Griffith UNIVERSITY

1814ict/2814ict/7003ict/1011ICT:
Data Management/
Database Design/
Applied Computing

# Topic 2.3: Entity-relationship model (advanced concepts)

(Chapter 4)

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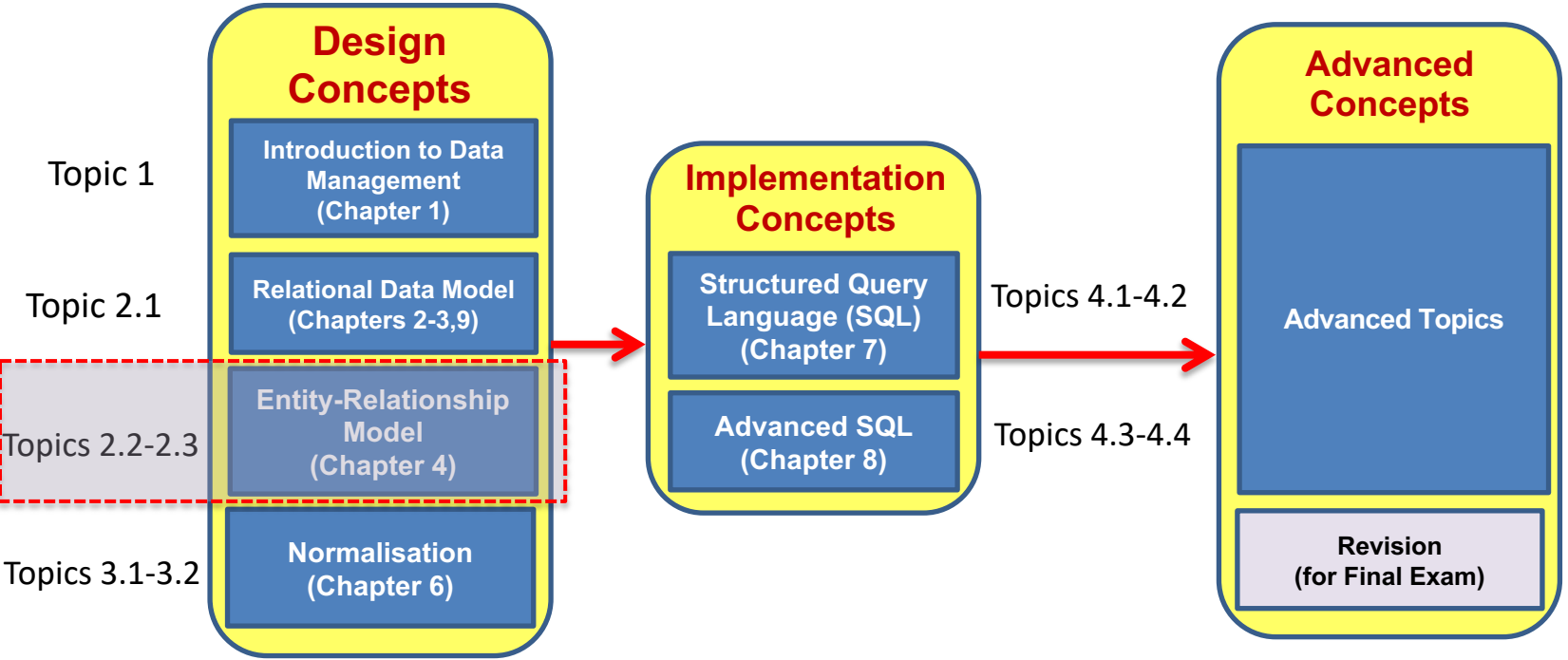
School of Information and Communication Technology

**Course developed by**: Dr Mohammad Awrangjeb; AProf John Wang; Dr Zhe Wang

# Course bigger picture

- Chapter references are to textbook *Database Systems: Design, Implementation, & Management - By Carlos Coronel and Steven Morris*



# Learning Outcomes

At the end of this lecture students will be able to know:

- Types of entities, attributes and relationships
- Converting ERD to Relation schema

