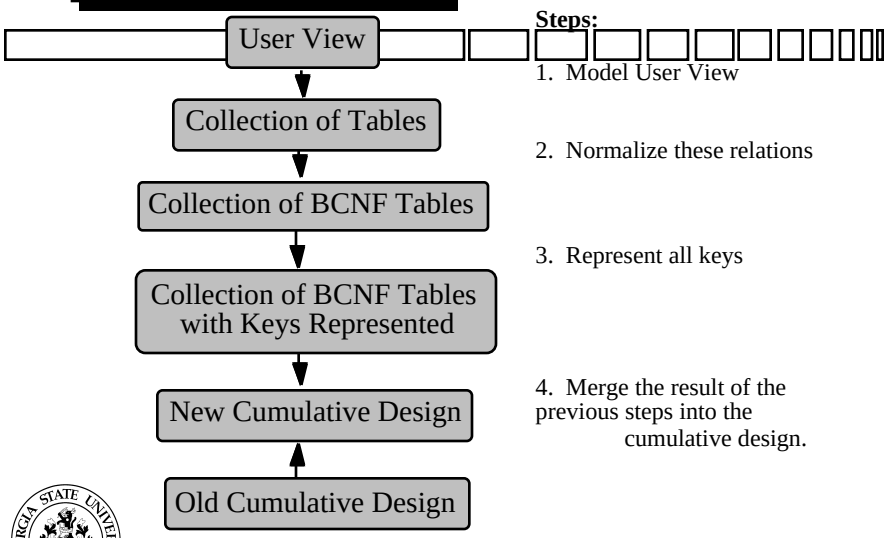
Entity-Relationship Diagrams

Entity-Relationship Diagrams

Contents:

Note: The Entity-Relationship Diagrams presented in this class are based on James Martin's Information Enginnering approach.

Design Approach



Steps:

1. Model User View
2. Normalize these relations
3. Represent all keys
4. Merge the result of the previous steps into the cumulative design.

Model User View

Advantages of Data Modeling:

+ Data Analysis vs. Process Analysis
+ Graphical Models vs. Prose
+ "Data is more stable than processes."

User Views

A *user view* is the view of the data that is necessary to support the operations of a particular user.

Example: Wells Junior College

User View #1 -- Registration

User View #2 -- Class Enrollment

User View #2 -- Grade Reporting

Entities/ Entity Set

An *entity* is a person, place, object, event, or concept about which the organization wishes to record data.

Rules: An *entity* . . .

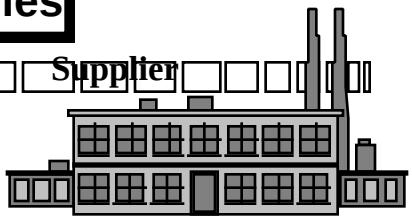
1. Must be within the scope of the system
2. Must have at least one non-key attribute

An *entity type* is a collection of entities with a similar data structure.

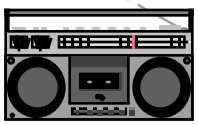
Entity Type -- Examples

Supplier

Customer



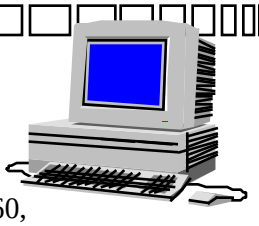
Product



Entity Instance (Entity)

Sally Smith

Allen
Baker



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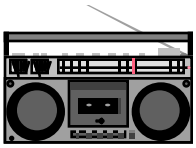

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Attributes

An *attribute* is a property of an entity that we choose to record.

