



COMP9311 DATABASE SYSTEMS

- Xuemin Lin

Assignment Project Exam Help

- Office: K17-503

- E-mail: lxue@cse<https://eduassistpro.github.io/>

- Ext: 6493

Add WeChat edu_assist_pro

- <http://www.cse.unsw.edu.au/~lxue>

-
- **www home address of 9311:**

- <http://www.cse.unsw.edu.au/~cs9311>

Course Information

Lectures:

17:00 - 19:00 (Mon)

week 1 – 9

16:00 - 18:00 (Tue)

week 1 – 9

9 weeks lectures in total.

Assignment Project Exam Help

Lab: Held online through Moodle(<https://moodle.telt.unsw.edu.au/>),
in “Lectures and Re
1 – Database Systems
2021 T1).

<https://eduassistpro.github.io/>

week 2 – 5, Add WeChat edu_assist_pro (Monday markup)

Consultation: TBA

Q&A Forum: <https://groups.google.com/group/comp9311-21t1>

Course Email: comp9311unsw@gmail.com

For routine questions, we recommend you use the Q&A forums. You are also welcome to contact us via course email if something is private.

Course Information_(cont)

2 assignments, 1 project. All individual work !

Assignments (50%):

- Ass 1: Data Modelling + Relational Algebra (20%) (week 2-4)
- Ass 2: DB Design Theory + Database Storage Structures + Transaction (30%) (week 7-9)

Projects (50%)

<https://eduassistpro.github.io/>

- Proj 1: SQL & PLpgsql (50%) (week 4-7) r PLpgsql)

Add WeChat edu_assist_pro

Penalty for late submissions:

Assignments: 0 mark for late submissions

Project: 10% reduction for the 1st day, then 30% reduction per day.

Course Information_(cont)

Exam: 100%

- If you are ill on the day of the exam, **do not attend** the exam.
- I will not accept medical special consideration claims from people who have already attempted the exam.

Assignment Project Exam Help

Final Mark by G <https://eduassistpro.github.io/>

- Final mark = $\sqrt{(\text{ass1} + \text{ass2}) / \text{exam}}$

Course Information_(cont)

Text Book:

- Elmasri & Navathe, *Fundamentals of Database Systems*,
Benjamin/Cummings, 6th Edition, 2010.

Assignment Project Exam Help

Reference Books:

- J. D. Ullman & J. <https://eduassistpro.github.io/>
Database Systems, Prentice Hall,
1997. Add WeChat edu_assist_pro
- R. Ramakrishan, *Database Management Systems*, McGRAW-HILL, 1997.
- D. Maier, *The Theory of Relational Databases*, Computer Science Press,
1983.

Course Outline

Time	Monday	Tuesday
Week 1	Subject Introduction, Conceptual DB Design (ER)	Conceptual DB Design (continue), Relational Data Model
Week 2	Relational Data Model(continue), Relational Algebra	SQL
Week 3	SQL(continue), PL/pgSQL	Functional Dependencies
Week 4	Functional Normal F	al Forms (continue) https://eduassistpro.github.io/
Week 5	Relational DB design	al DB design (continue)
Week 6	Disks, Files	Add WeChat edu_assist_pro
Week 7	Transaction Management	Transaction Management (continue)
Week 8	Graph Data and Graph Database	Graph Pattern Matching
Week 9	Towards Big Graph Processing: applications and challenges	Revisions

Introduction

Database Applications:

- Banking System,

- Stock Market,

Assignment Project Exam Help

- Transportation,

- Social Network,

<https://eduassistpro.github.io/>

- Marine Data Analysis,

Add WeChat edu_assist_pro

- Criminal Analysis and Control,

- Now, BIG DATA....

Introduction

Intelligent Transportation

Business Services

Natural Disasters

Assignment Project Exam Help

<https://eduassistpro.github.io/>

Add WeChat **edu_assist_pro**



Public Health

Modern Military

Tourism Development

Introduction

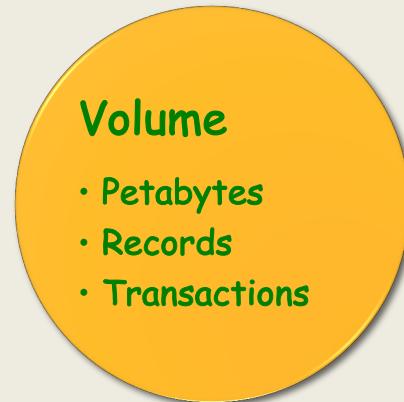
Assignment Project Exam Help

[https://eduassistpro.github.io/
Beta-Catenin Biological Network](https://eduassistpro.github.io/Beta-Catenin_Biological_Network)

