**《数据库系统》课外练习**

**一、单选题**

1. 一般不适合建立索引的属性有( D )。

A. 主码和外码

B. 可以从索引直接得到查询结果的属性

C. 对于范围查询中使用的属性

D. 经常更新的属性

1. （ D ）是存储分配和数据传输的基本单元。

A. 记录 B. 页 C. 文件 D. 数据块

1. 在静态散列中，如果我们插入一条记录，而桶没有足够的空间，就会发生（ C ）。A. 桶分裂 B. 数据丢失 C. 桶溢出 D. 桶合并
2. “年龄在15至30岁之间”这种要求属于DBMS的（ C ）功能。

A. 恢复 B. 并发控制 C. 完整性约束 D. 安全性

1. 超码、候选码和主码之间的关系是（　C　）。

A． 超码⊆候选码⊆主码 B. 超码⊆主码⊆候选码

C. 主码⊆候选码⊆超码 D. 主码⊆超码⊆候选码

1. 关于对象-关系数据库系统，下面描述正确的是（ B ）。

A. 只支持简单数据类型

B. 通过使用复杂数据类型支持复杂数据的存储和查询

C. 不支持扩展ER模型

D. 面向对象编程语言不能直接访问数据

1. 在SQL的排序子句中，ORDER BY 总分 DESC，英语 DESC表示（ B ）。

A. 总分和英语分数都是最高的在前面

B. 总分和英语分数之和最高的在前面 总分高的在前面，总分相同时英语分数高的在前面

C. 总分和英语分数之和最高的在前面，相同时英语分数高的在前面

D. 总分和英语分数之和最高的在后面，相同时英语分数高的在前面

1. 在数据库系统中，空值是（　D 　）

A. 0 B. 空格 C. 空字符串 D. 不确定

1. 多个事务的指令实际上是按照一定的顺序执行的，这种执行顺序称为（ D ）。

A. 调度 B. 排序 C. 协议 D. 串行

1. 为了保证在系统崩溃的时候能够恢复日志记录，下面正确的做法是（ B ）。

A. 在事务提交日志记录输出到稳定存储器前，事务可以进入提交状态

B. 事务提交日志记录输出到稳定存储器前，与该事务相关的所有日志记录必须已经输出到稳定存储器。

C. 直接将日志记录输出到稳定存储器

D. 在数据库中数据修改后，其相关的日志记录才输出到稳定存储器中。

1. 在SQL聚集函数中，不忽略聚集属性上空值的是（ C ）。

A. MIN B. AVG C. COUNT D. SUM

1. DB、DBMS和DBS三者之间的关系是（ B 　）。

A. DB包括DBMS和DBS B. DBS包括DB和DBMS

C. DBMS包括DB和DBS C. DBS与DB和DBMS无关

1. 为了提高数据的存储和访问速度，出现了很多技术，下列不包括的是（ D ）。

A. 缓冲 B. 预读 C.文件组织 D.硬盘存储

1. 代数优化中最常用的变换原则是（ A ）。

A. 尽量缩减查询过程中的中间结果

B. 在连接操作时,先做大关系连接，再做小关系连接

C. 先做二元操作，再作一元操作

D. 不考虑中间结果大小

1. 造成事务故障的原因可能是（ A ）。

A.逻辑错误

B.硬件错误

C.软件漏洞

D.设备故障

**16.** Consider the following table Games(name, price) and assume that these values already exist in the database: ('game1', 40), ('game2', 50),

('game3', 60).  We have the following two transactions:

T1: BEGIN TRANSACTION

S1: UPDATE  Games SET price=10 WHERE name='game1'

S2: INSERT INTO Games VALUES ('Game4', 0)

    S3: UPDATE Games SET price=30 WHERE name='game1'

    COMMIT;

T2: BEGIN TRANSACTION

    S4: SELECT AVG(price) AS average\_price FROM Games

    COMMIT;

Above two transactions are hitting the DBMS roughly at the same time.