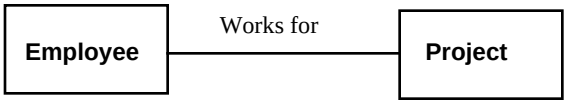
Attributes of **Customer** entity:

Social security number
Name
Address
Date of birth

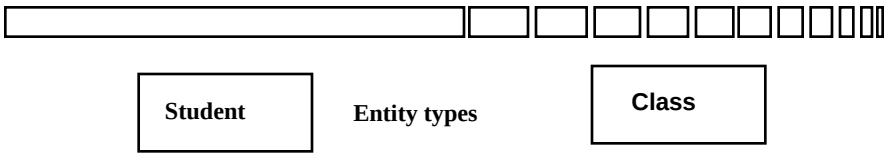
Entity-Relationship Diagrams

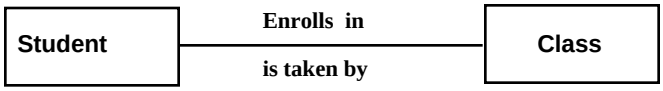
An *Entity-Relationship Diagram (ERD)* is a graphical portrayal of entities and their relationships.

***Entity types* are shown in rectangles and *relationship types* are shown as the lines that connect related entity types.**



Entity-Relationship Diagrams (ERDs)



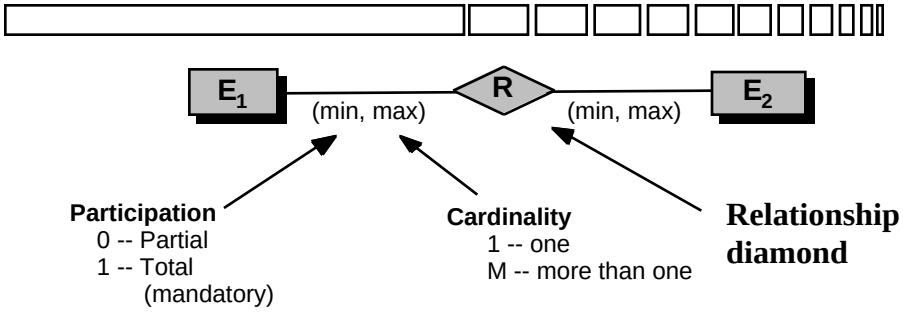


Relationships are named; sometimes in both directions.

Relationship: Cardinalities and Participation

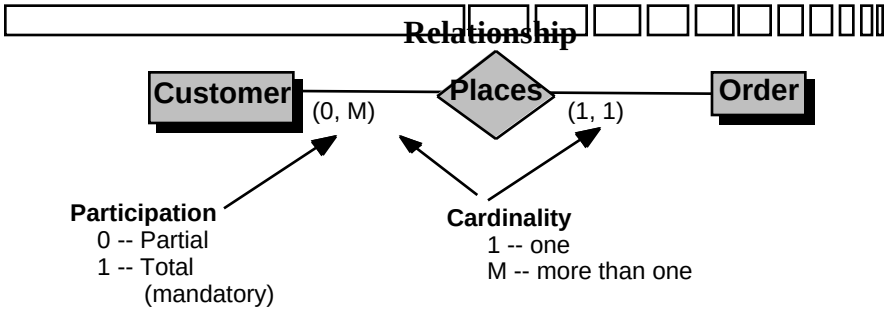
- Many represenation forms: Chen (min/max), Booch, Codd/Yordon, Crows feet...
- Default and prefered method in SA is Crows feet
- Difference between Min/Max and Crows feet:
  - how cardinality and participation is expressed.
  - the existence of the Assocation Diamond