# Content

- Types of entities incl. supertype & subtype
- Types of attributes
- Relationship degrees
- Unary relationships

**Outcome 1**

- Convert ERD into a relation (schema)

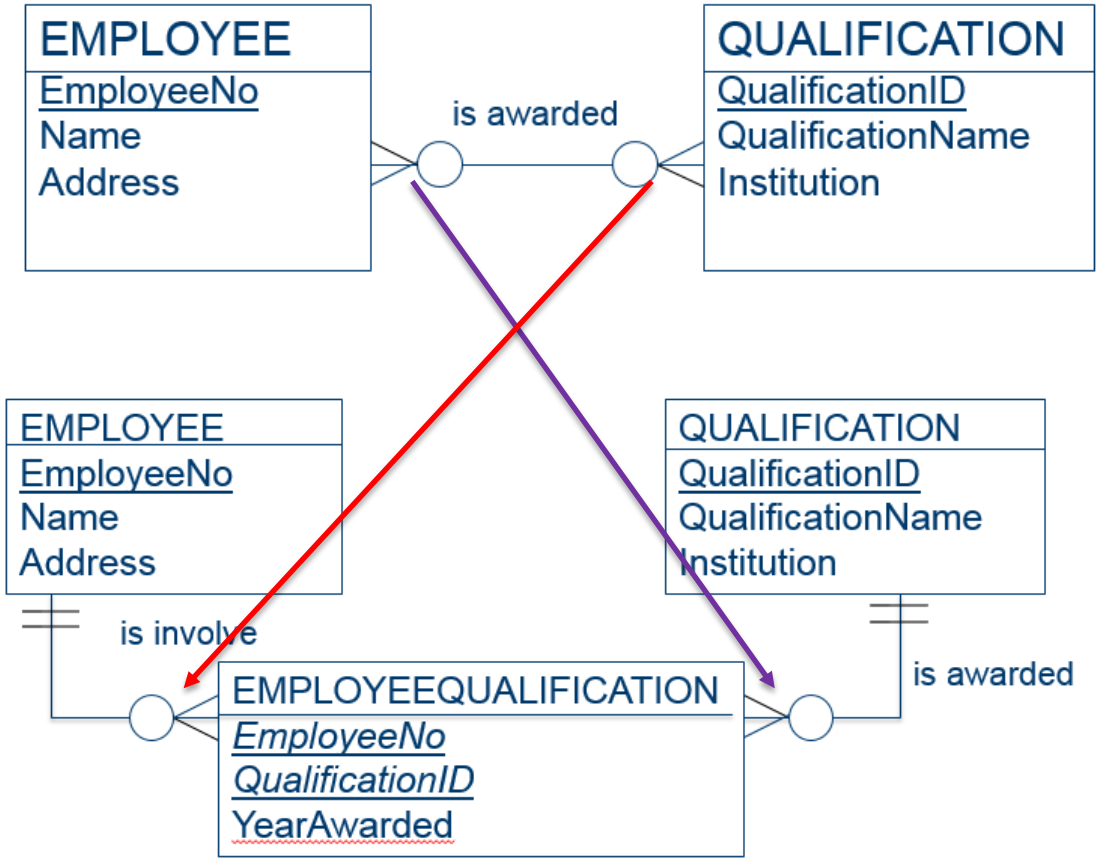
**Outcome 2**

# Recap from Topic 2.2

## Example 2:

### Steps:

1. Insert a Bridging Entity
2. Insert PKs from parent entities into new entity
3. Add in any attributes required
4. Connectivity – Crow's foot points to the new entity
5. Two FKs in new entity can be a composite primary key, or enter a new attribute to the primary key



# Types of Entities

# Strong / regular entity

- **Existence Independent:** A property of an entity that can exist apart from one or more related entities. Such a table must be created first when referencing an existence-dependent table. E.g., Parent entity in a 1:M relationship
- **Strong/regular entity:** An entity that is existence-independent
- **Existence Dependent:** E.g., Child entity in a 1:M relationship and it has strong relationship with the parent entity. Child cannot exist without the parent.
- **Strong (Identifying) Relationships:** A strong (identifying) relationship exists when the primary key of the related entity contains a primary key component of the parent entity.
- **Weak (Non-Identifying) Relationships:** A weak relationship, also known as a non-identifying relationship, exists if the primary key of the related entity does not contain a primary key component of the parent entity.