Suppose T2 must appear to be executed either completely before or completely after T1 , What are the possible values for average\_price?

I.  50

II. 44

III. 30

a)    I only.

b)    II only.

c)    I & II.

d)    I & III.

**answer is** ( a ) 50 35

**17.**Let R(A, B, C) satisfy the following functional dependencies (FDs): AB -> C, BC -> A, and AC -> B. The closure of A (i.e., A+) is

a)      A

b)      AB

c)      AC

d)     ABC

a

**18.** Suppose we have a relation R(A,B,C) and the FD's

AB-> C, A-> B, B-> C

What is true about the key(s) for R?

(a) Only A is a key

(b) Only AB is a key

(c) Only AB and AC are keys.

(d) Only AB, AC, and BC are keys

a

19.If R(A, B, C,D) satisfy the following functional dependencies (FDs): {A->B,AB -> C, BC -> D, and AC ->BD}. The closure of AD (i.e., (AD)+) is

a)   A

b)   AB

c)   ABC

d)  ABCD

d

20.As is well known, A DBMS suppots concurrent access to data. It can be accessed simultaneously by many distinct processes which are called transactions.

Which of the following is not a property of ACID TRANSACTION?

1. Atomicity
2. Concurrency
3. Isolation
4. Durability

**answer is** ( B )

21.If R(A，B，C，E, H, P, G) satisfies the following functional dependencies (FDs): { AC→PE, PG→A, B→CE, A→P, GA→B,GC→A, PAB→G, AE→GB, ABCP→H}. The closure of BG (i.e., (BG)+) is

a)  ABCEPG

b)  BCE

c)  BGCE

d)  ABCEHPG

ABCEGHP

d

**二、简答题**

**Question 1.**

Please explain the storage mechanism in database and compare B+ -tree index and hash index.

**Question 2.**

As is well known, A DBMS suppots concurrent access to data. It can be accessed simultaneously by many distinct processes which are called transactions.

Please descript the four properties (ACID) of Transaction.

**Question 3.**

Please explain why log record is needed in recovery system.

**Question 4.**

Please explain the concept of dead lock and the resolution for dead lock.

**Question 5.**

Please compare Hash indexing and B+-tree indexing.

**Question 6.**

Please describe the recovery process of log-based recovery mechanisms, and give out an example.

**Question 7.**

Please explain the recovery strategies according to different failure types in database systems.

**Question 8.**

Please explain the concept of transaction and its properties.

**Question 9.**

Why do we need use index structure in database system? Can you list the popular types of index and compare them?

**Question 10.**

Please describe the concept of dead lock(死锁) and starvation（活锁） in concurrency control.

**Question 11.**

Please explain the Log-Based（基于日志） recovery mechanism using an example

**Question 12.**

Please describe the concept of dense index （稠密索引）and sparse index（稀疏索引） using an example, and the advantages and

disadvantages of them.

**Question 13.**

请简述数据库中事务的特性及其与并发控制和故障恢复的联系。

事务是恢复和并发控制的基本单位

**Question 14.**

请简述基于检查点日志的恢复技术及其优势。

**Question 15.**

下图是T1和T2两个事务的一个并发执行调度，请分析该调度是否合理？为什么？

|  |  |
| --- | --- |
| T1 | T2 |
| LOCK-S (B) |  |
| READ B |  |
| LOCK-X (A) |  |
|  | LOCK-S (A) |
|  | READ A |
| A=B+1 |  |
| Write A |  |
| UNLOCK B |  |
| UNLOCK A |  |
|  | LOCK-X (B) |
|  | B=A+1 |
|  | Write B |
|  | UNLOCK A |
|  | UNLOCK B |

不合理。锁处理不对。

**三、SQL知识**

**Question 1.**

Consider the following relational schemas:

STORE(SNO,DNAME,EMP,CITY)

GOODS(GNO,GNAME,PRICE,QTY)

SUPPLY(SNO,GNO,QTY)

where EMP in relational schema STORE denotes the quantity of employees in a certain STORE.

