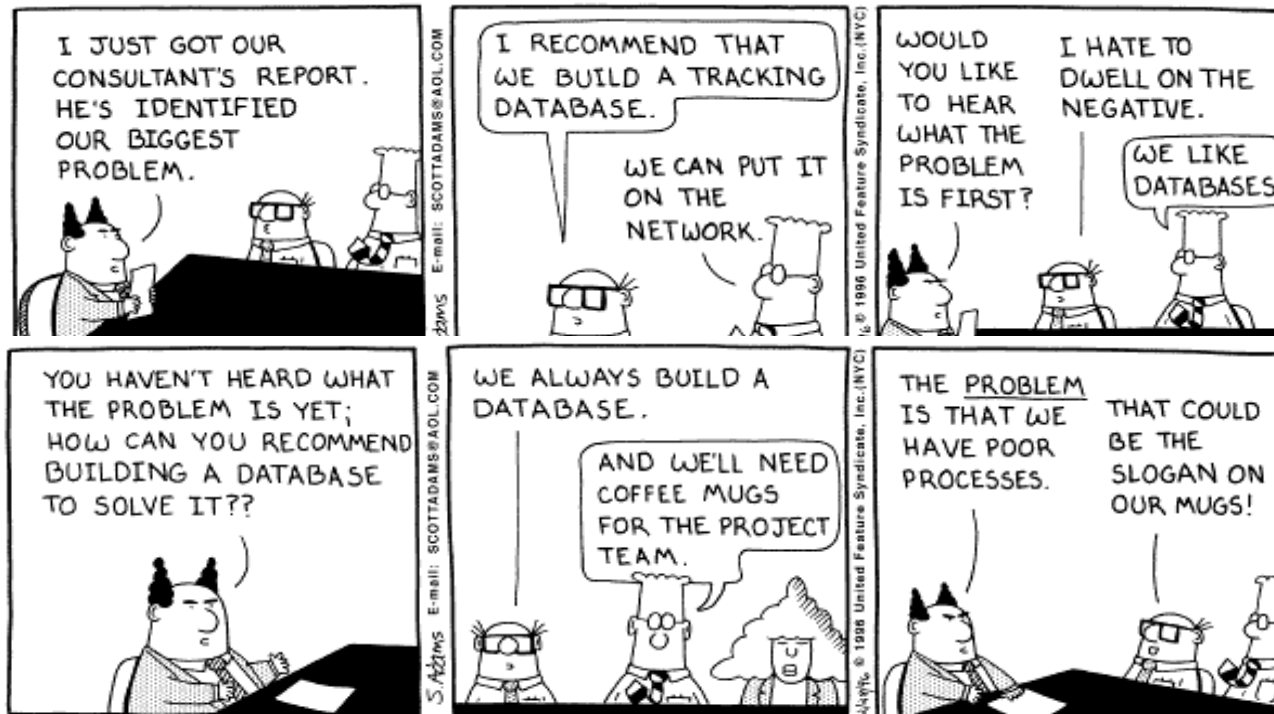


CS3223: Database Systems Implementation

(<https://www.comp.nus.edu.sg/~tankl/cs3223>)



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“Knowledge is of two kinds: we know a subject ourselves,
or we know where we can find information upon it.”

-- Samuel Johnson (1709-1784)

Course Admin

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URL: <https://www.comp.nus.edu.sg/~tankl/cs3223>

TAs: TBD (see course webpage)

CS3223: A “Second” DB Course

CS2102 (Application)

