95

北京邮电大学 2021——2022 学年第一学期

《数据库系统原理》期中测验

考试注意事项	一、学生参加考试须带学生证或学院证明，未带者不准进入考场。学生必须按照监考教师指定座位就坐。 二、书本、参考资料、书包等物品一律放到考场指定位置。 三、学生不得另行携带、使用稿纸，要遵守《北京邮电大学考场规则》，有考场违纪或作弊行为者，按相应规定严肃处理。 四、学生必须将答题内容做在试题答卷上，做在试题及草稿纸上一律无效。 五、填空题用英文答，中文答对得一半分。

考试课程	数据库系统原理				考试时间						
题号	一	二	三	四	五	六	七	八	九		总分
满分	16	14	30	20	20						100
得分	15	14	28	20	18						
阅卷教师											

15

1. (16 points) Choices

(1) In the following statements, the correct ones are C

I. The data model defines the specification of managing data items in database. It is a collection of conceptual tools for describing data structure, data relationships, data semantics, data operations and consistency constraints.

II. In relational model, as human-machine interfaces, the pure database language consists of two parts, i.e. the data manipulation language and the data definition language that is for specifying the database schema and as well as other properties of the data.

III. A foreign key is a set of one or more attributes that, taken collectively, can be used to identify uniquely a tuple in the relation.

IV. A C++ application program can access database via embedded SQL.

A. I, II, III, IV B. I, II, III
C. I, II, IV D. II, III, VI

(2) In the relational model, there are pure query languages defining operating on relational data, that is A.

A. relational algebra, tuple relational calculus, and domain relational calculus
B. relational algebra and tuple relational calculus
C. relational algebra and domain relational calculus
D. relational algebra, tuple relational calculus, and SQL

(3) Among the following groups of database products, which one is completely developed and distributed by domestic companies and manufactures? C

A. Oracle, OceanBase, OpenGauss, TiDB
B. SQL Server, MySQL, PostgreSQL, DB2
C. TiDB, 达梦, openGauss, OceanBase, PolarDB, 人大金仓,
D. Oracle, DB2, Sybase, SQL Server

(4) Among the following statements, the correct one/ones is/are C.

I. OpenGauss database, derived from PostgreSQL, is developed and distributed by Huawei

II. MySQL and PostgreSQL are two typical open-source database systems.

III. A on-line shopping site has a three-tier Browser-Server(B/S) architecture. Its application programs are programmed in Java, and these programs access MySQL database server via the ODBC interface.

IV. The relational model is applicable to managing structured data such as the table data, while XML provides a way to represent semi-structured data, e.g. the data with nested structures.

A. I, II, III, IV B. I, II, III C. I, II, IV D. II, III, IV

(5) In the relational data model, B is a language for specifying the database

schema as well as other properties of the data.

A DML B DDL C relational algbra D DSL

(6) With respect to DBS design, a relational table's primary key is defined at the B C Phase.

A. requirement analysis B. conceptual design

C. logical design D. physical design

(7) Data independence means that B and _____ are independent and unaffected.

A. view level, logical level B. data, applications

C. data, DBMS D. conceptual model, physical model X.

(8) With respect to DBS design, the index is defined on the table and the database file is determined at the D phase.

A. requirement analysis B. conceptual design

C. logical design D. physical design

9) The A describes the global logical structure of the database's total data, that s, how the data items are stored in DBS, and what relationships exist among those ata.

A. logical schema B. internal schema

C. external schema D. user schema

0) In relational databases, referential integrity can be ensured by defining C on bles.

A. primary key B. candidate key

C. foreign key D. not null constraint

) At the conceptual design stage for the database design, D is used to describe data objects in the world and the associations among the objects.

A. Relational model B. Hierarchical model

C. Network model D. Entity-Relationship data model

(12) Considering the ***University*** Database given in the textbook. For the following SQL queries, which one will use the relational algebra operator *Cartesian product*? A

A. select name, course_id
from instructor, ~~teaches~~
where name='Crick'

B. insert into student
values('3003', 'Green', 'Finance', 'null')

C. update course
set credits=3
where title=Database

D. select name, building
from instructor natural join department

(13) In SQL language, the statement that can be used for security control is D

A. insert B. update C. commit D. grant

(14) Consider the relation schema ***Department-schema***(*department-name, building, budget*) and relation ***department***, which one is not the metadata stored in data dictionary? D

A. the name of the relation ***department***

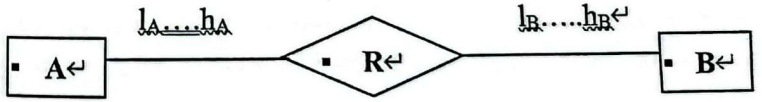
B. the domain and length of attribute ***building***

C. the number of tuples in ***department***

D. a tuple <*Computer, Building_3, 30000*>

(15) Given the cardinalities of the entity sets A and B with respect to the relationship set R, the participation constraints of A can be decided by A.