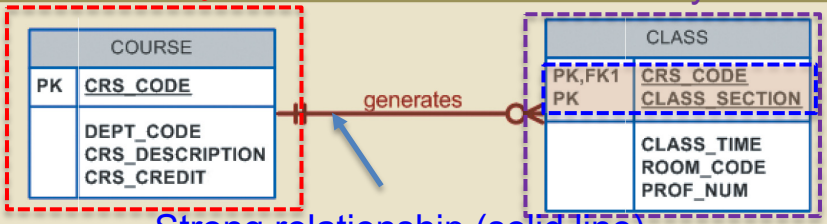
- Think relationship between Parent and Child
- Can a parent exist without a child, and vice versa?
- What if a child's face is almost the same as its parent?

# Strong / regular entity

## FIGURE 4.9 A STRONG (IDENTIFYING) RELATIONSHIP BETWEEN COURSE AND CLASS

Parent entity

Child entity




Strong relationship (solid line)

**Table name: COURSE** **Database name: Ch04_TinyCollege_Alt**

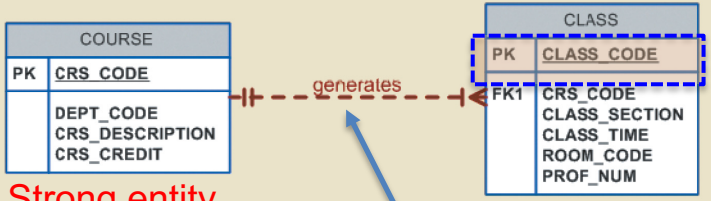
| CRS_CODE | DEPT_CODE | CRS_DESCRIPTION | CRS_CREDIT |
|---|---|---|---|
| ACCT-211 | ACCT | Accounting I | 3 |
| ACCT-212 | ACCT | Accounting II | 3 |
| CIS-220 | CIS | Intro. to Microcomputing | 3 |
| CIS-420 | CIS | Database Design and Implementation | 4 |
| MATH-243 | MATH | Mathematics for Managers | 3 |
| QM-261 | CIS | Intro. to Statistics | 3 |
| QM-362 | CIS | Statistical Applications | 4 |

CRS_Code is a part of the primary key in Class table

**Table name: CLASS**

| CRS_CODE | CLASS_SECTION | CLASS_TIME | ROOM_CODE | PROF_NUM |
|---|---|---|---|---|
| ACCT-211 | 1 | MWF 8:00-8:50 a.m. | BUS311 | 105 |
| ACCT-211 | 2 | MWF 9:00-9:50 a.m. | BUS200 | 105 |
| ACCT-211 | 3 | TTh 2:30-3:45 p.m. | BUS252 | 342 |
| ACCT-212 | 1 | MWF 10:00-10:50 a.m. | BUS311 | 301 |
| ACCT-212 | 2 | Th 6:00-8:40 p.m. | BUS252 | 301 |
| CIS-220 | 1 | MWF 9:00-9:50 a.m. | KLR209 | 228 |
| CIS-220 | 2 | MWF 9:00-9:50 a.m. | KLR211 | 114 |
| CIS-220 | 3 | MWF 10:00-10:50 a.m. | KLR209 | 228 |
| CIS-420 | 1 | W 6:00-8:40 p.m. | KLR209 | 162 |
| MATH-243 | 1 | Th 6:00-8:40 p.m. | DRE155 | 325 |
| QM-261 | 1 | MWF 8:00-8:50 a.m. | KLR200 | 114 |
| QM-261 | 2 | TTh 1:00-2:15 p.m. | KLR200 | 114 |
| QM-362 | 1 | MWF 11:00-11:50 a.m. | KLR200 | 162 |
| QM-362 | 2 | TTh 2:30-3:45 p.m. | KLR200 | 162 |