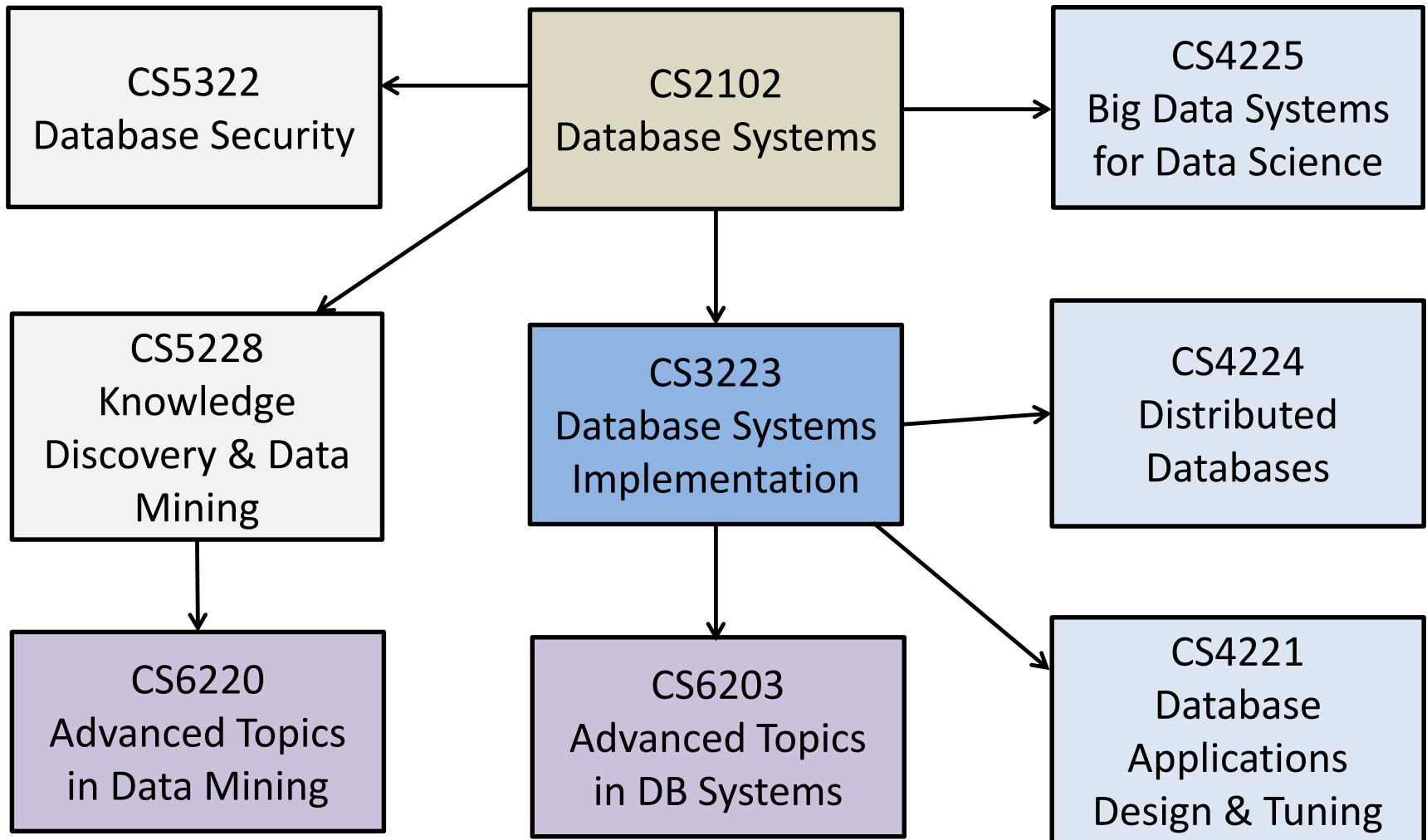
- Database design
 - ER design and normalization theory
 - Integrity management by design
 - Relational model
- Database programming
 - Relational algebra and calculus
 - Query languages
 - SQL
 - Embedded languages

CS3223 (Systems)

Database **Implementation**

- Storage management
 - Disk-based data organization for efficient data access
 - Indexes
 - Buffer management
- Query processing
 - Operators: Sort, join aggregates, etc
 - Query processing and optimization
- Transaction management
 - Concurrency control and recovery
- **System Implementation Project**

Database Courses @ SoC



Course Policies

- Students are responsible for the following:
 - Attend lectures & tutorials
 - Study referenced materials
 - Check course website/LumiNUS/emails for course-related announcements/updates
- Late assignment/project submissions will not be accepted without prior approval from lecturer
- Students can seek clarifications on lecture materials as follows:
 - Post questions to LumiNUS Discussion Forum
 - **Email the lecturer**
 - Emailed questions may be posted to LumiNUS Forum and answered there or emailed to all

Course Policies (cont.)

