David M. Kroenke and David J. Auer

Database Processing:

Fundamentals, Design, and Implementation

Chapter Five:

Data Modeling with the Entity-Relationship Model

Chapter Objectives

- use strong entities
- use ID-dependent and other weak entities
- use the ID-dependent association pattern
- use supertype/subtype entities
- use the ID-dependent multivalued attribute pattern
- use recursive patterns

E-R Model

CUSTOMER Entity

CUSTOMER
CustomerNumber CustomerName Street City State Zip ContactName Email

Entity class
(定義欄位)

特徵

Two CUSTOMER Instances

Entity instance
(實際資料)

1234 Ajax Manufacturing 123 Elm Street Memphis TN 32455 P_Schwartz P_S@Ajax.com	99890 Jones Brothers 434 10th Street Boston MA 01234 Fritz Billingsley Fritz@JB.com

相同的屬性
不同的值

EMPLOYEE: Attributes in Entity Rectangle

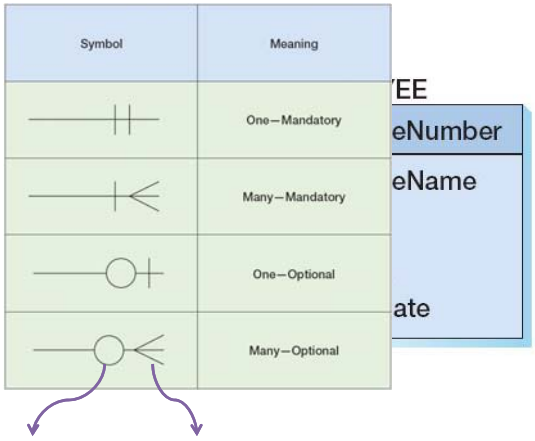
EMPLOYEE
EmployeeNumber
EmployeeName Phone Email HireDate ReviewDate

Entity Name

Identifier

Attributes

Data Modeling Notation: IE Crow's Foot I



Entities Classification

- Strong Entity
- Weak Entity : an entity whose existence depends upon another entity
  - Non-ID-dependent
  - ID-dependent

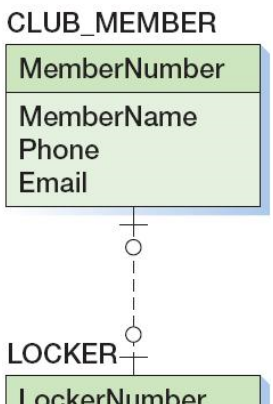
Strong Entity Patterns: 1:1 Strong Entity Relationships

(a) Club Membership Data Entry Form

(b) Club Locker Report

CLUB_LOCKERS

LockerRoom	*LockerNumber*	*MemberNumber*	*MemberName*	*LockerSize*
Mens	2100	1000	Jones	Med
Mens	2115	3000	Wu	Large
Womens	2200	2000	Abernathy	Large
Womens	2217	4000	Lai	Small



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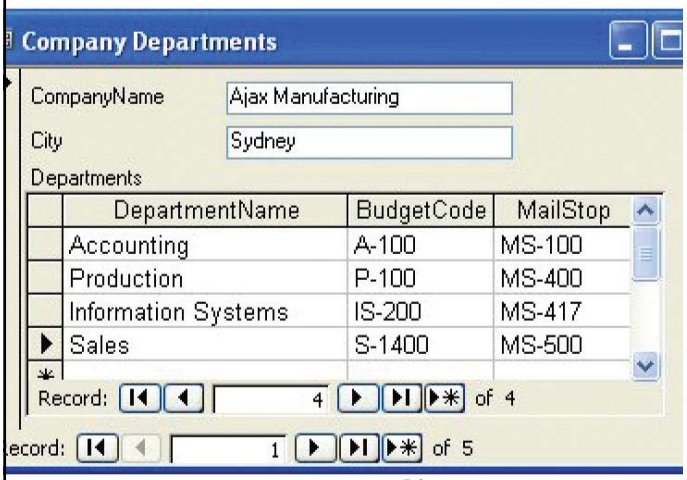
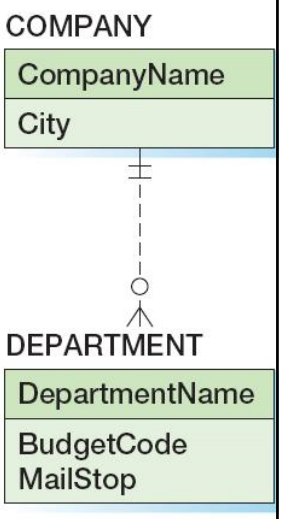
Strong Entity Patterns: 1:N Strong Entity Relationships





