



Week17_Course

Database System Summary





Outline – 重点掌握的内容

- Introduction to DBMSs (重点知晓数据库系统的三层模式结构和两层映像的功能)
- Principles of Data Layout and Index (本章不考核)
- The Entity Relationship model
- E/R to Relational Transformation
- SQL: Introduction
- SQL: Advanced
- DB Schema Design (考核所有知识点)
- Relation Algebra & Query Processing (关系代数基本操作, 查询处理优化基本逻辑)
- Crash Recovery (考核所有知识点)
- Concurrency Control (掌握优先图、两段锁等并发思想, Timestamp & Validation 不考核)

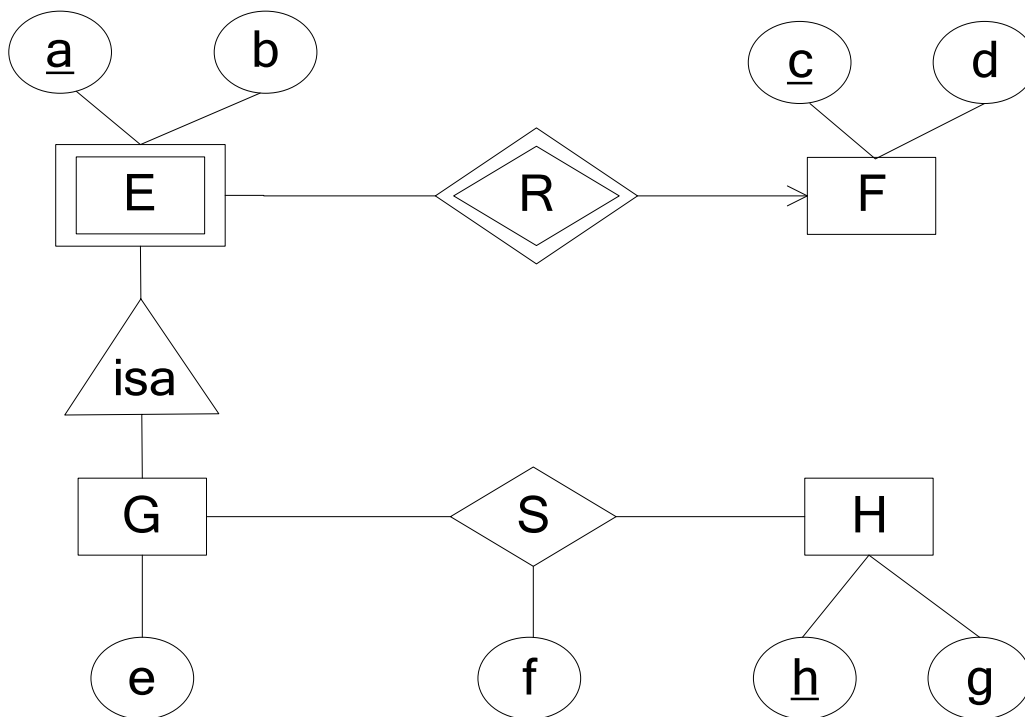
(ER转化为关系模型、SQL操作, 主外键约束)



知识点一：Data Models

概念模型与关系模型转换

应该明确了解实体、属性、联系、弱实体集和子类的概念。



Transform the E-R diagram into relation model (in 3NF)

Write SQL statements that create the tables





知识点一：Data Models

概念模型与关系模型转换

- Transform the following E-R diagram into relation model (in 3NF)

– Based relation model you designed fill the following table

关系表名	表中含有属性	主键	外键	参照表名及属性
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- Write SQL statements that create the tables including the foreign key and primary key indications according to E-R diagram.
- Describe which insert and delete operations in this database must be checked to ensure that referential integrity is not violated for that foreign key

(参照写法：On insert(SC) -> exists(Student) and exist(Course);

On delete(Student) -> delete(SC) or not allowed)



知识点二： Normal Form

关系模式设计

- 重点掌握3NF、BCNF，掌握保持无损连接和函数依赖的模式分解的算法，会判断是否无损链接，会找键。
 - FD and attribute closure
 - keys and superkeys
 - normal form(3NF,BCNF,4NF)





知识点二： Normal Form

关系模式设计

Consider a relation $R = (.....)$ with FD's

- What is the attribute **closure** of ***?
- Of the following FDs, circle the ones that are **implied by the functional dependencies** given above.
- List **all keys** for R.
- Which of the given functional dependencies are **BCNF/3NF violations**?
- We decompose R into $R_1(...)$ and $R_2(...)$. What are the **keys** of R_1/ R_2 ? Is this decomposition (i) **dependency preserving**, and (ii) **lossless join**?
- Decompose R into two or more relations that are all in **3NF**. And make sure your decomposition is (i) dependency preserving, and (ii) lossless join.
- Relation $R_3(...)$ satisfies the **multi-valued dependency** ... and has tuples ... Which of the following ... is not necessarily in the current instance of R?



知识点三：SQL Queries

SQL语言操作

- DDL (table, view)
- DML (select)
- 能够使用SQL语句实现用户查询，包括LIMIT等的使用
- DCL (grant diagram)





知识点四

Relational Algebra and Query Processing

- Write the relational algebraic expression
(Including division operation)
- State if the following expressions are equal and
justify your answer
- Draw the optimized expression tree.





知识点五：数据库故障恢复

- 掌握日志的记录方式：What are the all of the possible values on disk for each of the database elements A, B and C?
- 掌握日志的恢复过程：Which, if any, transactions will need to be redone and undone in the recovery process?
- 知道日志恢复后数据库的正确状态：If finished the system recovery, what are the values on disk for each of the database elements A, B and C





知识点六：并发控制

- 若干事务并发运行，能够判断所给的调度是不是可串行化调度（优先图），或者加锁的几个事务交叉运行时会不会破坏数据库的一致性
- 深刻理解两段锁的三个封锁协议（Well-formed transactions, Legal scheduler, Two phase locking），能够进行判断
- 了解死锁是怎样形成的
- 多粒度锁的原理（S/X/IS/IX）



Key Questions We Will Answer

- How can we **collect and store** large amounts of data?
 - By building tools and data structures to efficiently index and serve data
- How can we **efficiently query** data?
 - By compiling high-level declarative queries into efficient low-level plans
- How can we **safely update** data?
 - By managing concurrent access to state as it is read and written

The world is increasingly **driven by data...**