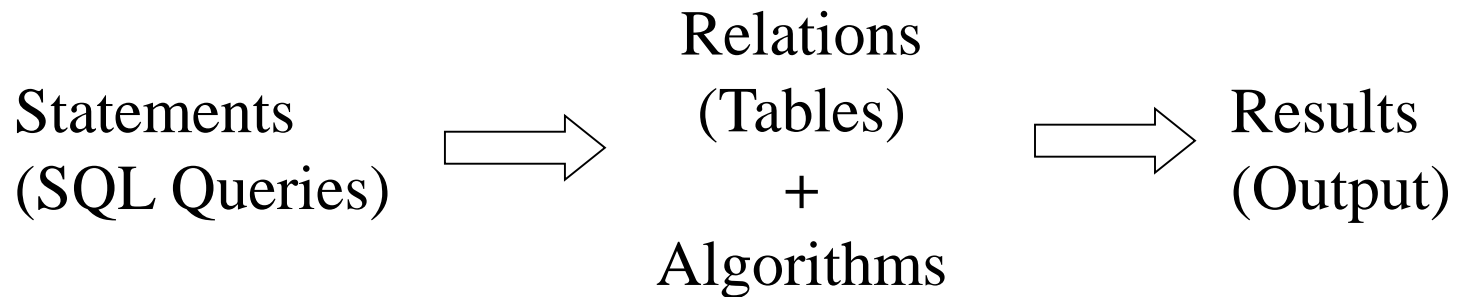
- **Zero-tolerance for plagiarism**

<https://www.comp.nus.edu.sg/cug/plagiarism/>

- Plagiarism is generally defined as the practice of taking someone else's work or ideas and passing them off as one's own (The New Oxford Dictionary of English).
 - *You have the obligation to make clear to the assessor which is your own work, and which is the work of others.* Otherwise, your assessor is entitled to assume that everything being presented for assessment is being presented as entirely your own work. This is a minimum standard.
 - You may not knowingly intend to plagiarise, but that should not be used as an excuse for plagiarism. *You should seek clarification* from your instructors if you are unsure.

Introduction

*Isn't Implementing a (Relational) **Database** (**Management**) System Simple?*



myDBMS: A Simple Implementation

- Relations stored in files (ASCII), e.g., relation R is in /usr/db/R

Smith	#	123	#	CS
Jones	#	522	#	EE

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

R1	#	A	#	INT	#	B	#	STR	...
R2	#	C	#	STR	#	A	#	INT	...

Sample evaluation strategy

- To execute “**select * from R where R.a = 10**”:
 - (1) Read dictionary to get R attributes
 - * Exit if there is any error (e.g., R does not exists, R.a is not of type int)
 - (2) Read R file, for each line:
 - (a) Check condition: R.a = 10?
 - (b) If OK, output/display record