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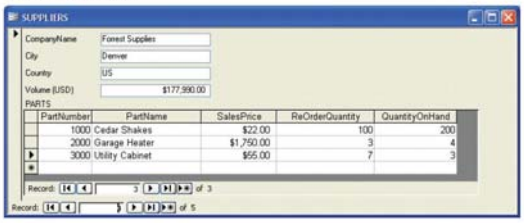
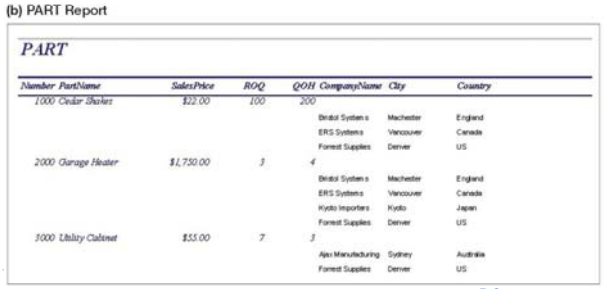
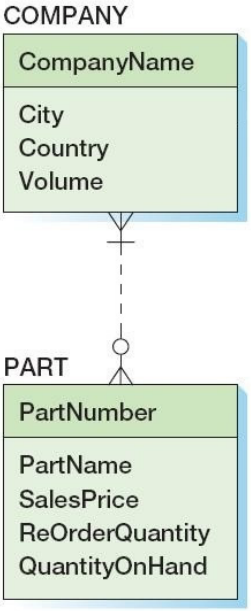
N:M Strong Entity Relationships

(a) SUPPLIERS Form



(b) PART Report

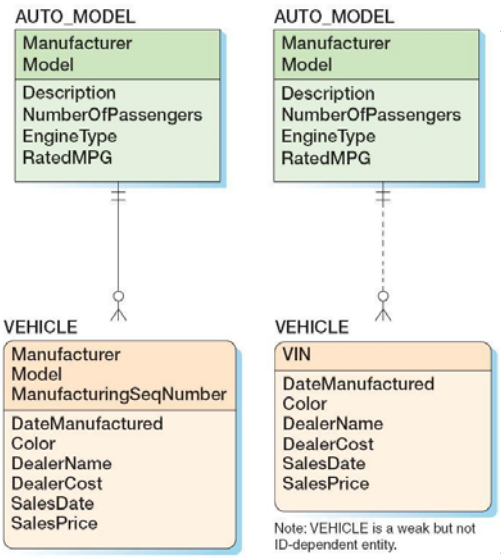




Weak Entities

ID-dependent

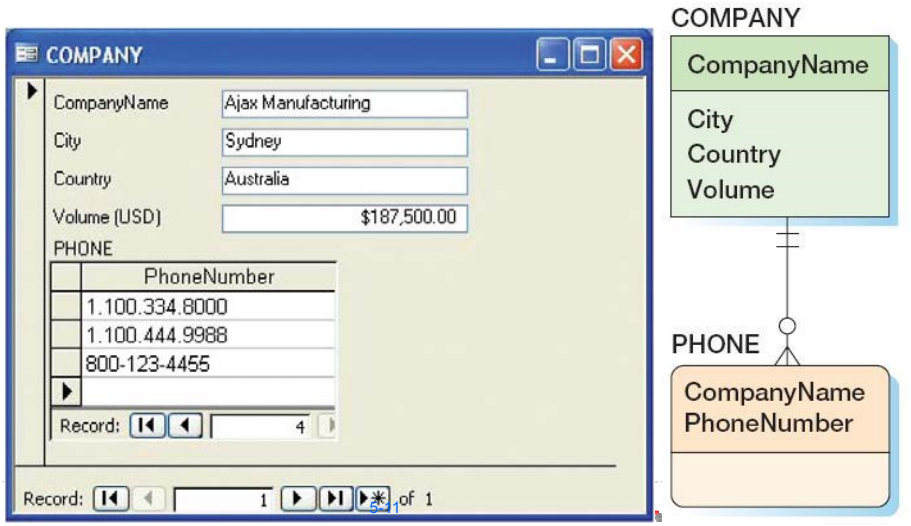
Non-ID-dependent



(a) ID-Dependent Entity

(b) Non-ID-Dependent Weak Entity

ID-Dependent Relationships: The Multivalued Attribute Pattern



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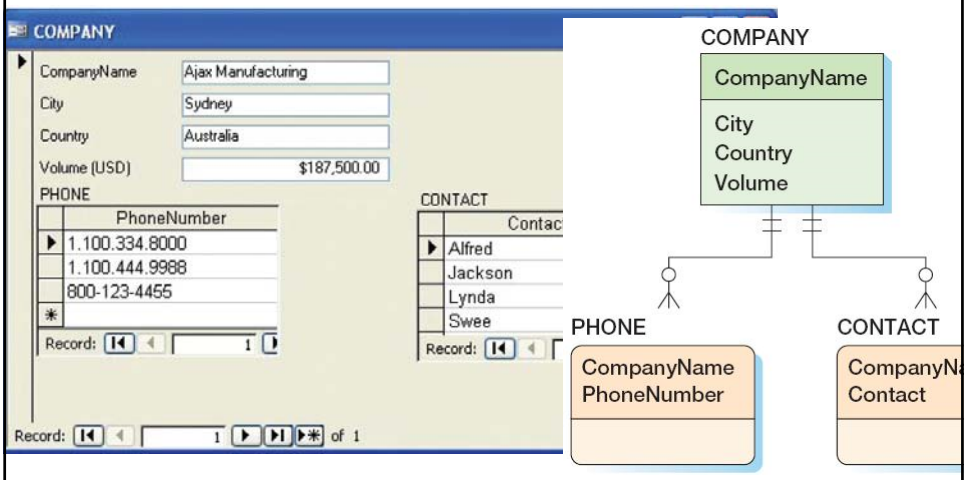
ID-Dependent Relationships: The Multivalued Attribute Pattern



