INDE499B:
Information Systems
Course Review
Autumn 2000

• WHAT did we cover?

• HOW did we cover it?

• WHY did we cover it?

• And the exam, what’s on it…
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• WHAT did we cover?
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WHAT DID WE COVER?

- **Phase 1: Scope and Design of Information Systems**
  - Information systems
  - Database approach
  - Design of information/database systems – SDLC
  - Relationship of Information Systems to IE
  - Differences between data and information

- **Phase 2: Describing and Designing Data**
  - Conceptual Design and ER Diagrams
    - *What is the important data?*
  - Logical Design and Relational Data Schemas
    - *How should we organize it in a database?*
  - Physical Design and Access Databases
    - *Creating the actual database*
  - Special Case: Data Warehouse

- **Phase 3: Interacting with Data**
  - Getting data in and out (processes)
    - *SQL (Chapter 9, Some of Chapter 10)*
  - Getting data in and out (components)
    - *Client Server Architecture (Chapter 8)*
  - Managing Data –
    - *Database Administration (Chapter 13)*
Characterizing an Information System

An information system can be defined as a set of components and processes for aggregating, managing and using information toward some end.
1 Systems Development Life Cycle

- **Project Identification and Selection**
  - Which projects

- **Project Initiation and Planning**
  - What steps, who, when,

- **Analysis**
  - What functions
    - (end-user & maintenance)

- **Logical Design**
  - What data to support functions
  - Approach for supporting functions

- **Physical Design**
  - What database structure
  - Mock ups of approach

- **Implementation**
  - Create database and programs

- **Deployment (Going Live)**
  - When? How?

- **Maintenance**
  - How to resolve problems?
Problem 3c: A laboratory has several chemists who work on one or more projects. Chemists also may use certain kinds of equipment on each project. Attributes of CHEMIST include Employee_ID (identifiers), Name, and Phone_No. Attributes of PROJECT include Project_ID (identifier) and Start_Date. Attributes of EQUIPMENT include Serial_No and Cost. The organization wishes to record Assign_Date – that is, the data when a given equipment item was assigned to a particular chemist working on a specified project. A chemist must be assigned to at least one project and one equipment items. A given equipment item need not be assigned, and a given project need not be assigned either a chemist or an equipment item.

**PROCESS:**
- What are entities?
  - Name?
  - Attributes?
  - Identifiers?
- What are relationships?
  - Name?
  - Attributes?
  - Cardinality?
- Final Check – Ensure that model agrees with Description
ER Modeling

Problem 4

- The figure shows a Grade Report that is mailed to students at the end of each semester. Prepare an ER diagram reflecting the data contained in Grade Report. Assume that each course is taught by one instructor.

<table>
<thead>
<tr>
<th>Course ID</th>
<th>Title</th>
<th>Instructor Name</th>
<th>Instructor Location</th>
<th>Grade</th>
</tr>
</thead>
<tbody>
<tr>
<td>IS 350</td>
<td>Database Mgmt</td>
<td>Codd</td>
<td>B104</td>
<td>A</td>
</tr>
<tr>
<td>IS 465</td>
<td>System Analysis</td>
<td>Parsons</td>
<td>B317</td>
<td>B</td>
</tr>
</tbody>
</table>

- Process:
  - Entities
  - Relationships
Part 2: Describing & Managing Data

- **Starting Point:** Data Scope / System Functions
  - Scope of Data:
  - Functions of System:

- **Conceptual Design of Data** (Chapter 3)
  - What is scope of data & relationships among data
  - For us: Model w/ ER (Entity Relationship) Diagrams

- **Logical Design of Data** (Chapter 6)
  - What tables ("relations") to create?
  - What constraints on data ("integrity constraints")?
  - For us: Transform ER Diagrams to Table Specs.

- **Physical Design of Data** (Chapter 7)
  - How to specify fields / create tables
  - For us: Transform Table Specs to Access database

- **End Goal:** Physical database created
2 Logical Design and Relational Data Model

• Essential Elements
  – **Data structure** - data are organized in the form of tables (relations) with rows and columns
  – **Data integrity** - Facilities are included to specify (business) rules that maintain the integrity of the data when they are manipulated.
  – **Data manipulation** - Powerful operations (using the SQL language) are used to manipulate data stored in the relations

• How will this help you?
2 Logical Design
Transforming ER Diagrams into Relations

- **Step 1: Map Regular Entities**
  - Step 1a: Composite attribute
  - Step 1b: Multi-valued attributes

- **Step 2: Map Weak Entities**

- **Step 3: Map Binary Relationships**
  - Map One-to-Many
  - Map Many-to-Many
  - Map One-to-One

- **Step 4: Map Associative Entities**
  - Proceed as with Many-Many Binary relationship

- **Step 5: Map Unary Relationships**
  - Map Unary One-to-Many
  - Map Unary Many-to-Many

- **Step 6: Map Ternary (and n-ary) Relationships**
QUESTION 3: CREATING A RELATIONAL DATABASE SCHEMA (37 points).