## FIGURE 4.8 A WEAK (NON-IDENTIFYING) RELATIONSHIP BETWEEN COURSE AND CLASS




Strong entity

Weak relationship (dotted line)

**Table name: COURSE** **Database name: Ch04_TinyCollege**

| CRS_CODE | DEPT_CODE | CRS_DESCRIPTION | CRS_CREDIT |
|---|---|---|---|
| ACCT-211 | ACCT | Accounting I | 3 |
| ACCT-212 | ACCT | Accounting II | 3 |
| CIS-220 | CIS | Intro. to Microcomputing | 3 |
| CIS-420 | CIS | Database Design and Implementation | 4 |
| MATH-243 | MATH | Mathematics for Managers | 3 |
| QM-261 | CIS | Intro. to Statistics | 3 |
| QM-362 | CIS | Statistical Applications | 4 |

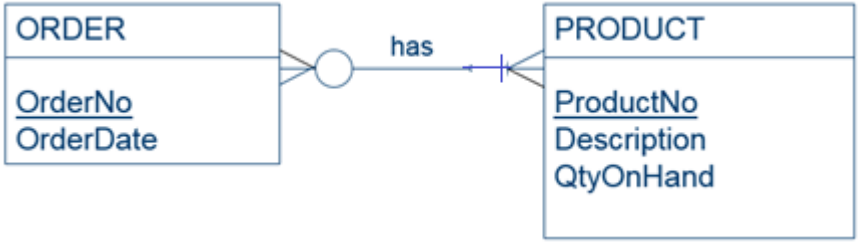
CRS_Code is NOT a part of the primary key in Class table

**Table name: CLASS**

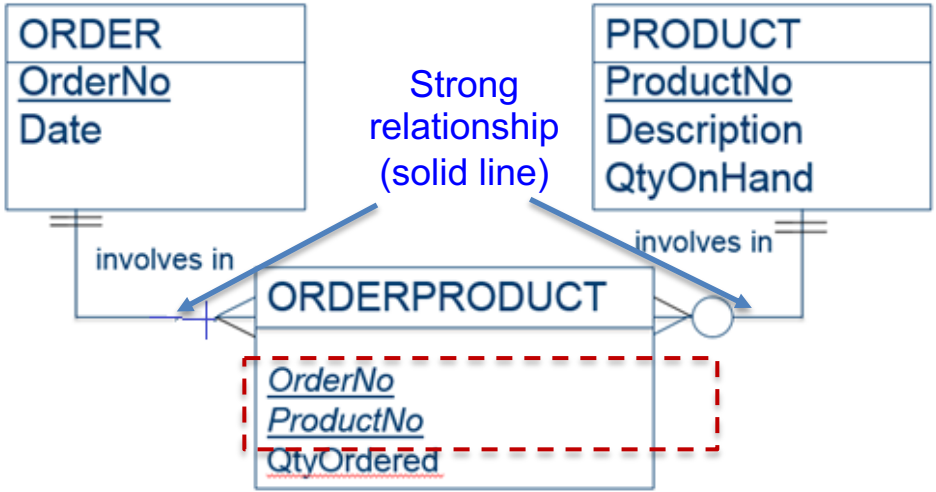
| CLASS_CODE | CRS_CODE | CLASS_SECTION | CLASS_TIME | ROOM_CODE | PROF_NUM |
|---|---|---|---|---|---|
| 10012 | ACCT-211 | 1 | MWF 8:00-8:50 a.m. | BUS311 | 105 |
| 10013 | ACCT-211 | 2 | MWF 9:00-9:50 a.m. | BUS200 | 105 |
| 10014 | ACCT-211 | 3 | TTh 2:30-3:45 p.m. | BUS252 | 342 |
| 10015 | ACCT-212 | 1 | MWF 10:00-10:50 a.m. | BUS311 | 301 |
| 10016 | ACCT-212 | 2 | Th 6:00-8:40 p.m. | BUS252 | 301 |
| 10017 | CIS-220 | 1 | MWF 9:00-9:50 a.m. | KLR209 | 228 |
| 10018 | CIS-220 | 2 | MWF 9:00-9:50 a.m. | KLR211 | 114 |
| 10019 | CIS-220 | 3 | MWF 10:00-10:50 a.m. | KLR209 | 228 |
| 10020 | CIS-420 | 1 | W 6:00-8:40 p.m. | KLR209 | 162 |
| 10021 | QM-261 | 1 | MWF 8:00-8:50 a.m. | KLR200 | 114 |
| 10022 | QM-261 | 2 | TTh 1:00-2:15 p.m. | KLR200 | 114 |
| 10023 | QM-362 | 1 | MWF 11:00-11:50 a.m. | KLR200 | 162 |
| 10024 | QM-362 | 2 | TTh 2:30-3:45 p.m. | KLR200 | 162 |
| 10025 | MATH-243 | 1 | Th 6:00-8:40 p.m. | DRE155 | 325 |