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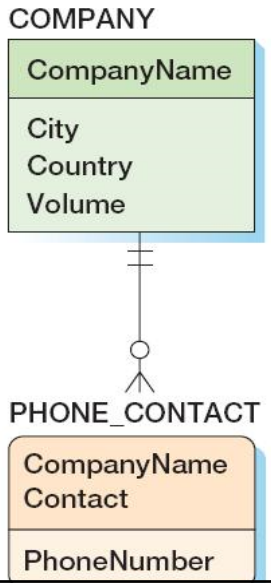
ID-Dependent Relationships: The Multivalued Attribute Pattern

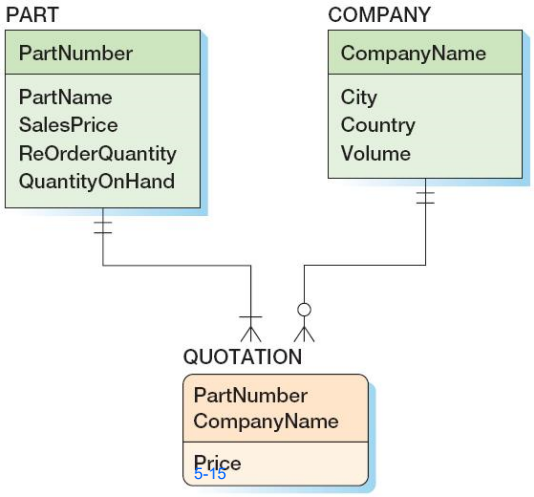


ID-Dependent Relationships: The Association Pattern

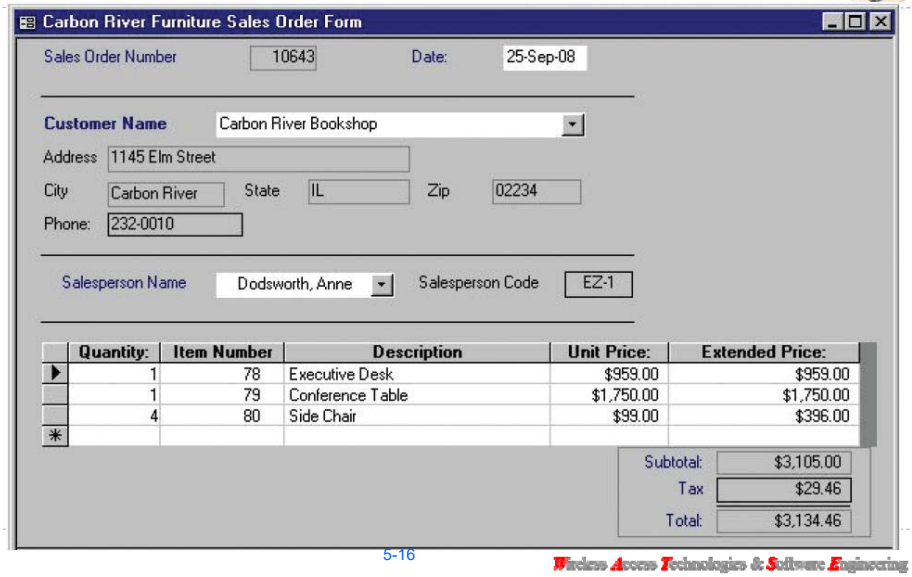
Part Quotations

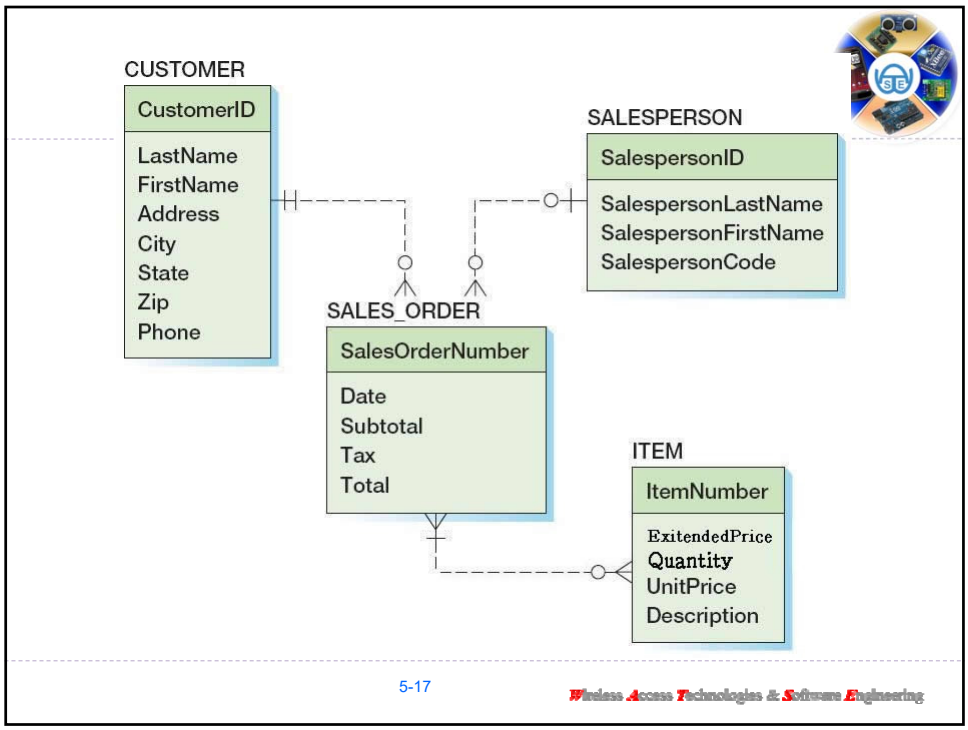
Number	Name	SalesPrice	ROQ	QOH	Company	City	Price
1000	Cedar Shakes	$22.00	100	200			
					Bristol Systems	Machester	$14.00
					ERS Systems	Vancouver	$12.50
					Forrest Supplies	Denver	$15.50
2000	Garage Heater	$1,750.00	3	4			
					Bristol Systems	Machester	$950.00
					ERS Systems	Vancouver	$875.00
					Kyoto Importers	Kyoto	$1,100.00
					Forrest Supplies	Denver	$915.00