Add WeChat [edu_assist_{WeChat}_pro](#)

Social Network

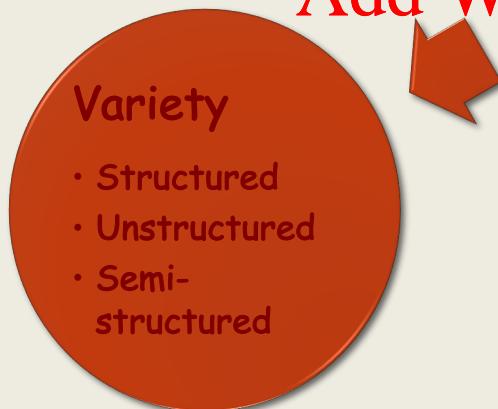




Assignment Project Exam Help

<https://eduassistpro.github.io/>

Add WeChat edu_assist_pro



Velocity

- Batch
- Real time
- Streaming

Major Research Issues

New Computing Platform/Architecture

New Graph Analytics Models

Assignment Project Exam Help
New Processing Algorithms & Indexing

<https://eduassistpro.github.io/>
System

Add WeChat edu_assists_pro

- Query language
- Distributed techniques
- Storage
- etc

Introduction(cont)



Develop a *good* database system:

Assignment Project Exam Help

Effectively organize data (database design).

Efficiently execute users queries (transaction management).

<https://eduassistpro.github.io/>



These are even more important in modern applications, e.g. internet:

Add WeChat edu_assist_pro

e unstructured
ation is available in
ernet.

Must access the information efficiently and effectively

What is data?

Data - (Elmasri/Navathe):

known facts that can be recorded and have explicit meaning . . .

Item	Type of data	Stored as
Family name	String	Character
Birthdate	Date	https://eduassistpro.github.io/
Weight	Real number	Floating point number?
...		

student records

Add WeChat edu_assist_pro
ormation identifying students, courses they are enrolled in, results from past courses . . .

What is a database?

Elmasri/Navathe:

- . . . a collection of related data . . .

Data items alone are relatively useless.

Assignment Project Exam Help

We need the data t

<https://eduassistpro.github.io/>

Database can be manipulated by a data

Add WeChat edu_assist_pro

What is a database management system (DBMS)?

Elmasri/Navathe:

- *DBMS*: . . . a collection of programs that enables users to create and maintain a database . . .
- *Database system* . . . The database and DBMS together . . .

<https://eduassistpro.github.io/>

Add WeChat edu_assist_pro

Database requirements

Database system provides facilities to:

- *Define a database* - specifying the data items to be stored and their types,
- *Construct a database* - loading the data items and storing them on some storage medium (usually disk),
Assignment Project Exam Help
- *Manipulate a data* <https://eduassistpro.github.io/>
 - querying - i.e. retrieving relevant data,
 - updating - i.e. adding, deleting or modifying data
 - from one “correct” state to another “correct” state,
- *reporting*

Add WeChat edu_assist_pro

Database requirements_(cont)

Database system must be

- *Timely* - e.g. an airline database (fast response), a CAD system (must be interactive),
 - *Multi-user* - e.g. trading system,
 - *Modifiable* - must be able to be extended or reorganised, e.g. to cope with new laws, requirements, busi
- Assignment Project Exam Help
- Add WeChat edu_assist_pro
- <https://eduassistpro.github.io/>
- *Secure* - different classes of users may have different levels of access,
 - *No redundancy*,
 - *Robust* - e.g. power failure during an update - must be able to recover to a consistent state.

Database requirements_(cont)

A database system must address these issues and provide solutions - DBMS:

- *a special purpose DBMS,*
- *a general DBMS*

Assignment Project Exam Help

<https://eduassistpro.github.io/>

The DBMS solution vs meta-d
Add WeChat edu_assist_pro

To allow a general DBMS to be applied to a particular database application, we need **meta-data**.

Database requirements_(cont)

Meta-data: a definition and description of the stored database, such as structure of each file, type and storage format of each data item, constraints etc.

Assignment Project Exam Help
Stored in the system *catalog*.