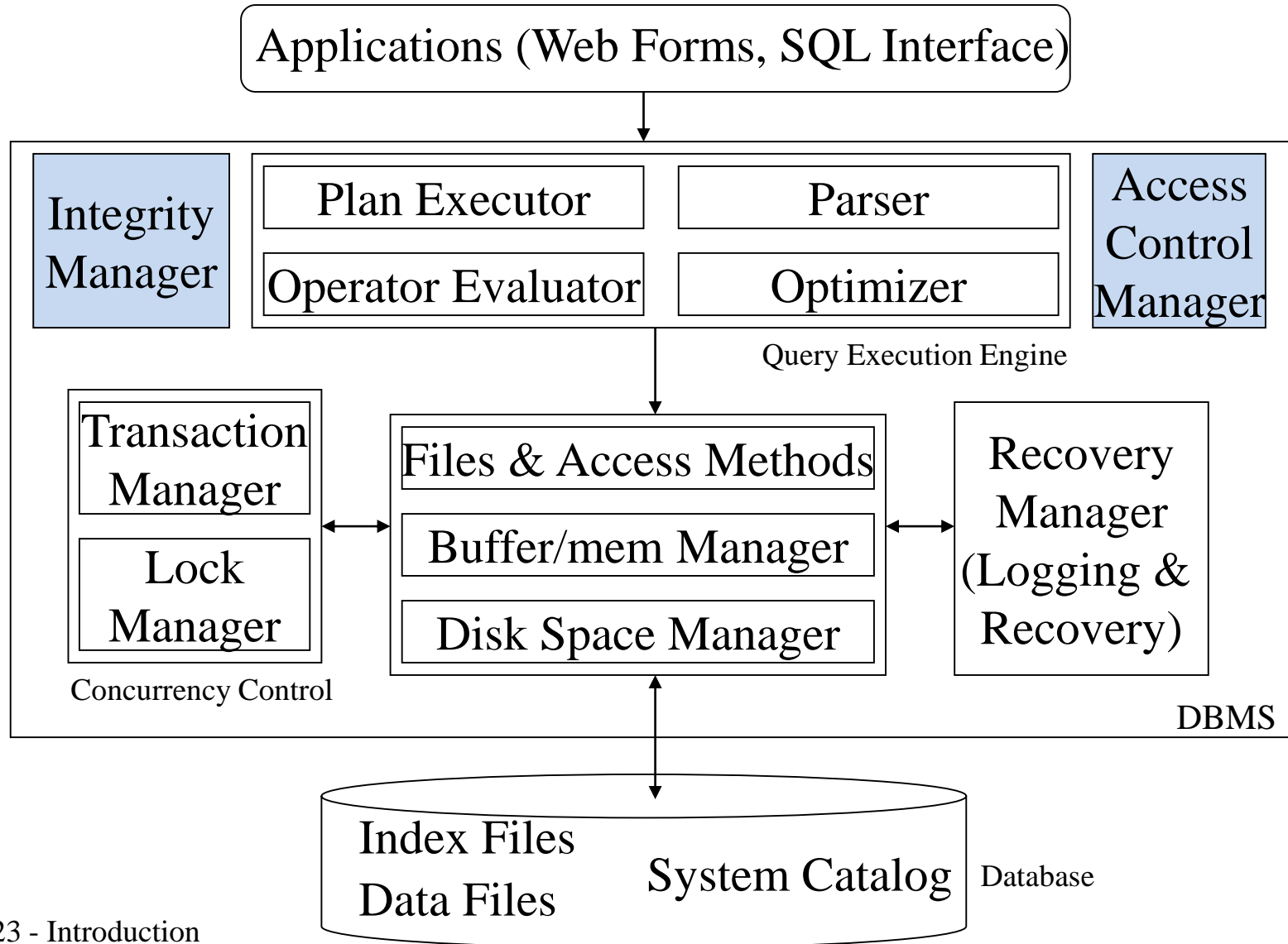
What's “wrong” with myDBMS?

- 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
- Search expensive; no indexes
 - Cannot find tuple with a given key quickly
 - Always have to read/scan full relation
- Brute force query processing

What's wrong with myDBMS?

- No buffer manager
 - Need caching
- No concurrency control
- No reliability
 - Can lose data
 - Can leave operations half done!
- No security
 - File system insecure
 - File system security is coarse
- No application program interface (API)
 - How can a payroll program get at the data?
- No GUI
- Poor dictionary facilities
- Cannot interact with other DBMS/tools

Architecture of a DBMS



Capabilities of a Modern (R)DBMS

- **Persistence** - permanent storage of data
- **Efficiency** - manage *large* volumes of data efficiently
- **High-level access** - data model & language for defining database structures, retrieval and manipulation
- **Transaction management** - provide correct, concurrent access to the database by many users at once
- **Access control** - limit access by unauthorized users
- **Integrity management** - assure compliance to known constraints imposed by application semantics
- **Resiliency** - ability to recover from system failures without losing data