3000	Utility Cabinet	$55.00	7	3			
					Ajax Manufacturing	Sydney	$37.50
					Forrest Supplies	Denver	$42.50

ID-Dependent Relationships: The Association Pattern



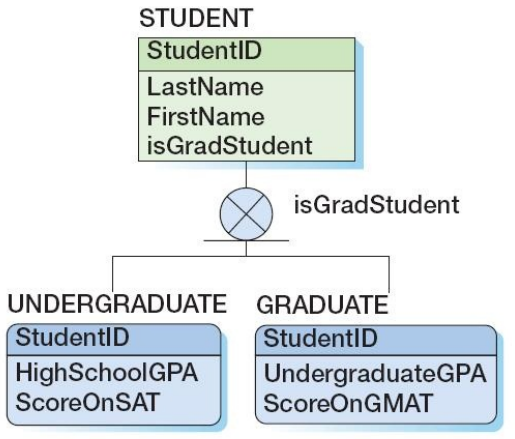
Mixed Patterns: The Line-Item Pattern





Subtype Entities

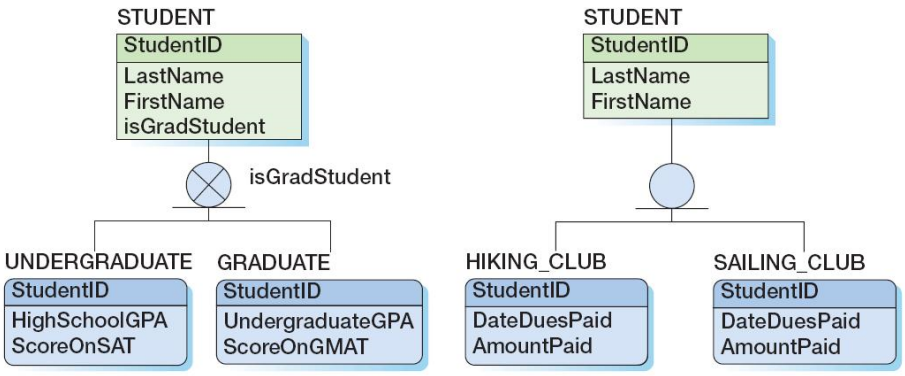
- A **subtype entity** is a special case of a **supertype entity**:
  - STUDENT :
    UNDERGI
- Supertype: all common
- Subtypes: specific attrib
- The supertype may hav
  which indicates the sub
- Subtypes are used to av



(a) Exclusive Subtypes with Discriminator

Subtypes: Exclusive or Inclusive

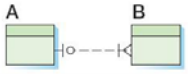
- **Exclusive:** at most one subtype
- **Inclusive:** one or more subtypes.