A. l_A B. h_A C. l_B D. h_B



The mapping cardinality from **A** to **B** can be decided by C.

A. [l_A, l_B] B. [h_A , h_B] C. [h_B , h_A] D. [l_A, h_B]

14

2. (14 points) Suppose there are the following relations:

Book(BookNum, BookName, Author, PublishingHouse);

Reader(BorrowCardNum, ReaderName, ReaderAddress);

Borrowing(BorrowCardNum, BookNum, BorrowDate, ReturnDueDate);

Returning(BorrowCardNum, BookNum, ReturnDate)

Please use relational algebra to write the following queries.

(1) Find the book names that Andy borrowed, published by the "POSTS & TELECOMM PRESS" and already returned. (5 points)

(2) Find the reader names and book names that have not returned the books before 31, Dec, 2020. (5 points)

(3) Find the reader names that have not borrowed any books before. (5 points)

(1) $\Pi_{BookName}(\sigma_{ReaderName='Andy' \wedge PublishingHouse='POST\&\ TELECOMM\ PRESS'}(Returning \bowtie Book \bowtie Reader))$.

(2) $\Pi_{ReaderName, BookName}(Reader \bowtie Borrowing \bowtie Book) - \Pi_{ReaderName, BookName}(\sigma_{ReturnDate<'2020-12-31'}(Reader \bowtie Returning \bowtie Book))$.

(3) $\Pi_{ReaderName}(Reader) - \Pi_{ReaderName}(Borrowing \bowtie Reader)$

28

3. (30 points). In the database of a school sport-meeting management system, there are five relational tables as follows.

competition_category(category_id, cname, manager)

competition_event(event_id, ename, time, level, category_id)

player(player_id, pname, age, sex, phone_number, team_number)

event_player(event_id, player_id, grade)

team(team_number, tname, leader)

The four data objects competition category, competition events, department teams, players are modelled as the relational table *competition_category*, *competition_event*, *team*, and *player*, respectively. Every competition category has several competition events. Each event belongs to a unique category. Every team has several players. Each player belongs to a unique team. Each player could attend different competition events. And each event can be attended by more than one player. Players have their grades in different events.

Give SQL statements for the following queries.

(1) Create the table *player*, in which {*player_id*}is the primary key; there exists a referential integrity constraint from *player* to *team*. It is also required that the player's *phone_number* is not null. (10 points)

(2) Find the *player_id* and average competition grade of each player in the "computer science department team", whose average grade of the competition is more than 85. (10 points)

(3) Use one or more SQL statements to verify whether or not *cname* is the candidate key in the table *competition_category*(*category_id*, *cname*, *manager*), i.e. the functional dependency *cname* → *category_id*, *manager* is satisfied by the table, according to the query results of one or more SQL statements. (10 points)

(1) create table player(
player_id int,
p_name varch(20),
age int,
sex ch(1),
phone_number ch(11) not null,
team_number ~~int~~ varch(50),
primary key (player_id),
foreign key (team_number reference team)

(2) Select player_id, avg(grade)
from player natural join event_player, team
where team_number = 'computer science department team'
group by player_id
having avg(grade) > 85.

(3) ~~Select S.category_id, S.manager~~
Select count (*)
from (select S.category_id, S.manger, T.category_id, T.manager
from competition_cetegory as S, competition as T,
where S.cname = T.cname
and (S.category_id, S.manger) <> (T.category_id, T.manger)
)

查询结果若为0，则 cname 可作为一个 Candidate key.
否则不能.

20.

4.(20 points) A naval base (海军基地) is preparing to set up a fleet (舰队) management information system, which gives the following information.

(1) A *fleet* is uniquely identified by a *FleetName* and described by *FleetLocation* and *FleetState*.

(2) Every *warship* (舰艇) is identified by a *ShipID* and described by *ShipName* and *ShipType*.