STORE

|  |  |  |  |
| --- | --- | --- | --- |
| SNO | SNAME | EMP | CITY |
| 101 | Isetan Store | 15 | SHANGHAI |
| 204 | Xinshiji Store | 89 | CHONGQING |
| 256 | Xidan Store | 500 | BEIJING |
| 345 | Chongqing Store | 76 | CHONGQING |
| 620 | Pacific Store | 412 | SHANGHAI |

GOODS

|  |  |  |
| --- | --- | --- |
| GNO | GNAME | PRICE |
| 1 | pen | 21 |
| 2 | Basket ball | 5 |
| 3 | notebook | 300 |
| 4 | bag | 76 |

SUPPLY

|  |  |  |
| --- | --- | --- |
| SNO | GNO | QTY |
| 101 | 1 | 105 |
| 101 | 2 | 42 |
| 101 | 3 | 25 |
| 101 | 4 | 104 |
| 204 | 3 | 61 |
| 256 | 1 | 241 |
| 256 | 2 | 91 |
| 345 | 1 | 141 |
| 345 | 2 | 18 |
| 345 | 4 | 74 |
| 620 | 4 | 125 |

1) Please write the following queries in SQL

(1).Find out all the names of stores whose quantity of employees is not greater than 100 or located in CHONGQING.

select SNAME

from STORE

where EMP <= 100 and city != ’CHONGQING’;

(2).Find out the name of stores that supply bags.

select SNAME

from STORE,GOODS,SUPPLY

where GNAME = ’bag’ and SUPPLY.GNO = goods.gno and SUPPLY.SNO = STORE.SNO;

(3).Find out the name and location of stores, which supply all the goods that are supplied by the stores that at least supply ‘256’goods (找出至少供应代号为256的商店所供应的全部商品的商店名和所在城市)

select SNAME,CITY

from STORE natural join SUPPLY

where GNO in(

select GNO

from SUPPLY

where SNO = ’256’

);

2) Provide users the view of information (name, quantity, price) about the goods supplied by each store, using SQL.

create view V as

select GNAME, QTY, PRICE

from STORE natural join GOODS natural join SUPPLY;

3) Suppose that user A is the owner of the relation STORE and no other user holds privileges on them initially, the following are executed:

by A: GRANT DELETE ON STORE TO B WITH GRANT OPTION;

by B: GRANT DELETE ON STORE TO C WITH GRANT OPTION;

by C: GRANT DELETE ON STORE TO D WITH GRANT OPTION;

by D: GRANT DELETE ON STORE TO B WITH GRANT OPTION;

a .Please complete the following requirement in SQL:

user B will revoke the privilege of delete from user C with cascade option;

revoke delete on STORE from C;

或revoke delete on STORE from C cascade;

b. Which is the exact set of users that have the privilege DELETE ON STORE after all the above executions including execution in question a.?

AB

**Question 2.**

We have the statements of Q1 and Q2:

Q1:

SELECT DISTINCT a

FROM R

WHERE b > 10;

Q2:

SELECT a

FROM R

WHERE b > 10

GROUP BY a;

Which of the following answer is correct?

(a) Q1 and Q2 produce the same answer.

(b) The answer to Q1 is always contained in the answer to Q2.

(c) The answer to Q2 is always contained in the answer to Q1.

(d) Q1 and Q2 produce different answers.

A

**Question 3.**

Relation R(a, b, c) currently has the following instance:

{(1; 2; 3), (3; 4; 2), (2; 6; 1)}

We make the following view definitions:

CREATE VIEW V AS

SELECT a\*b AS d, c FROM R;

CREATE VIEW W AS

SELECT d, SUM(c) AS e FROM V GROUP BY d;

What is the sum of all the components of all the tuples of the following query?