<https://eduassistpro.github.io/>

Add WeChat **edu_assist_pro**

Benefits of meta-data

program-data independence - DBMS access programs may be written independent of file structures and storage formats,

data abstraction - information hiding

Assignment Project Exam Help

- Users are provided with a *data model*. They can manipulate the data using a high level language.

<https://eduassistpro.github.io/>

Add WeChat edu_assist_pro

support for views - different users can have different views of the database. e.g.

- salary details may be hidden from some users,
- statistical summaries may be derived and appear as stored data for some users.

Database personnel

Database Administrator(DBA) - This person is responsible for the centralised control of the database:

- authorising access

Assignment Project Exam Help

- monitoring usage,

- recovery,

<https://eduassistpro.github.io/>

- identifying the data,

Add WeChat edu_assist_pro

- choosing appropriate structures to represent and store the data,

- managing definitions of views . . .

Database personnel_(cont)

End user - People requiring access to the database for querying, updating, reporting etc.

- Naive (parametric) user - typically use the database via “canned transactions”
 - standardised queries and updates, often through a menu system of some kind,
 - Online user - has a stem. May be capable of designing their own queries etc.
- <https://eduassistpro.github.io/>
[Assignment Project Exam Help](#)
[Add WeChat edu_assist_pro](#)

Database personnel_(cont)

Systems analyst:

- determine end users requirements,
- develop specifications for canned transactions and reports,
- may also take part in database design.

Assignment Project Exam Help

Application progra

ations given by

analyst:

Add WeChat edu_assist_pro

- tests,
- debugs,
- maintains the resulting programs.

DBMS concepts

Data model: a set of concepts that is used to describe the allowed structure of a database. i.e. the structure of the meta-data.

May be classified as:

Assignment Project Exam Help

- High-level or conceptual (concerns entities, attributes and relationships)
<https://eduassistpro.github.io/>
- Implementation or record-based (e.g. RDBMS, Hierarchical - suggests a physical implementation)
- Low-level or physical (concerns record formats, access paths etc)

Add WeChat edu_assist_pro

DBMS concepts_(cont)

Database Schema: An instance of a data model, that is, a description of the structure of a particular database in the formalism of the data model. (Intention)

Database Instance (or State): The data in the database at a particular time.

(Extension) **Assignment Project Exam Help**

In these terms:

<https://eduassistpro.github.io/>

- We define a database by specifying its schema.
Add WeChat edu_assist_pro
- The state is then an empty instance of the schema.
- To create the initial instance we load in data.
- After this, each change in state is an update.