# Converting M:N to 1:M

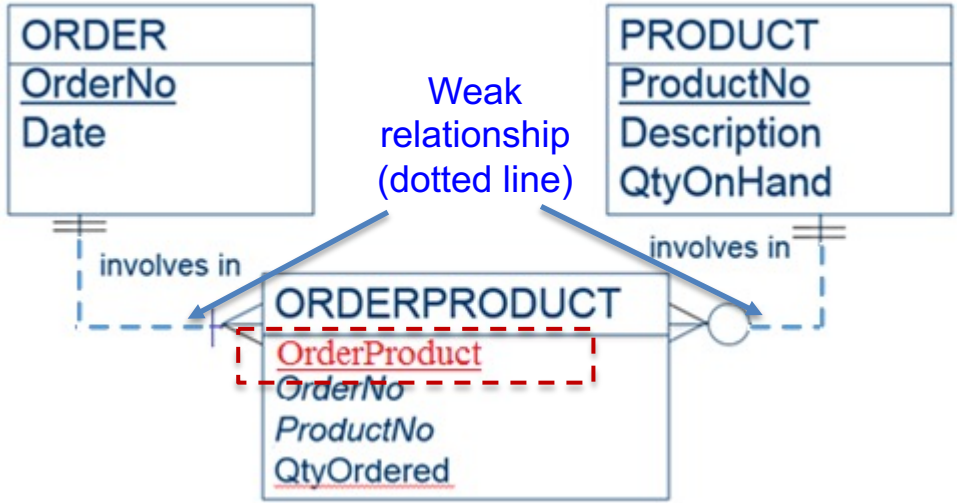
## Example 1 from Week 3:




## Solution A:



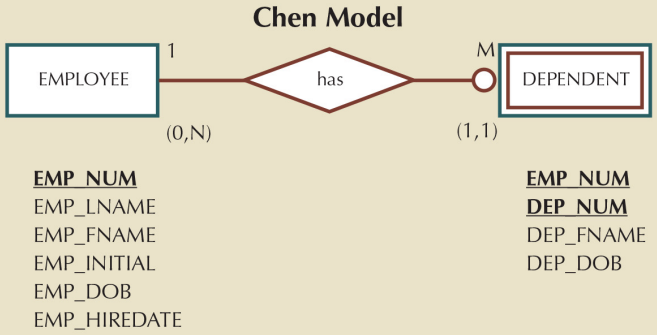

## Solution B:



# Weak entity

- An entity that displays existence dependence and inherits the primary key of its parent entity. For example, a DEPENDENT requires the existence of an EMPLOYE