SELECT AVG(d), e FROM W GROUP BY e;

(a) 10

(b) 7

(c) 23

(d) 28

A

7 3 sum为10

**Question 4.**

Suppose there are two system tables in the database named systable and syscolumn, as following forms. Careful study the forms, Please fill the contents of the tables after execution of the following sql statement

Create table Student(

id int,

classnumber int,

name char(20),

gender char(2),

birthday datetime )

Table: systable

|  |  |  |  |
| --- | --- | --- | --- |
| Tableid | tablename | createdate |  |
| 1 | course | 2014-5-10 |  |
| 2 | teacher | 2014-5-11 |  |
| 3 | Student |  |  |
|  |  |  |  |
|  |  |  |  |

Table: syscolumn

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| tableid | columnid | columnname | columntype | columnlength |
| 1 | 1 | id | int | 4 |
| 1 | 2 | name | char | 20 |
| 1 | 3 | credit | float | 8 |
| 2 | 1 | id | int | 4 |
| 2 | 2 | name | char | 20 |
| 2 | 3 | phone | char | 20 |
| 2 | 4 | office | char | 20 |
| 3 | 1 | id | int | 4 |
| 3 | 2 | Classnumber | int | 4 |
| 3 | 3 | Name | char | 20 |
| 3 | 4 | gender | char | 2 |
| 3 | 5 | birthday | datetime | 8 |

**四、应用题**

**Question 1.**

Design database **for a supermarket company** that best represents the following five stipulations(规定/条款):

(1)The supermarket company has several warehouses（仓库）, several chain stores（连锁店）, and supplies several merchandises（商品）.

(2)One manager manages one chain store where several cashiers(收银员) work, and each cashier can only work in one chain store.

(3) Several kinds of merchandises are sold in each chain store and each kind of merchandise can be sold in different chain stores.

(4)Each merchandise ID has the corresponding merchandises name while different merchandise IDs can relate to the same merchandise name, and each kind of merchandise may have several kinds of prices.

(5)The purchasers (采购员)are responsible for the purchase of merchandises(进货) for the supermarket company.

Please complete your design in the following two steps:

a. draw an E-R diagram;

b. translate the above E-R diagram into a set of relational schemas, and a list of constraints, including primary-key and foreign-key constraints.

**Question 2.**

Suppose the functional dependency set F for relation R(A,B,C,D,E,F)is shown as follows：

F＝{A→C，C→A，B→AC，D→AC}

(1).Find out the candidate keys for R。BDEF

！注意函数依赖中可能不包含部分属性，要看关系的属性集(EF)！

(2).Find out the minimal cover Fmin of F。

Fmin＝{A→C，C→A，B→A, B→C，D→A, D→C}＝{A→C，C→A，B→C，D→C}

或{A→C，C→A，B→A, D→A}

(3).Decompose R into 3NF satisfying lossless join and preserving dependency.

R2={A,C} F2={ A→C，C→A }

R3={B,C} F3={ B→C}

R4={D,C} F4={ D→C}

R5={B,D,E,F} F5={ }

**Question 3.**

Consider the following three database schemas:

Student(SNO,SNAME,AGE,SEX)

Course(CNO,TITLE,INSTUCTOR)

SC(SNO,CNO,GRADE)

1）Please write the queries in relational algebra(关系代数) according to the description：

a. find out the names of all students who take the course“C language”;

投影SNAME(选择TITLE=“C language”(Student自然连接（Course自然连接SC）))

b. find out all the titles and grades of the courses given by instructor “Tom”, which the student named “Mike”takes;（找出学生Mike选修的老师Tom教的课程的课程名和成绩）

投影TITLE,GRADE (选择SNAME = “Mike” and INSTRUCTOR = “Tom” (Student自然连接（Course自然连接SC）))

c. find out the names of the students who are older than 20 and the courses that they take.

投影 SNAME,TITLE（选择AGE>20（Student自然连接（Course自然连接SC））)

2）Optimize the relational algebra expression a. in 1), draw the optimized relational algebra expression tree.

