CS 4432
Database Systems II

Lecture 1: Introduction

Professor Elke A. Rundensteiner

Today: Tim Sutherland

Recommended Background

- Beginning database design knowledge as gained in say CS3431 (in particular knowledge of the relational data model and SQL) and some knowledge of software engineering (we will be using Java), such as CS3733.

Staff

- INSTRUCTOR: Professor Elke A. Rundensteiner
- Office Hours: Mondays noon-1pm. Thursdays 9:15-10:15pm
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- TEACHING ASSISTANTS
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See course web Page (http://my.wpi.edu) for office location & hours.

Protocol for Communication

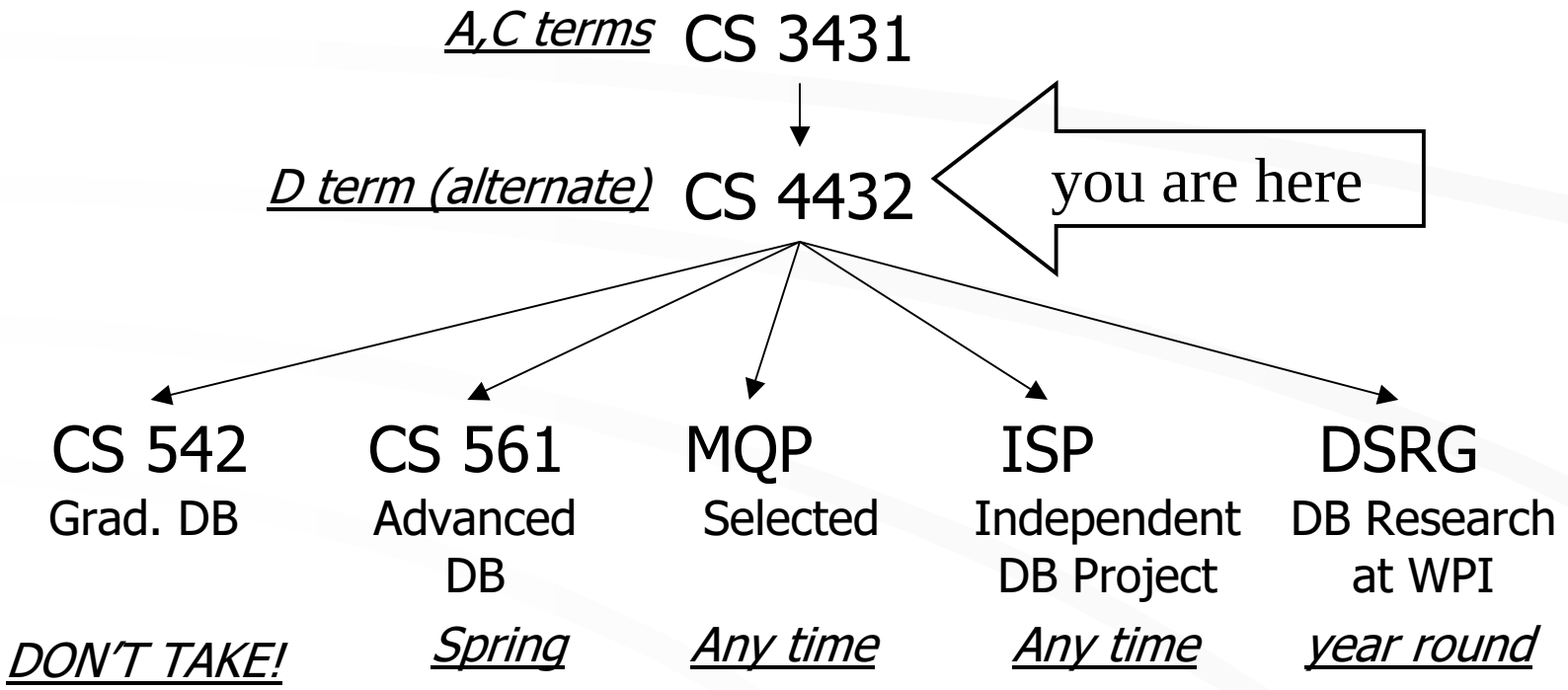
1. Post to the discussion board!
2. Come to Office Hours!!
   - We have 8 office hours spread throughout the week, on Mondays-Thursdays
3. E-Mail cs4432-staff@cs.wpi.edu
   - Expect *at least* a 24 hour response time
4. Schedule an office hour with the course staff.