Production tracking is important in many manufacturing environments (e.g., the pharmaceuticals industry, children’s toys, etc.). The following ER diagram captures important information in the tracking of production. Specifically, the ER diagram captures relationships between production lots (or batches), individual production units, and raw materials.

a. Please convert the ER diagram into a relational database schema. Be certain to indicate primary keys and referential integrity constraints. 

(25 pts)

Solutions:

**Production Units**

<table>
<thead>
<tr>
<th>Serial#</th>
<th>ExactWeight</th>
<th>ProductType</th>
<th>ProductDesc</th>
<th>QualityTest?</th>
<th>LotNumber</th>
</tr>
</thead>
</table>

**Lot**

<table>
<thead>
<tr>
<th>LotNumber</th>
<th>CreateDate</th>
<th>CostOfMaterials</th>
</tr>
</thead>
</table>

**Raw Materials Usage**

<table>
<thead>
<tr>
<th>LotNumber</th>
<th>MaterialID</th>
<th>Units</th>
</tr>
</thead>
</table>

**Raw Materials**

<table>
<thead>
<tr>
<th>MaterialID</th>
<th>Type</th>
<th>UnitCost</th>
</tr>
</thead>
</table>
# Physical Design

- Defining Indices
- Defining Data Formats
- Defining Relationships
- Defining Tables

## Data Design Process

Revisiting the System Development Life Cycle (SDLC)
Focusing specifically on Data Design

<table>
<thead>
<tr>
<th>Phase Name and Description</th>
<th>Key Issue(s)</th>
<th>Input(s)</th>
<th>Output(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Identification and Selection</td>
<td>...</td>
<td>...</td>
<td>...</td>
</tr>
<tr>
<td>2. Project Initiation and Planning</td>
<td>...</td>
<td>Commitment to do project</td>
<td>Project plan</td>
</tr>
<tr>
<td>3. Analysis</td>
<td>...</td>
<td>Information from client about what system reqts.</td>
<td>Functional specifications</td>
</tr>
<tr>
<td>4. Data Design</td>
<td>Capturing all data - Capturing relationships - Data integrity</td>
<td>Functional specs - General understanding of problem</td>
<td>ER diagram</td>
</tr>
<tr>
<td>a. Conceptual Design</td>
<td>Creating model that captures major entities, relationships among entities, and attributes of entities required for a particular system.</td>
<td>ER diagram</td>
<td></td>
</tr>
<tr>
<td>b. Logical Design</td>
<td>Providing location for all data - Data integrity</td>
<td>ER diagram</td>
<td>Relational database schema</td>
</tr>
<tr>
<td>b2 Improving Logical Design</td>
<td>Minimizing redundancy - Minimizing ambiguity</td>
<td>Relational database schema</td>
<td>Relational database schema</td>
</tr>
<tr>
<td>c. Physical Design</td>
<td>Performance - Data integrity</td>
<td>Relational database schema</td>
<td>Technical specifications for construction of the database</td>
</tr>
<tr>
<td>4. Design – Interacting w/ Data</td>
<td>...</td>
<td>...</td>
<td>...</td>
</tr>
<tr>
<td>5. Implementation</td>
<td>Technical specs from physical design</td>
<td>Actual database</td>
<td></td>
</tr>
</tbody>
</table>
3 SQL
Structured Query Language

• Specifically, commands used to maintain and query a database, including…
  – Insert … into …
  – Delete .. from…
  – Update …
  – Select … from …

CLASS PREPARATION GUIDE – WEEKS 8 AND 9
SQL (Structured Query Language)

<table>
<thead>
<tr>
<th>Date</th>
<th>Monday, 11/13</th>
<th>Wednesday, 11/15</th>
<th>Friday, 11/17</th>
<th>Monday, 11/20</th>
<th>Wednesday, 11/22</th>
</tr>
</thead>
<tbody>
<tr>
<td>Class, Part 1 Application</td>
<td>Discuss Organization of Class for Last Four Weeks</td>
<td>Discuss Class Prep Activity on SQL “Select” Single Table Basic Syntax</td>
<td>Discuss Class Prep Activity on SQL “Select” Single Table Advanced Syntax</td>
<td>Discuss Class Prep Activity on SQL “Select” Multi table “Join” Syntax</td>
<td>Discuss Class Prep Activity on SQL “Insert, Update, Delete” SQL “Create”</td>
</tr>
<tr>
<td>Class, Part 2 Theory</td>
<td>SQL “Select” Single Table Basic Syntax</td>
<td>SQL “Select” Single Table Advanced Syntax</td>
<td>SQL “Select” Multi table “Join” Syntax</td>
<td>SQL “Insert, Update, Delete” SQL “Create”</td>
<td>Review</td>
</tr>
</tbody>
</table>
3 SQL – Viewing in Access

