ER Model

- Entities, attributes, identifiers
- HAS-A Relationships
  - Degree: binary, ternary
  - Maximum cardinality
  - Minimum cardinality
- Weak entities
  - ID-dependent entities; identifying relationships
- IS-A Relationships
  - Inclusive, Exclusive

Goals of This Lecture

- Create ER model from user requirements
Forms, Reports and ER Model

- User input:
  - Forms
  - Reports
  - Discussions
- DB modeler: Entity-Relationship model
- Same entities, relationships under the surface
1:1 Strong Entity Relationships

![Diagram of 1:1 Strong Entity Relationships]

1:N Strong Entity Relationships

![Diagram of 1:N Strong Entity Relationships]
1:N Strong Entity Relationships

N:M Strong Entity Relationships

N:M Strong Entity Relationships
N:M Strong Entity Relationships

The Association Pattern

Association Class
Entity vs. Attribute

Multi-valued Attribute → Entity

Recursive Relationships

- **Recursive relationship:** an entity has a relationship to itself
1:N Recursive Relationship

1:1 Recursive Relationship

N:M Recursive Relationship
Class Exercise

- Draw ER diagram for a database used to manage IT420 class (at least 3 entities)
  - Specify entities, attributes, identifiers
  - Specify relationships
  - Specify cardinalities for relationships

Highline University

- The Highline University [HU] database will track such entities as:
  - Colleges
  - Departments
  - Faculty
  - Students
- We have gathered a set of HU reports that will be the source documents for a data model

The College Report

<table>
<thead>
<tr>
<th>Department</th>
<th>Chairperson</th>
<th>Phone</th>
<th>Total Majors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Accounting</td>
<td>Jackson, Seymour P.</td>
<td>232-1041</td>
<td>318</td>
</tr>
<tr>
<td>Finance</td>
<td>Hsu, Tien, Susan</td>
<td>232-1414</td>
<td>211</td>
</tr>
<tr>
<td>Info Systems</td>
<td>Brammer, Nathaniel D.</td>
<td>236-0011</td>
<td>247</td>
</tr>
<tr>
<td>Management</td>
<td>Tuttle, Christine A.</td>
<td>236-9868</td>
<td>134</td>
</tr>
<tr>
<td>Production</td>
<td>Barnes, Jack T.</td>
<td>236-1184</td>
<td>212</td>
</tr>
</tbody>
</table>
Data Model from the College Report

The Department Report

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, 306  | 232-5791
Wu, Elizabeth  | Social Science, 207  | 232-9112

The DEPARTMENT / PROFESSOR Relationship: Alternate Model 1: Using a 1:N Relationship
The DEPARTMENT / PROFESSOR Relationship: Alternate Model 1: Using a 1:N Relationship

The DEPARTMENT / PROFESSOR Relationship: Alternate Model 2: Using an N:M Relationship

The DEPARTMENT / PROFESSOR Relationship: Alternate Model 3: Using an Association Pattern
The DEPARTMENT / PROFESSOR Relationship: Alternate Model 4: Using an Association Pattern and a 1:N Relationship

The Department Major Report

Student Major List
Information Systems Department
Chairperson: Brammer, Nathaniel D  Phone: 236-0011

<table>
<thead>
<tr>
<th>Major's Name</th>
<th>Student Number</th>
<th>Phone</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jackson, Robin R.</td>
<td>12345</td>
<td>237-8713</td>
</tr>
<tr>
<td>Lincoln, Fred J.</td>
<td>48127</td>
<td>237-8713</td>
</tr>
<tr>
<td>Madison, Janice A.</td>
<td>37512</td>
<td>237-8713</td>
</tr>
</tbody>
</table>

Data Model with STUDENT Entity
The Student Acceptance Letter

Mr. Fred Parks
888 East Street
Los Angeles, CA 90002

Dear Mr. Parks,

We are pleased to inform you that you have been accepted as a major in the Accounting Department at Sigelton University, starting in the Fall semester, 2005. The office of the Accounting Department is located in the Business Building, Room 218.

Your advisor is Professor William Johnson, whose telephone number is 888-9999 and whose office is located in the Business Building, Room 207. Please feel free to contact him with your questions as soon as you arrive on campus.

Congratulations and welcome to Sigelton University!

Sincerely,

Joe H. Shukers
President

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Data Model with Advises Relationship

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Final Data Model

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ER Modeling: Case Study

- Drugwarehouse.com has offered you a free life-time supply of prescription drugs (no questions asked) if you design its database schema. Given the rising cost of health care, you agree. Here is the information that you gathered:
  - Patients are identified by their SSN, and we also store their names and age
  - Doctors are identified by their SSN, and we also store their names and specialty
  - Each patient has one primary care physician
  - Each doctor has at least one patient
  - Doctors prescribe drugs for patients