FIGURE 4.10 A WEAK ENTITY IN AN ERD



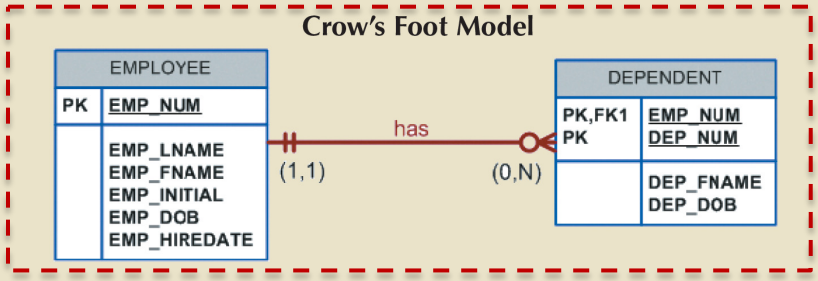




FIGURE 4.11 A WEAK ENTITY IN A STRONG RELATIONSHIP

Table name: EMPLOYEE — Database name: Ch04_ShortCo

| EMP_NUM | EMP_LNAME | EMP_FNAME | EMP_INITIAL | EMP_DOB | EMP_HIREDATE |
|---|---|---|---|---|---|
| 1001 | Callifante | Jeanine | J | 12-Mar-64 | 25-May-97 |
| 1002 | Smithson | William | K | 23-Nov-70 | 28-May-97 |
| 1003 | Washington | Herman | H | 15-Aug-68 | 28-May-97 |
| 1004 | Chen | Lydia | B | 23-Mar-74 | 15-Oct-98 |
| 1005 | Johnson | Melanie | | 28-Sep-66 | 20-Dec-98 |
| 1006 | Ortega | Jorge | G | 12-Jul-79 | 05-Jan-02 |
| 1007 | O'Donnell | Peter | D | 10-Jun-71 | 23-Jun-02 |
| 1008 | Brzenski | Barbara | A | 12-Feb-70 | 01-Nov-03 |

Table name: DEPENDENT

| EMP_NUM | DEP_NUM | DEP_FNAME | DEP_DOB |
|---|---|---|---|
| 1001 | 1 | Annelise | 05-Dec-97 |
| 1001 | 2 | Jorge | 30-Sep-02 |
| 1003 | 1 | Suzanne | 25-Jan-04 |
| 1006 | 1 | Carlos | 25-May-01 |
| 1008 | 1 | Michael | 19-Feb-95 |
| 1008 | 2 | George | 27-Jun-98 |
| 1008 | 3 | Katherine | 18-Aug-03 |

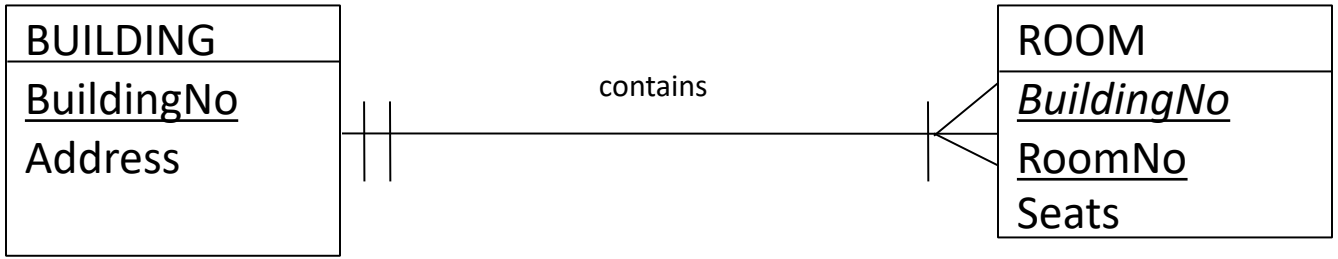
**Crow's foot model shows Weak entity by:**

- Strong relationship &
- PK/FK designation in child table

# Weak entity – another example

**Business rules:**

- A building has many rooms
- Each room must be identified under a building
- Example: N44_2.20, N44_1.17




**Relation schema:**

- BUILDING (BuildingNo, Address)
- ROOM (*BuildingNo*, RoomNo, Seats)

- Why Relationship is strong but the child entity is weak?
  - Because it is fully dependant on its parent!

# Thank you