**Question 4.**

Consider the following database schema:

Paintings(artist, work, date, museumname)

Museums(museumname, city, curator)

We have the statement:

SELECT curator

FROM Paintings, Museums

WHERE Paintings.Museumname= Museums.museumname AND

Paintings.artist=’ LeonardodaVinci’ (达。芬奇)

Please give the process of the query optimization for the statement above.

**Question 5.**

Suppose we have a relation R(A,B,C) and the FD's

AB-> C, A-> B, B-> C

1) What are the keys for R? A

2) To decompose R into 3NF.

F1={ A-> B } F2={ B-> C }

**Question 6.**

Consider the following three database schemas:

Student(SNO,SNAME,AGE,GENDER)

Course(CNO,TITLE,INSTUCTOR)

SC(SNO,CNO,GRADE)

Suppose that there is a query like “Find out the names and grades of the students who take the course “Database system”, please resolve the following questions:

1）Please write the query in relational algebra expression(关系代数表达式) according to the description：

投影SNAME,GRADE(选择TITLE=“Database system”(Student自然连接（Course自然连接SC）))

2）Assume that there are 1000 records in Student , 100 records in Course, and 10000 records in SC, and indexing on the primary key respectively. Please Optimize the relational algebra expression for the above query and draw the optimized relational algebra expression tree（语法树）.

**Question 7.**

Suppose there are two transactions as below:

T1：Read(B)；Read(A); A=B+1；Write(A)

T2：Read(B)；Read(A); B=A+1；Write(B)

1. Suppose that A=2, B=2 initially, the execution of a certain concurrent schedule results in A=3、B=3 , please tell whether the concurrent schedule is correct or not, Why?

Not ，串行结果为3，4或4,3.

（2）Please give a （conflict）serializable schedule for T1 and T2 using lock-based protocol along with（以及） its execution result.

T1：SB;Read(B)；XA;Read(A); A=B+1；Write(A);USB;UXA;commit

**Question 8.**

Suppose we have a relation R(A,B,C,D,E,F) and the FD's

{A-> BC,D->EF, B->E，A->E}

1) What is true about the key(s) for R?

(a) Only A is a key

(b) Only D is a key

(c) Only AD is a key.

(d) A and D both are keys

C

2) To decompose R into 3NF

{A->B, A->C, D->E, D->F, B->E，A->E}

{A->B, A->C, D->E, D->F, B->E}

F1={ A->B, A->C }

F2={ D->E, D->F }

F3={ B->E }

F4={ AD }

**Question 9.**

Suppose two relations E1 and E2 as follows, E2 is the result of relational operation on E1. Please write the corresponding relational operation expression(关系代数表达式).

|  |
| --- |
| E2 |

|  |
| --- |
| E1 |

|  |
| --- |
| A B C   1. 2 3   4 5 6  7 8 9 |

|  |
| --- |
| B C  5 6  8 9 |

ρ E2 (投影B,C(选择 A>2 (E1)))

**Question 10.**

Suppose we have a relation R(A,B,C,D,E) and the FDs 主码AB或AC

{AB→C, B → D, D → E, C→B,B→E }

1. compute the “minimal” set of functional dependencies for the FDs.

{AB→C, B → D, D → E, C→B }

2. To decompose R into 3NF

拆成三个（最后一个并起来）

**Question 11.**

Consider the following three database schemas:

Sellers(SID,SNAME,GENDER,PHONE)

Products(PID,PNAME,UNIT-PRICE)

SP(SID,PID,SELL-NUMBER)

Suppose that there is a query like “Find out the names and sell-number of the sellers who sell the product “computer”, please resolve the following questions:

1）Please write the query in relational algebra expression(关系代数表达式) according to the description.

2）Assume that there are 200 records in Sellers, 1000 records in Products, and 20000 records in SP, and indexing on the primary key respectively. Please Optimize the relational algebra expression for the above query and draw the optimized expression tree（表达式树）. And describe the process of the optimized evaluation-plan.