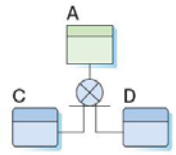
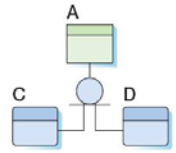
(a) Exclusive Subtypes with Discriminator

(b) Inclusive Subtypes

IE Crow's Foot Symbol Summary

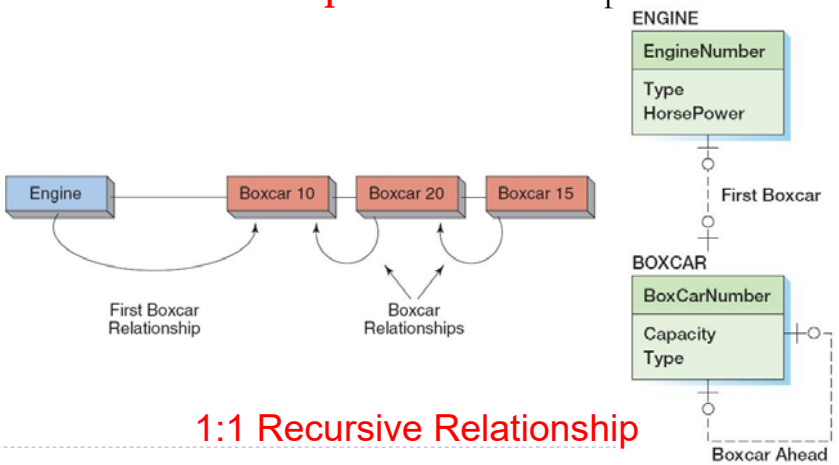
DEPARTMENT DepartmentName BudgetCode OfficeNumber	DEPARTMENT entity; DepartmentName is identifier; BudgetCode and OfficeNumbe are attributes.
	1:1, nonidentifying relationship. A relates to zero or one B; B relates to exactly one A. Identifier and attributes not shown.
	1:N, nonidentifying relationship. A relates to one or many Bs; B relates to zero or one A. Identifier and attributes not shown.
	Many-to-many, identifying relationship. A relates to zero or more Bs; B relates t one or more As.
	1:N identifying relationship. A relates to zero, one, or many Bs. B relates to exactly one A. Identifier and attributes not shown. For identifying relationships, the child must always relate to exactly one parent. The parent may relate to zero, one, many, or a combination of these minimum cardinalities.

IE Crow's Foot Symbol Summary

	A is supertype, C and D are exclusive subtypes. Discriminator not shown. Identifier and attributes not shown.
	A is supertype, C and D are inclusive subtypes. Identifier and attributes not shown.

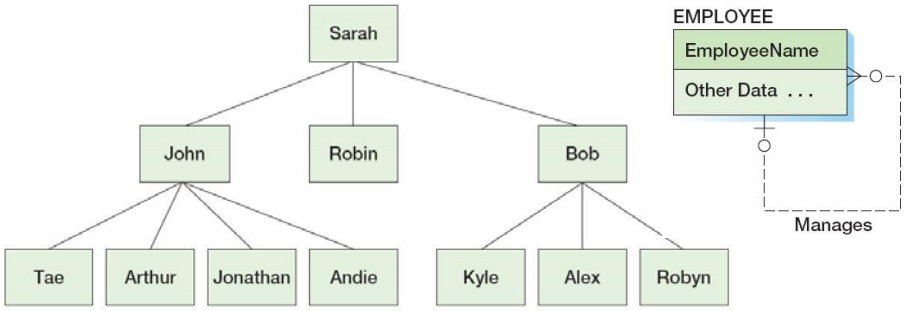
Recursive Relationships

- **recursive relationship** : has a relationship to itself.