**SQL View**

```sql
SELECT resources.resourceName, resources.resourceType
FROM resources
WHERE ((resources.resourceType)="movies");
```

**Design View**

(QBE: Query-by-Example)

**Results View**
Log file Analysis: Putting it all together

- Some context/history:
  - Development of the Arthritis Source
  - Interview with designer
  - Logfile analysis to empirically explore some of the issues.

- Assertions from Interview with Designer
  - Concerning Users: “Arthritis is a chronic lifetime condition -- we hope users can create a lifetime relationship with the site.”
  - Concerning Timeframe: “Arthritis Source provides information to users regardless of time and place”
  - Concerning Resources: “The Arthritis Source provides information that will be valuable to people interested in Arthritis.”

- Challenge:
  - Finding log file evidence to support/discount assertions...
  - YOUR TASK: Choose a team, an assertion, and create a question and query...
Questions:
- What is an information system architecture?
- What alternatives are available?
- What are tradeoffs among alternatives?
- How would one choose?
- What complicates architectures description/decisions?
- What alternatives are prevalent in different circumstances?

Types:
- Stand-along computers
- Client-Server Architectures
  - File Server
  - Database Server
  - Three-tier
Comparing Architectures

Issues that Differ Across Architectures

**ISSUES**

1. **Network Traffic / Communication Load:** What are the demands on the network? Which has more information going across network? What are the risks that result? Which is more “tied” to the network (if it goes down, what can you still do?)
2. **Software Issues:** How many copies of the software are needed (DBMS or Application)? What are the impacts of software “upgrades”?
3. **Hardware Requirements:** What types of hardware are required in each scenario (e.g., memory, hard-drive size, processing power, etc.)?
4. **Data issues – integrity, security, efficiency:** Which scenarios make this easier? Harder?
5. **Scalability:** What happens when number of “clients” grows?
6. **Technical Expertise Required:** What types of technical expertise needed, which need more?
7. **Technological Flexibility:** What if client is a handheld or cell phone? What if end users have very different machines? What if you wish to use pre-existing modular code? What makes changes easy?
8. **End User Issues:** How much control do end users have? How much knowledge do they need? What if end users are highly distributed?

**COST:**

Cost is affected by each of these issues. For each issue, what type of cost is affected? Is overall cost more or less? Under what conditions?

And Making Recommendations...
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Instructional Approach

• Philosophy
  – Use a variety of learning and assessment activities.
  – Create a supportive learning environment.
  – Relate topics to a broader knowledge context.
  – Tie topics to student interests.

• Elements
  – Readings: Textbook, Websites
  – Lectures:
  – Projects:
    • Individual Pre-Project
    • Three-phase team project
  – Midterms

  – But also…
Class Preparation Activities
(15 on Web)

INDE 499 B
Class Preparation Activity - for 9/27

The purpose of this survey is to guide your reading of the syllabus and to collect information about study in the class. Responses are due by 8:00 am on Wednesday, 9/27. Responses will be discussed in class. The first five questions of this survey are based on the syllabus content. A copy of this syllabus is located at:

Question 1. Using the "information system" definition in the syllabus as a guide, describe one information system that you have worked with.

Question 2. Each of the first three objectives listed in the syllabus maps to a variety of work situations industrial engineers find themselves. For one of the first three objectives, please describe a work situation it would be an instance of the objective. In other words, please describe a work situation that involves in diagnosis, or evaluation...

Question 3. For each of the following topics, please state (1) when the topic will be covered in the class, (2) the objective(s) to which you believe the topic relates: (a) asking and answering data questions using different ways to describe and represent data, (c) important criteria for information systems development, client-server architecture and client "diversity."