**Question 12.**

Suppose there are two transactions as below:

T1：Read(A);A=A-20;Read(B); B=B+50; Write(A);Write(B)

T2：Read(B);Read(A); B=A+10；Write(B)

(1)Suppose that A=200, B=200 initially, the execution of a certain concurrent schedule results in A=180、B=190 , please tell whether the concurrent schedule is correct or not, Why?

(2) Please give out a conflict-serializable schedule for T1 and T2 using Two-phase locking protocol along with（以及） its execution result.

**Question 13.**

Consider the following relation schemas in a library information management database:

BOOK(BOOKID,TITLE,SUM,LOCATION,PUBNAME,…,totally 20 attributes)

PUBLISHER(PUBNAME,EMAIL,TEL,POSTCODE,ADDRESS,…, totally 20 attributes)

BORROWER(ID,NAME, affiliation,…, totally 20 attributes)

BORROW（ID，BOOKID，DATEOFBORROW，DATEOFRETURN,…, totally 30 attributes）

Suppose that there is a query like “Find out the names of the borrowers who have borrowed the book titled in “Database systems” published by The “MacGraw-Hill Companies”” , please resolve（解决） the following questions:

（1）Please write the query in relational algebra expression(关系代数表达式) according to the above description：

（2）Assume that there are 3000 records in BORROWER , 10000 records in BOOK, and 40000 records in BORROW, and indexing on the primary key respectively. Please Optimize the relational algebra expression for the above query and draw the optimized relational algebra expression tree（语法树）:

**Question 14.**

Suppose there are two transactions as below:

T1：Read(B)；Read(A); A=A+B；Write(A)

T2：Read(B)；Read(A); B=A+B；Write(B)

（1）Suppose that A=4, B=2 initially, the execution of a certain concurrent schedule results in A=6、B=6 , please tell whether the concurrent schedule is correct or not, Why?

（2）Please give a （conflict）serializable schedule for T1 and T2 using lock-based protocol along with（以及） its execution result.

**Question 15.**

If R(A, B, C,D,E) satisfy the following functional dependencies (FDs): {A->B,AB -> C, BC -> D, and AC ->BD}. Please compute the closure of AD. (i.e., (AD)+)

ABCD

**Question 16.**

Suppose that there is a relation schema, R(employee, project, salary, sectionID,manager).

If each employee can take part in several projects and get salary respectively; **each project is only managed by one section（部门）; and each section only has one manager.**

1. Find out the basic functional dependencies for R according to these rules and the following table.

{AB🡪C,D🡪E,B🡪D}(注意方向)

(2) Find out the candidate key(s) for R. AB

(3) Is R in 3NF? If not, please decompose R into 3NF.

{AB🡪C }{B🡪D}{D🡪E}

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| employeeA  (职工名) | projectB  (项目名) | salaryC  (工资) | sectionIDD  (部门号) | managerE  (部门经理) |
| Eric | MIS | 1200 | BM1 | John |
| Eric | EAST | 1800 | BM2 | Tom |
| Elsa | CQU | 1650 | BM3 | Smith |
| Dora | MIS | 2000 | BM1 | John |
| Dora | CQU | 2300 | BM3 | Smith |
| … | … | … |  |  |

**Question 17.**

There are two tables:

Department(dept\_id, dept\_name, dept\_manager,emp\_num)

Employee(emp\_id, emp\_name, job, hire\_date, dept\_id)

1) please design a trigger(触发器) for employee. when add a new employee to a department, the property “emp\_num” of the department must be increased by 1.

2) please design a trigger for department. when delete an department, all of employees in that department must set the property “dept\_id” to NULL .

3) please design a trigger for employee. when update an employee to another department, change the property “emp\_num” for departments involved.

**Question 18.**

There are two transactions as following:

T1：XQ;Read(Q);SP;Read(P);SS;Read(S);Q=Q+S-P;Write(Q);U

T2：SP;Read(P);XS;Read(S);SQ;Read(Q);S=P+Q;Write(S);U

（1）The initial value of the data items Q,P,S is assumed to be 2,3,4 respectively，suppose one concurrent schedule results in Q=3、P=3、C=5, Is the concurrent schedule correct or not? please give out the reason?