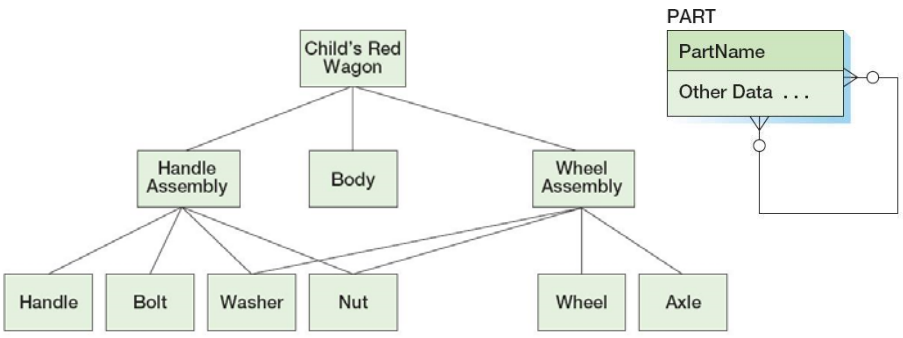


1:1 Recursive Relationship

Recursive Patterns: 1:N Recursive Relationship



Recursive Patterns: N:M Recursive Relationship

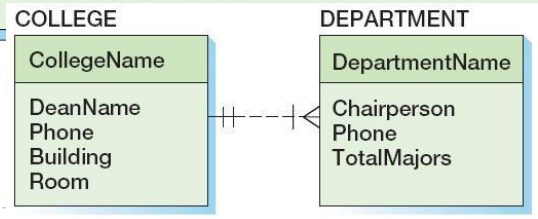


College of Business
Mary B. Jefferson, Dean

Phone: 232-1187

Campus Address:
Business Building, Room 100

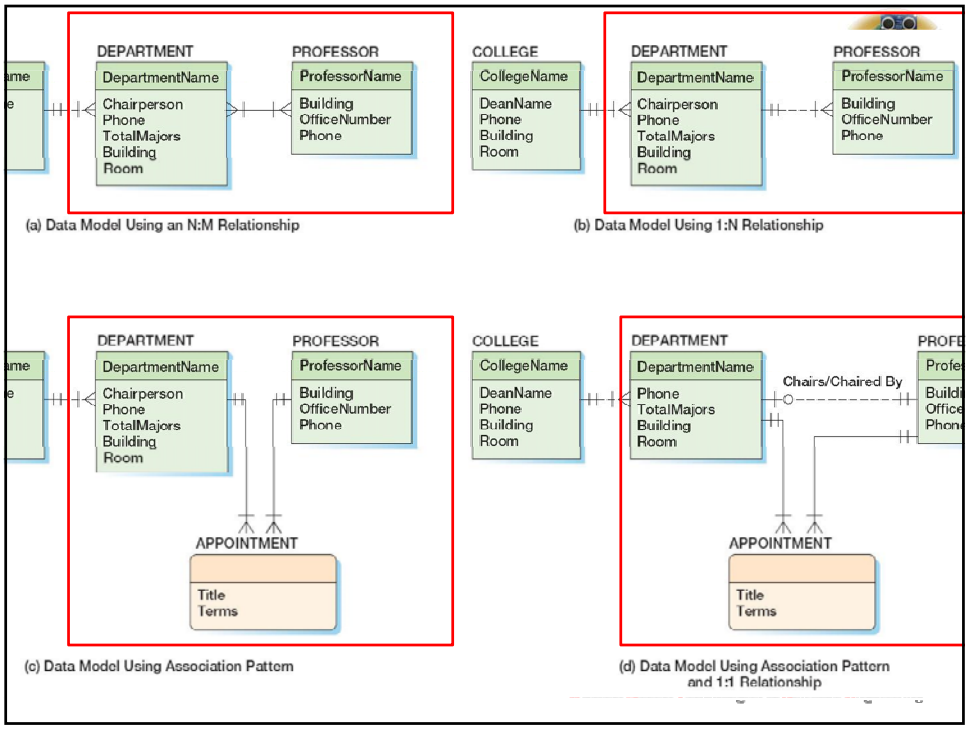
Department	Chairperson	Phone	Total Majors
Accounting	Jackson, Seymour P.	232-1841	318
Finance	HeuTeng, Susan	232-1414	211
Info Systems	Brammer, Nathaniel D.	236-0011	247
Management	Tuttle, Christine A.	236-9988	184
Production	Barnes, Jack T.	236-1184	212

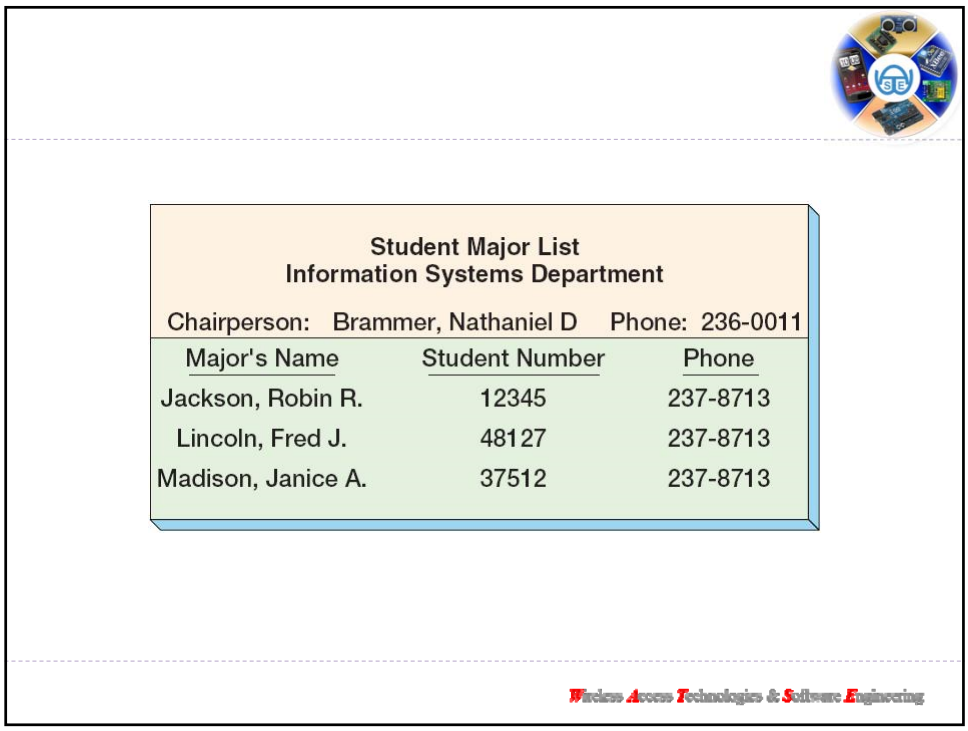


Information Systems Department
College of Business

Chairperson: Brammer, Nathaniel D
Phone: 236-0011
Campus Address: Social Science Building, Room 213