Chen's (Min/Max)Notation:Cardinalities and Participation



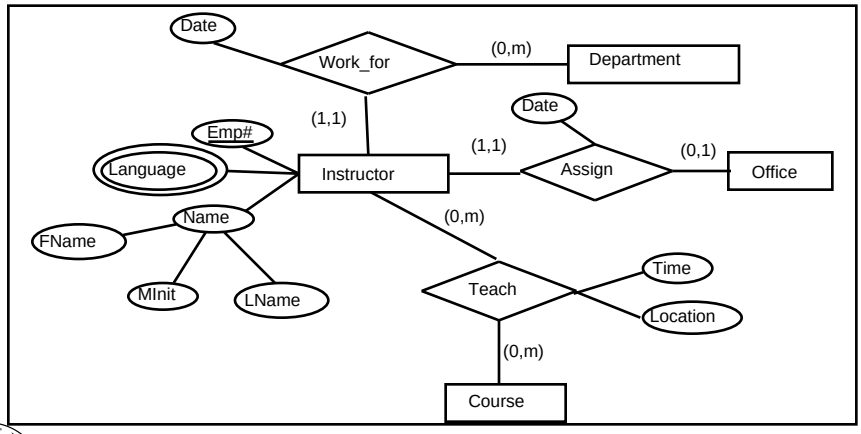
- Read in terms of the entity instance you are leaving. i.e. E1

Chen's (Min/Max)Notation: anexample



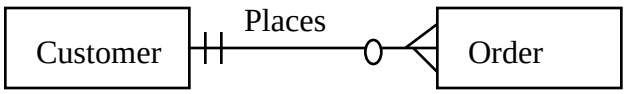
- Read: A Customer may participate in from zero to many relationships

Chen's (Min/Max)Notation: anexample



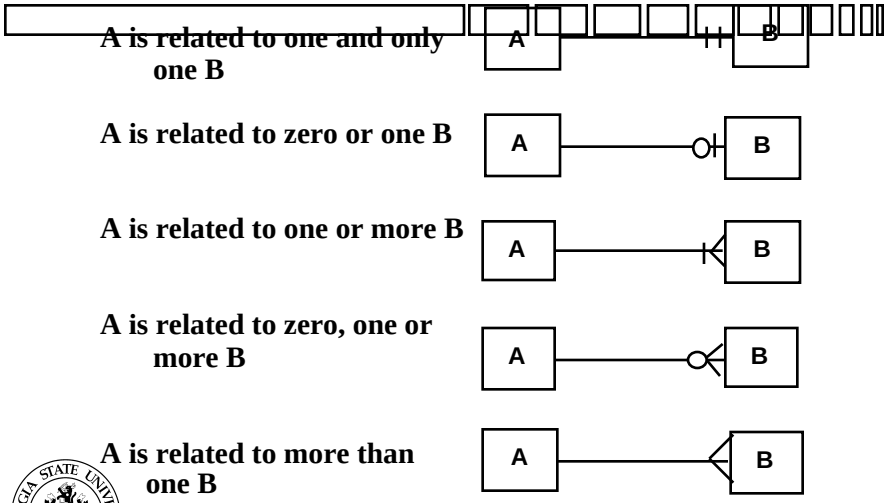
Crows Foot Notation

- Read in terms of the relationship with which an entity instance is participating
- Participation and Cardinality are shown by the crows feet.

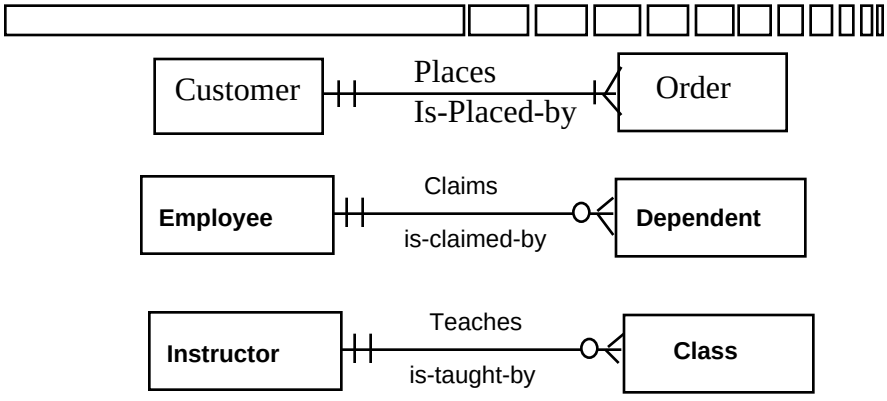


- Read: A customer places (or may place) zero to many orders; An order is placed by one and only one Customer