Question 4. In this course, you will be asked to do a variety of activities both within class and outside of class. Why?
## Interactive In-Class Activities

### “MEMORABLE WEBSITES”
A class community-building exercise

<table>
<thead>
<tr>
<th>Step 1: <strong>Group Formation:</strong> Join a group, as directed by instructor.</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Step 2: <strong>Individual Information:</strong> Take a few minutes to think about websites you have found to be memorable (i.e., funny, impressive, inspiring, irritating, etc.). Please record the information below.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Name:</td>
</tr>
<tr>
<td>Memorable website:</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Step 3: <strong>Group Form Exchange:</strong> Within your group, exchange forms so no one has their own.</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Step 4: <strong>Group Insights:</strong> Within your group, you should take turns completing this step. When it is your turn, introduce one student in the group to the rest of the group by reading the information from step 1 above and then …</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Step 3a:</strong> “Insights” suggested by classmates: Ask group members to suggest what they think they might learn about the student based on his/her memorable website. Record ideas here.</td>
</tr>
<tr>
<td><strong>Step 3b:</strong> The “real” reason: Ask the student to comment on the truth of the “insights” suggested by classmates, and also the “real” reason the website is memorable. Record ideas here.</td>
</tr>
</tbody>
</table>

| Step 5: **Class-wide Student Introductions:** Students introduce other students to the class. When it is your turn, introduce the student by summarizing the information from steps 2 and 4 above -- the name, the memorable websites, classmate “insights”, and real reasons. |
Website Interactions

Information Systems (INDE499B) - Autumn 2000

In this course, you will develop an understanding of information systems that will permit you to understand, use, and even design such systems in your future career as an Industrial Engineer. Because industrial engineering activities (e.g., plant layout, procurement, inventory mgmt), typically require the management of large quantities of information, a working knowledge of information systems issues will enable you to more effectively accomplish your job as an Industrial Engineer and an engineering professional.

Instructor: Dr. Jennifer Torres
Contact Info: jtorres@engr.washington.edu
Office: Box Engineering Annex
Office Hours: Tuesday, 4:00-5:00; Wednesday, 12:30-1:30

Teaching Assistant: Linda Chen
Contact Info: lchen@u.washington.edu

Class Preparation Materials

Week 1 (9/26, 9/27, 9/29)
- Class Preparation Guide
- Classroom Preparation Survey for 9/27 - Due at 8:00AM, Results from Questions 1 and 2
- Reading for 9/27 - Explanation of IE
- Reading for 9/27 - What Employers Want
- Lecture Notes from 9/29 - Includes Flow Diagram for Exploring Class Scope

Week 2 (10/2, 10/4, 10/6)
- Class Preparation Guide
- Lecture Notes for 10/2
- Classroom Preparation Survey for 10/4 (due at 8:00AM), Results
- Lecture Notes for 10/4
- Lecture Notes for 10/6

Week 3 (10/5, 10/11, 10/13)
- Class Preparation Guide
- Classroom Preparation Survey for 10/9 (due at 8:00AM), Results
- Lecture Notes for 10/13 [into 10/11]
- Lecture Notes for 10/11

Week 4 (10/16, 10/18, 10/20)
- Class Preparation Guide
- Classroom Preparation Survey for 10/18 (due at 8:00AM), Results
- Classroom Preparation Survey for 10/20 (due at 8:00AM)

Week 5 (10/23, 10/25, 10/27)
CLASS PREPARATION GUIDE – WEEK 4
INDE 499B: Information Systems
Dr. Jennifer Turner
Autumn 2000

For Monday, 16 October 2000:

Reading(s):
- Chapter 3 – The Entity Relationship Model. Textbook, p. 85-114. Please note that we
  will be covering this material on Monday, 10/16, and Wednesday, 10/18 (and possibly
  finishing on Monday, 10/23). A good reading of the material before Monday (10/16) will
  serve you well for the week.

Classroom Preparation Activity:
- Please respond to the survey located at:
  http://depts.washington.edu/cdl/catalyst/webq/survey.cgi?user=jturns&survey=4
  The goal of the survey is to ensure that you are prepared for a discussion of terminology
  and basic concepts.

  This assignment is due by 8:00 AM on 10/16.

For Wednesday, 18 October 2000:

Reading(s):
- Chapter 3 – The Entity Relationship Model. Textbook, p. 85-114. (continued)

Classroom Preparation Activity:
- None

** Project Deliverable 2 is due in class

For Friday, 20 October 2000:

Reading(s):
- The Relational Data Model, Textbook, p. 208-212
- Integrity Constraints, Textbook, p. 213-214 (up to, but not including, “operational
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Thinking about the Scope of INDE499B

The Problem Statement: The scope of this class involves the interaction of three elements: (1) the general topic of information systems, (2) the industrial engineering discipline and (3) the needed skills of graduating engineers. Please develop a picture or diagram that captures this relationship as you understand it.

A Solution: A possible solution is given in the diagram below:

- Understanding the "solution": Information systems, with at least three sub-areas, is a subject learned by industrial engineers. Industrial engineering, which focuses on specific types of problems, is a type of general engineering, which implies specific skills of the engineer.
- Using the "solution": Imagine the different wheels can spin/move. Then, places where three elements line up can be "read" and used to think of issues/generate questions. For example, one could align Ethical responsibility, manufacturing, and getting information in and out – and then think about what issues exist at such an intersection.
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