Professor	Office	Phone
Jones, Paul D.	Social Science, 219	232-7713
Parks, Mary B	Social Science, 308	232-5791
Wu, Elizabeth	Social Science, 207	232-9112

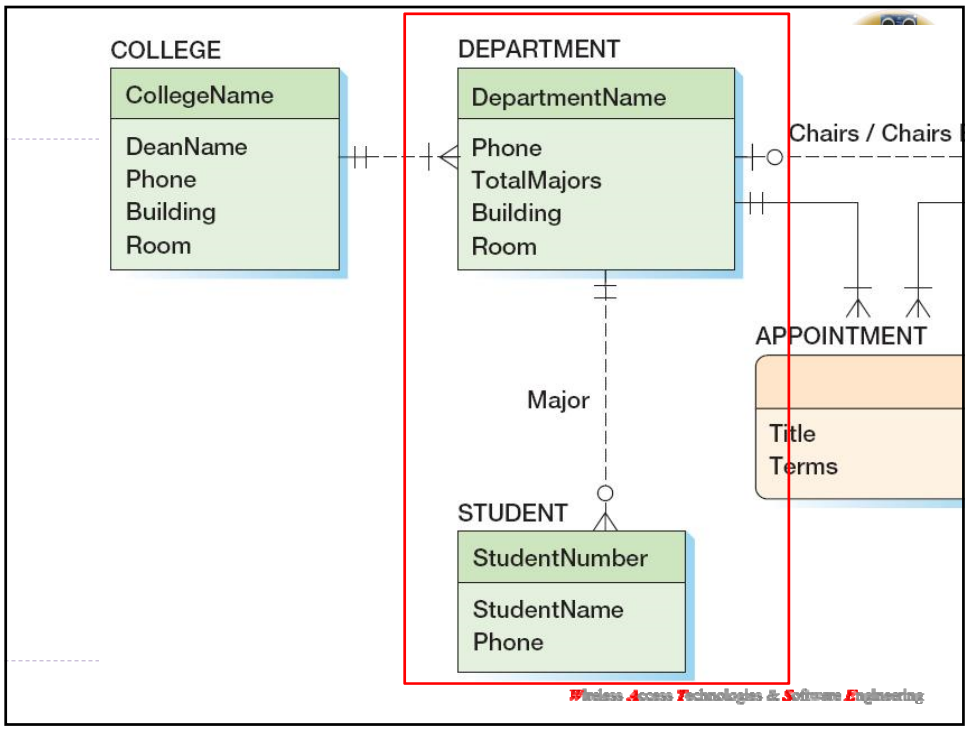




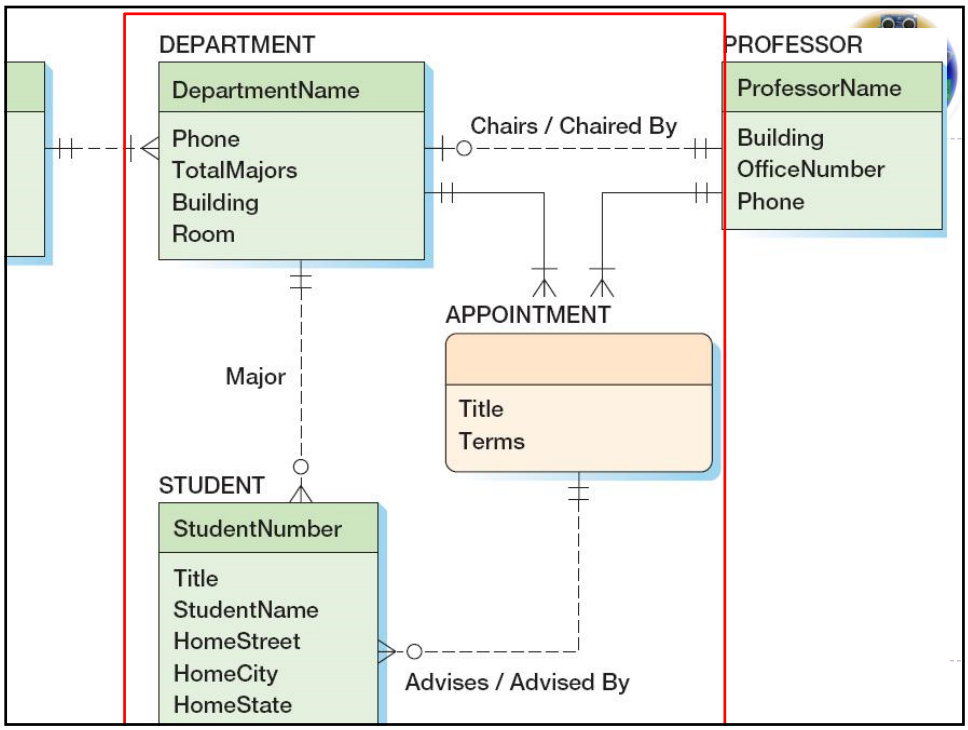
Student Major List
Information Systems Department