Relationship Cardinalities



Cardinality Examples



Finding Entities and Relationships

1. Identify the system information
   a. User interviews
   b. Paper and screen documents
   c. Previous system documentation

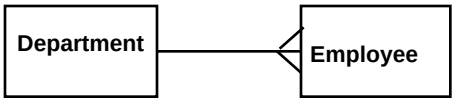
2. Identify entities
   a. Heuristics
   b. Analysis of English grammar --> Entity-Relationship Diagrams
   c. Normalization process

Entity Identification: English Grammar - Rule #1

English	***ERD***
Proper Noun	**Entity ("Name" of an Entity)**
Common Noun	**Entity or Entity-Type**
Transitive Verb	**M-ary Relation (M>1)**
Intransitive Verb	**Unary Relationship or Attribute Value**
Adjective	**Attribute of an Entity**
Adverb	**Attribute of a Relationship**

Entity Identification: English Grammar - Rule #1

Convert any sentence in the following form:
"There are . . . X in Y"
into
"Y has . . . X"



Example:

X Y
"There are more than 200 employees in every department"

Y X
"Every department has more than 200 employees"

English Grammar - 3

If the English sentence says, "The X of Y is Z"

Rule #3: Y is an *Entity*

Rule #4: X is either an *Attribute* or an *Entity*, depending on what type of "Z" it is.

Rule #5a: If "Z" is a proper noun, then X is a *Relationship* between Y and Z

Rule #5b: Otherwise, X is an *Attribute* of Y

Grammar - 3 (Examples)

The birthdate of the student is 10/22/71.

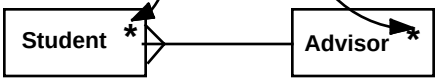
(x) ***(y)*** ***(z)***

Attribute ***Entity*** **not a proper noun**

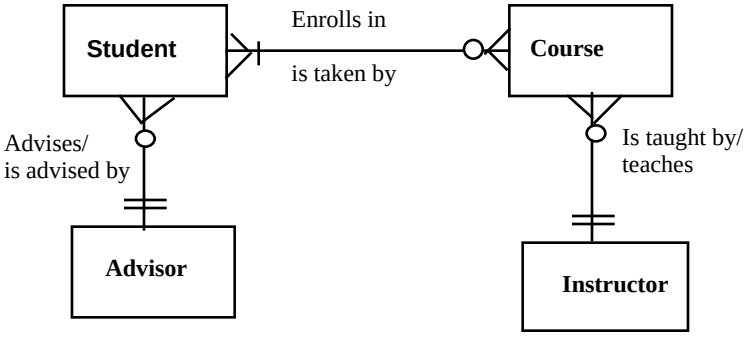
The advisor of John Smith is Dr. Greene.