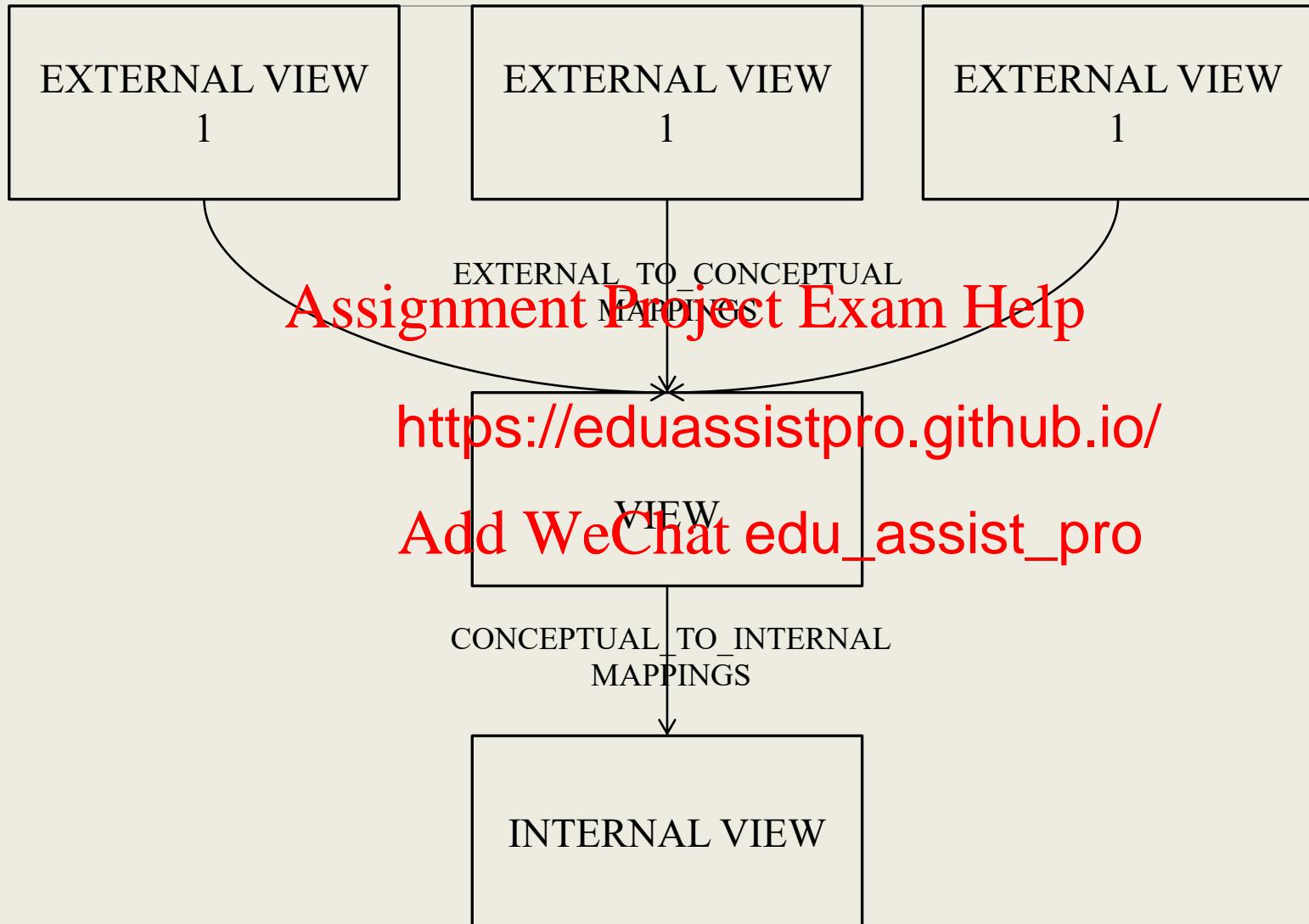
ANSI-SPARC three level architecture

ANSI: American National Standard Institute.

SPARC: Standards Planning and Requirements Committee.

ANSI-SPARC ~~Three level architecture (1975-1977)~~ Assignment Project Exam Help

- The *external* or *view level* describes the external schemas or user views.
<https://eduassistpro.github.io/>
Add WeChat edu_assist_pro
- The *conceptual level* has a conceptual schema, which describes the structure of the whole database for a community of users.
- The *internal level* has an internal schema, which describes the physical storage structure of the database.



ANSI-SPARC three level architecture_(cont)

3 levels of abstraction => 2 levels of data independence:

- *logical data independence*: the ability to change the conceptual schema without changing external views. Must change the external-to-conceptual mapping though.
- *physical data inde* <https://eduassistpro.github.io/> yscal storage paths and access structures without changing the c . Must change the conceptual-to-internal mapping though.

Assignment Project Exam Help

Add WeChat edu_assist_pro

Database languages

In the three level architecture:

- *Data definition language (DDL)*: used to define the conceptual schema.
- *View definition language (VDL)*: used to define external schemas.
- *Storage definition language (SDL)*: used to define the internal schemas.

<https://eduassistpro.github.io/>

In DBMS where co mixed up, DDL is
used to define both schemas.

Add WeChat edu_assist_pro

Database languages_(cont)

Data manipulation language (DML): used to construct retrieval requests (queries) and update requests:

- Low-level or procedural

◦ embedded in a general purpose language,

◦ record at a time

Assignment Project Exam Help

<https://eduassistpro.github.io/>

- High-level or non-p

◦ interactive and/or embedded

Add WeChat edu_assist_pro

◦ set at a time/ set oriented.

In most current DBMSs, a comprehensive integrated language is used; for example SQL.

Database components

See Fig2.3 in Elmasri/Navathe.

Run-time database processor - Receives retrieval and update requests and carries them out with the help of the stored data manager.

Assignment Project Exam Help

Stored data manager or file manager - Controls access to the DBMS information stored on disk:

- may use the OS for disk a <https://eduassistpro.github.io/>
- controls other aspects of data transfer, such as handling

Add WeChat edu_assist_pro

Pre-compiler - Extracts DML commands from the host language program.

- These are compiled by the DML compiler, the rest is compiled by the host language compiler, then they are linked to produce executable code with calls to the data manager.

Query processor (or Complier) - Parses high-level queries and converts them into calls to be executed by the data manager.

Assignment Project Exam Help

<https://eduassistpro.github.io/>

Add WeChat edu_assist_pro

Component modules of a DBMS and their interactions.