(3) Each *weapon* (武器) is identified by *WeaponID*. It also has descriptive attributes *ProductionTime* and *StorageAddress*.

(4) A *soldier* (士兵) is distinguished by its *SoldierID*. For each soldier, the *SoldierName, Age, Sex* and *Rank* should be recorded.

(5) A *camp* (军营) is recognized by its *CampName* and has attributes *CampLocation* and *Capacity*.

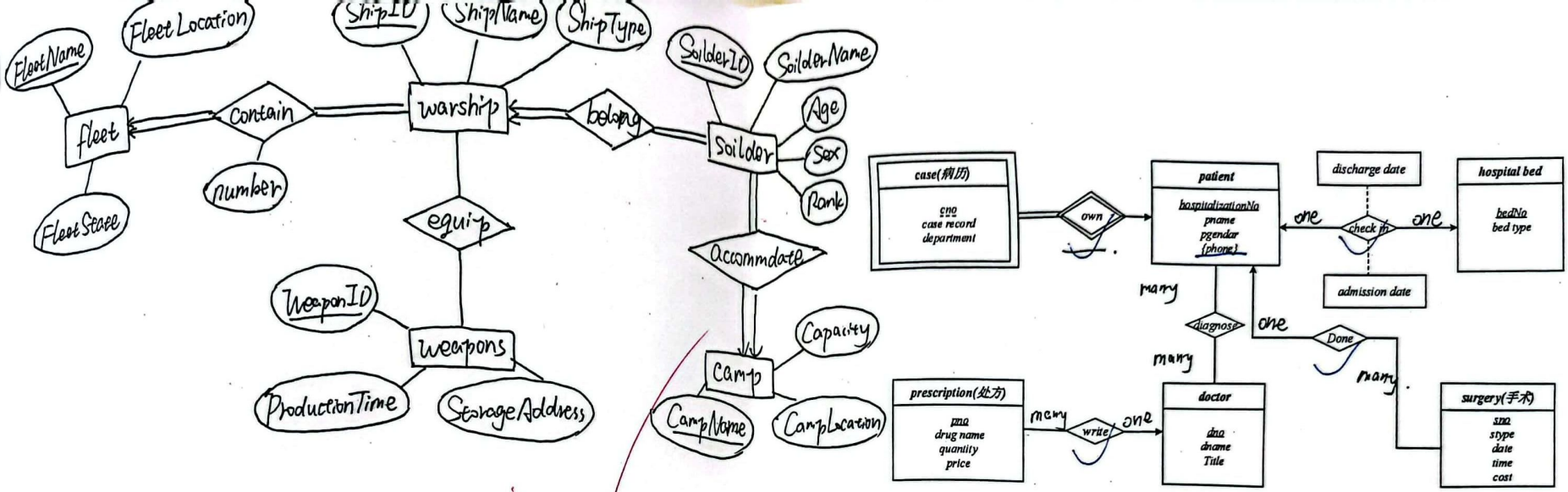
(6) Each fleet *contains* more than one warship, and every warship belongs to a unique fleet. The *number* of warships contained by each fleet must be recorded.

(7) Each warship is *equipped* with several weapons, and a weapon can be used on different warships.

(8) A soldier *belongs* to a unique warship, but a warship has more than one soldier.

(9) A camp can *accommodate* many soldiers, but a soldier can only belong to a unique camp.

Construct an E-R diagram to depict the above mentioned data items and the associations among them.



case (cno, hospitalizationNo, case record, department)
patient (hospitalizationNo, pname, pgendar)
patient_phone (hospitalizationNo, phone)
hospital bed (bedNo, bed type)
check in (hospitalizationNo, bedNo, discharge date, admission date)
surgery (sno, stype, date, time, cost)
Done (sno, hosptializationNo)
doctor (dno, dname, Title)
diagnose (hospitalizationNo, dno)
prescription (pno, drug name, quantity, price)
write (pno, dno)

doctor (dno, dname, Title)
diagnose (hospitalizationNo, dno)
prescription (pno, drug name, quantity, price, dno)

18

5. (20 points) Convert the following E-R diagram about the hospital management information system to the relation schemas, and identify the primary key of each relation by underlining the primary attributes.

case (cno, hospitalizationNo, case record, department)
patient (hospitalizationNo, pname, pgendar) patient_phone (hospitalizationNo, phone)
hospital-bed (bedNo, bed-type, discharge date, admission date, hospitalizationNo)
surgery (sno, stype, date, time, cost, hospitalizationNo)