(x) ***(y)*** ***(z)***

Relationship ***Proper noun***

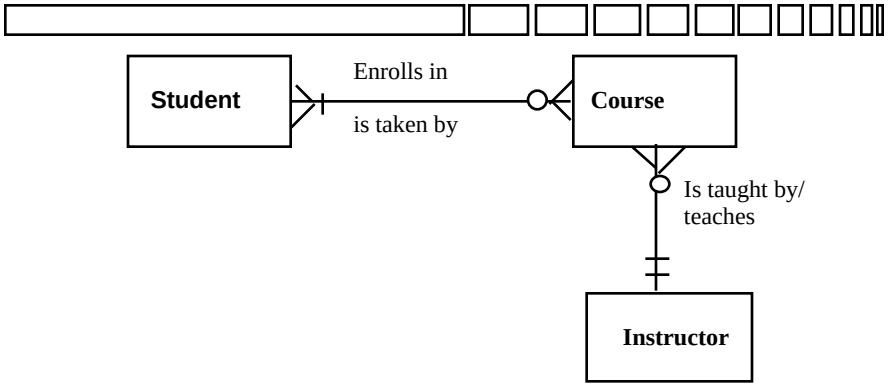


ERD for Student Registration



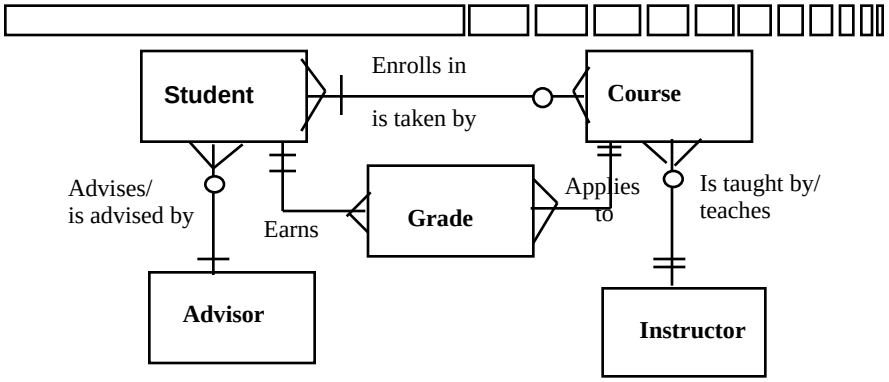
**** Note: Attributes should be specified for each entity-type***

ERD for Course Enrollment



** Note: Attributes should be specified for each entity-type*

ERD for Grade Report



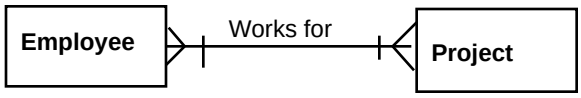
** Note: Attributes should be specified for each entity-type*

Relationship Attributes

If a *Relationship* has *Attributes,*

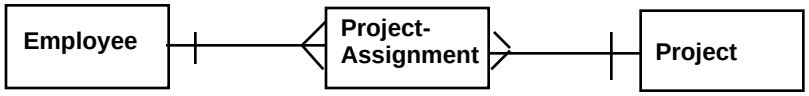
For example:

- **An Employee is assigned to a project for a certain % of time.**
- **An Employee has a particular role for each project he/she works on (e.g., programmer, analyst, project manager, etc.)**

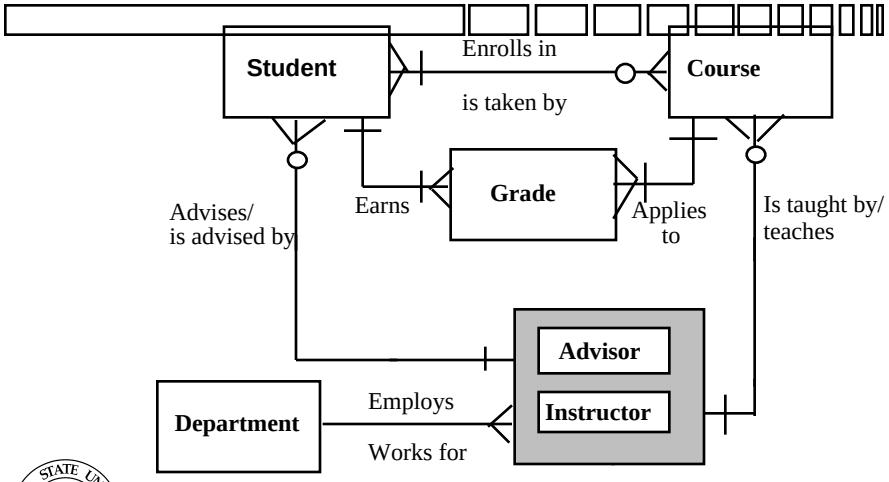


Relationship-Entity

Then the *Relationship* becomes a *Relationship-Entity*:



Extended Model



**** Note: Attributes should be specified for each entity-type***

Review

Definitions:

- User View
- Entity, Entity-Type
- Relationship
- Cardinality

Using English Grammar to identify
- Entities and Relationships

Entity-Relationship Diagrams