（2）Please design a serializable schedule for T1 and T2 using Two-Phase locking protocol (两阶段封锁协议) .

**Question 19.**

Suppose R = (A, B, C, D, E, F), and functional dependencies on R is {A->D, BD -> C, DE -> B and AC ->F}.

Please compute the closure of AE. (i.e. (AE)**+**)

ABCDEF

**Question 20.**

Consider the following three database schemas:

Bookstore(BSID,SNAME,ADDRESS,PHONE)

Book(BID,BNAME,PRICE)

Supply(BSID, BID, supply-NUMBER)

Now there is a query like “Find out the names and supply-number of the bookstore(书店) who supply the book “Database”, please resolve the following questions:

1）Please write out the SQL expression and relational algebra(关系代数) expression for the above query.

2）Suppose there are 100 records in Bookstore, 500 records in Book, and 10000 records in Supply. Please Optimize(优化) the relational algebra expression for the above query using heuristic-based optimization（启发式优化）method and draw the optimized expression tree.

**Question 21.**

Suppose we have a relation R(A,B,C,D) and the FD's

A-> B, B-> C, B-> D, A-> C

1) Find out the candidate key(s) for R? A

2) To decompose R into 3NF.

{ A-> B }

{ B-> C, B-> D }

**Question 22.**

对于以下数据表提供的数量信息，请完成以下要求:

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| 部件号 | 部件名 | 现有数量 | 项目代号 | 项目内容 | 项目负责人 | 提供项目使用数量 |
| 205 | CAM | 30 | 12 | AAA | 01 | 10 |
| 205 | CAM | 30 | 20 | BBB | 02 | 15 |
| 210 | COG | 155 | 12 | AAA | 01 | 30 |
| 210 | COG | 155 | 25 | CCC | 11 | 25 |
| 210 | COG | 155 | 30 | DDD | 12 | 15 |
| … |  |  |  |  |  |  |

1. 写出基本函数依赖集，并找出候选码。
2. 判断最高达到第几范式，并说明理由。1NF
3. 如果不是3NF，将其分解成3NF模式集。

**Question 23.**

设某医院病房计算机管理中心需要如下信息：

科室（科名、科地址、科电话、医生姓名）

病房（病房号、床位号、所属科室名）

医生（姓名、职称、所属科室名、年龄、工作证号）

病人（病历号、姓名、性别、诊断、主管医生、病房号）

其中，一个科室有多个病房、多个医生，一个病房只能属于一个科室，一个医生只属于一个科室，但可负责多个病人的诊治，一个病人的主管医生只有一个。

请完成该系统的概念模型设计并作出相应的E-R图。

**Question 24.**

假设数据库中有以下三个关系模式：

仓库(仓库号, 所在地, 面积)

员工( 员工号, 薪水)

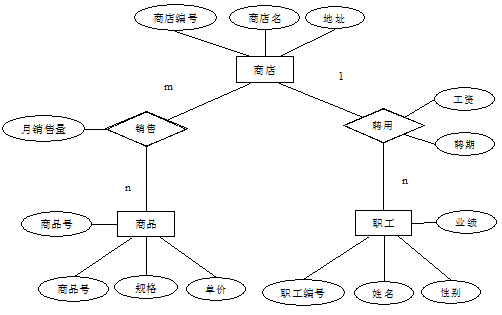
订单 (订单号, 员工号, 供应商号, 日期)

供应商(供应商号, 名称, 地址)

1. 请写出查找与职工号为E6的员工有业务联系的供应商名称的SQL语句。
2. 请对以上查询语句进行代数优化，写出优化后的代数表达式及语法树。

**Question 25.**

设某商业集团数据库设计得到如下E-R图：



1. 将该E-R图转换为关系模式结构。
2. 指出关系模式中的主码和参照完整性约束。