) Implementation



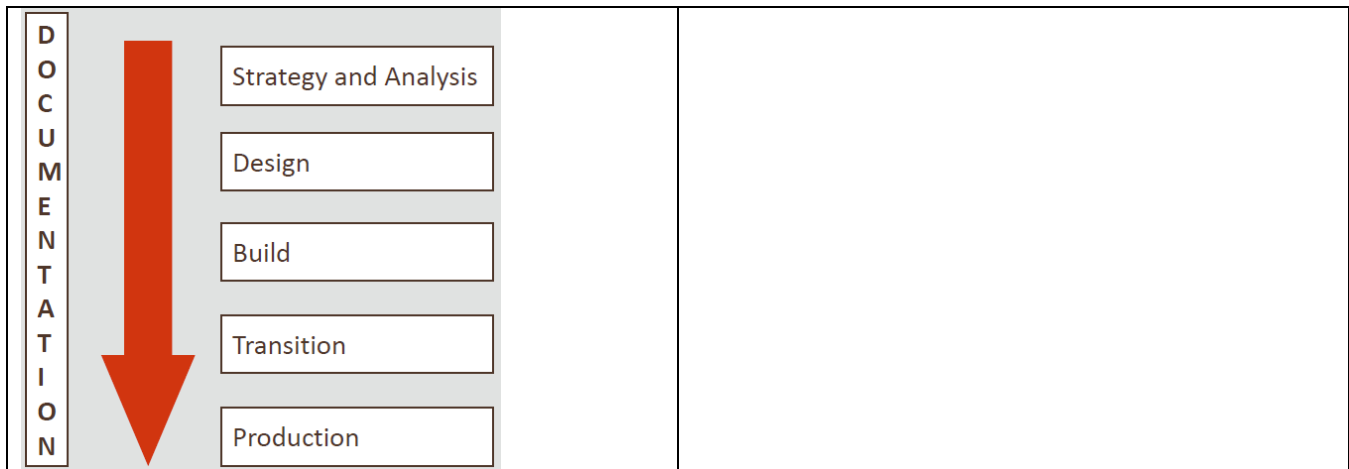
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Section 10 – Creating Database Projects

10-1 System Development Life Cycle

| | |
|-------------------------------|--|
| Populate | To enter data into a table |
| System development life cycle | The process of developing information systems through a multi-step process |
| User-acceptance testing | The type of testing where monitored users determine whether a system meets all their requirements, and will support the business for which it was designed |
| Parallel operations | The simultaneous execution of two different operations |
| SDLC | System Development Life Cycle |



10-2 Project Overview and Getting Started

10-3 Presentation Project Management

10-4 Final Presentation Components