Details

- LECTURES: Monday, Tuesday, Thursday, Friday 2-3pm FL320
- TEXTBOOK: Garcia-Molina, Ullman, Widom;
  either "DATABASE SYSTEM IMPLEMENTATION"
  or "DATABASE SYSTEMS, THE COMPLETE BOOK"

- ASSIGNMENTS: 4-5 Written Homework Assignments. 3 Group Projects.
- GRADING:
  - **Midterm: : 20%**
  - **Final Exam : 30%**
  - **Homework Assignments: 20%.**
  - **Projects: 30%.**
  - **Class participation: +/-**
- WEB SITE: http://my.wpi.edu
- Homework Submission: WPI's Turnin Program (NO EMAIL)
- Please check it daily for last minute announcements.

DB Material at WPI



Isn’t Implementing a Database System Simple?

Introducing the

MEGATRON 3000

Database Management System

- The latest from Megatron Labs
- Incorporates latest relational technology
- UNIX compatible

Megatron 3000 Implementation Details

- Relations stored in files (ASCII)

  e.g., relation Students is in /usr/db/Students

Students

```
Smith # 123 # CS
Jones # 522 # EE
.
.
```

Depts

```
CS # Fuller Labs
EE # Atwater Kent
PH # Olin Hall
 .
 .
```

Megatron 3000 Implementation Details

- Directory file (ASCII) in /usr/db/schema

```
Students#name#STR#id#INT#dept#STR
Depts#name#STR#office#STR
        ⋮
```

Megatron 3000
Sample Sessions

```
% MEGATRON3000
   Welcome to MEGATRON 3000!
&
   .
   .
   .
& quit
%
```

Megatron 3000
Sample Sessions

```
& select *
  from Students #

    Relation Students
   A        B     C
   SMITH   123    CS
   JONES   522    EE

&
```

Megatron 3000
Sample Sessions

```
& select Students.name,Depts.office
  from Students,Depts
  where Students.dept = Depts.name
Students.id > 300 #

Smith # 123 # CS # CS # Fuller Labs
Smith # 123 # CS # EE # Atwater Kent
Smith # 123 # CS # PH # Olin Hall
Jones # 522 # EE # CS # Fuller Labs
Jones # 522 # EE # EE # Atwater Kent
Jones # 522 # EE # PH # Olin Hall
```

Megatron 3000
Sample Sessions

```
& select *
  from Students | LPR #
&
```

Result sent to LPR (printer).

Megatron 3000
Sample Sessions

```
& select *
  from R
  where R.A < 100 | T #
&
```

New relation T created.

Megatron 3000

- To execute "**`select * from R where `*`condition`***":

  (1) Read dictionary to get R attributes

  (2) Read R file, for each line:

  (a) Check condition

  (b) If OK, display

Megatron 3000

- To execute "**`select * from R where `*`condition`*` | T`**":

  (1) Process select as before

  (2) Write results to new file T

  (3) Append new line to dictionary

Megatron 3000

- To execute "**`select A,B from R,S where `*`condition`*`**`":
  - (1) Read dictionary to get Students,Depts attributes
  - (2) Read Students file, for each line:
    - (a) Read Depts file, for each line:
      - (i) Create join tuple
      - (ii) Check condition
      - (iii) Display if OK

What's wrong with the Megatron 3000 DBMS?

GROUP EXERCISE (15 mins):

On your Syllabus is a number from 1-10:

1. Find all the members of your group
2. Find as many problems with this design as possible.
3. With remaining time, come up with a potential solution to each problem.
4. Have one person come up to board to write down problems.

What's wrong with the Megatron 3000 DBMS?

- Tuple layout on disk

e.g., - Change string from 'Cat' to 'Cats' and we have to rewrite file

- ASCII storage is expensive

- Deletions are expensive

What's wrong with the Megatron 3000 DBMS?

- Search expensive; no indexes

e.g., - Cannot find tuple with given key quickly

- Always have to read full relation

What's wrong with the Megatron 3000 DBMS?

- Brute force query processing

e.g.,
```
select *
from R,S
where R.A = S.A and S.B > 1000
```

- Do select first?
- More efficient join?

What's wrong with the Megatron 3000 DBMS?

- No buffer manager

e.g., Need caching

What’s wrong with the Megatron 3000 DBMS?

- No concurrency control

What's wrong with the Megatron 3000 DBMS?

- No reliability

e.g., - Can lose data

- Can leave operations half done

What's wrong with the Megatron 3000 DBMS?

- No security

e.g., - File system insecure

- File system security is coarse

What's wrong with the Megatron 3000 DBMS?

- No application program interface (API)

e.g., How can a payroll program get at the data?

What's wrong with the Megatron 3000 DBMS?

- Cannot interact with other DBMSs.