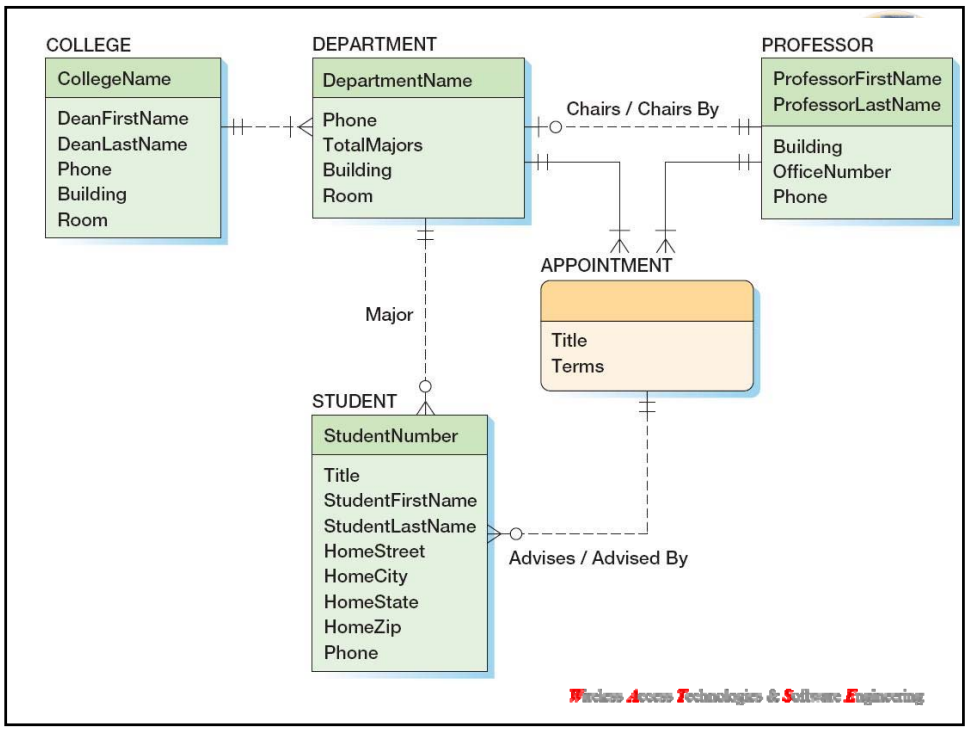
Chairperson: Brammer, Nathaniel D Phone: 236-0011

Major's Name	Student Number	Phone
Jackson, Robin R.	12345	237-8713
Lincoln, Fred J.	48127	237-8713
Madison, Janice A.	37512	237-8713


COLLEGE
CollegeName
DeanName
Phone
Building
Room
DEPARTMENT
DepartmentName
Phone
TotalMajors
Building
Room
Chairs / Chairs
APPOINTMENT
Title
Terms
Major
STUDENT
StudentNumber
StudentName
Phone
Wireless Access Technologies & Software Engineering


Mr. Fred Parks
123 Elm Street
Los Angeles, CA 98002
Dear Mr. Parks:
You have been admitted as a major in the Accounting Department at Highline University, starting in the Fall Semester, 2009. The office of the Accounting Department is located in the Business Building, Room 210.
Your adviser is professor Elizabeth Johnson, whose telephone number is 232-8740 and whose office is located in the Business Building, Room 227. Please schedule an appointment with your adviser as soon as you arrive on campus.
Congratulations and welcome to Highline University!
Sincerely,
Jan P. Smathers
President
JPS/rkp
Wireless Access Technologies & Software Engineering


DEPARTMENT
DepartmentName
Phone
TotalMajors
Building
Room
Chairs / Chaired By
PROFESSOR
ProfessorName
Building
OfficeNumber
Phone
APPOINTMENT
Title
Terms
Major
STUDENT
StudentNumber
Title
StudentName
HomeStreet
HomeCity
HomeState
Advises / Advised By


COLLEGE
CollegeName
DeanFirstName
DeanLastName
Phone
Building
Room
DEPARTMENT
DepartmentName
Phone
TotalMajors
Building
Room
Chairs / Chairs By
PROFESSOR
ProfessorFirstName
ProfessorLastName
Building
OfficeNumber
Phone
APPOINTMENT
Title
Terms
Major
STUDENT
StudentNumber
Title
StudentFirstName
StudentLastName
HomeStreet
HomeCity
HomeState
HomeZip
Phone
Advises / Advised By
Wireless Access Technologies & Software Engineering

Chapter Review

- understand the E-R model
- use strong entity patterns
- use ID-dependent and other weak entities
- use supertype/subtype entities
- use the ID-dependent association pattern
- use the ID-dependent multivalued attribute pattern
- use recursive patterns