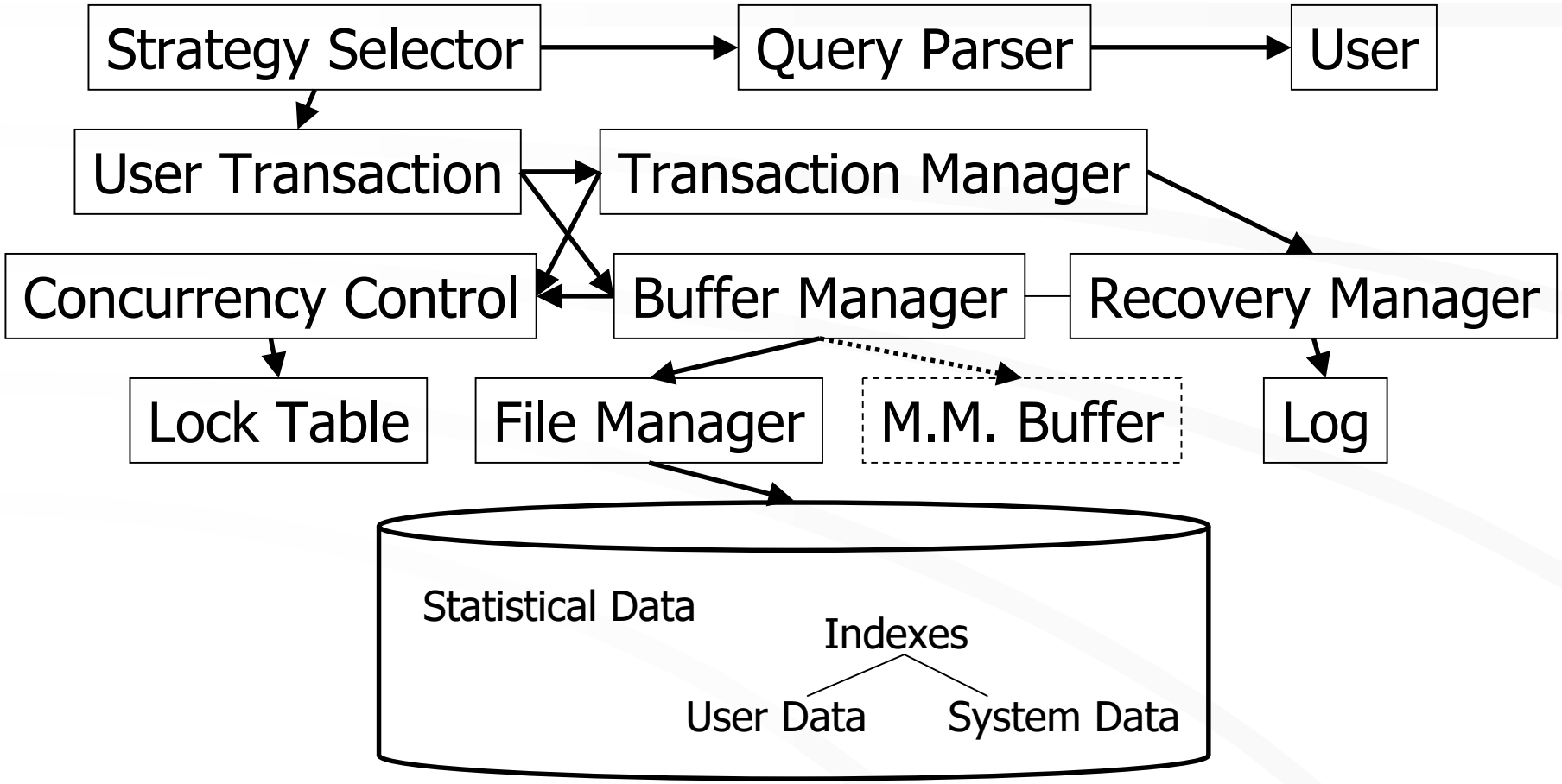
What's wrong with the Megatron 3000 DBMS?

- Poor dictionary facilities

What’s wrong with the Megatron 3000 DBMS?

- No GUI

System Structure



Course Overview

- File & System Structure

  Records in blocks, dictionary, buffer management,…
- Indexing & Hashing

  B-Trees, hashing,…
- Query Processing

  Query costs, join strategies,…
- Crash Recovery

  Failures, stable storage,…

Course Overview

- Concurrency Control

  Correctness, locks,…

- Transaction Processing

  Logs, deadlocks,…

- Security & Integrity

  Authorization, encryption,…

- Distributed Databases/Streaming Data

  Interoperation, distributed recovery,…

Next time:

- Hardware
- Read chapters 1 and 2