

```

create table account(
    number varchar(10),
    branch varchar(10),
    balance integer,
    primary key (number));

create table depositor(
    ID varchar(10),
    number varchar(10),
    primary key (ID, number),
    foreign key (number) references account on update cascade);

create view testview as
    select *
        from account left outer join depositor
            on account.number = depositor.number;

create trigger test_(6)-1_ insert on works
referencing_(6)-2_ row as nrow
for each row
when nrow.salary < 0
begin
    rollback
end;

```

The account relation:

number	branch	balance
A1	First	10000
A2	Second	20000
A3	First	30000

The depositor relation:

ID	number
C1	A1
C2	A2

Figure 1: the program show.php

```
$db = new PDO("mysql:host=localhost;dbname=test;charset=utf8", 'root',  
'pass');  
$db->setAttribute(PDO::ATTR_ERRMODE, PDO::ERRMODE_EXCEPTION);  
$db->setAttribute(PDO::ATTR_EMULATE_PREPARES, false);  
$sql = "SELECT * FROM account WHERE branch = 'Second'";  
$stmt = $db->prepare($sql);  
$stmt->execute();  
$result = $stmt->fetchAll();  
for ($i = 0; $i < count($result); $i++) {  
    echo $result[$i]['number'];  
}
```

1. (5%) Consider the PHP program in Figure 1. If this program has no error and can be successfully executed, what will be outputted on the screen based on the original relation instance?
2. (5%) The program in Figure 1 uses the "prepare" and "execute" APIs. Another way is to use the API "query". Which of the following is NOT one of the benefits of using "prepare" and "execute" in general? (a) avoiding SQL injection; (b) improving efficiency when processing many similar commands; (c) creating a user-friendly interface;
3. (5%) What will happen after we execute the following SQL command? `update account set number = 'A4' where number = 'A2';` (a) No tables are updated due to the violation of the primary constraint. (b) No tables are updated due to the violation of the foreign key constraint. (c) Only the account table is updated. (d) Both the account table and the depositor table are updated.
4. (5%) What will happen after we execute the following SQL command? `delete from account where number = 'A1';` (a) A tuple will be deleted. (b) No tuple will be deleted due to violating the primary key constraint. (c) No tuple will be deleted due to violating the foreign key constraint. (d) The command is incorrect.
5. (5%) What will be outputted after we execute the SQL command: "select count(*) from testview;"? (a) the value "2" (b) the value "3" (c) the null value (d) an error message

6. (5%) If the trigger "test" is designed to prevent a negative salary from being inserted into the works relation, what should be filled in the blanks marked (6)-1 and (6)-2, respectively? (根據 SQL 標準語法) (a) before; new (b) after; new (c) before; old (d) after; old

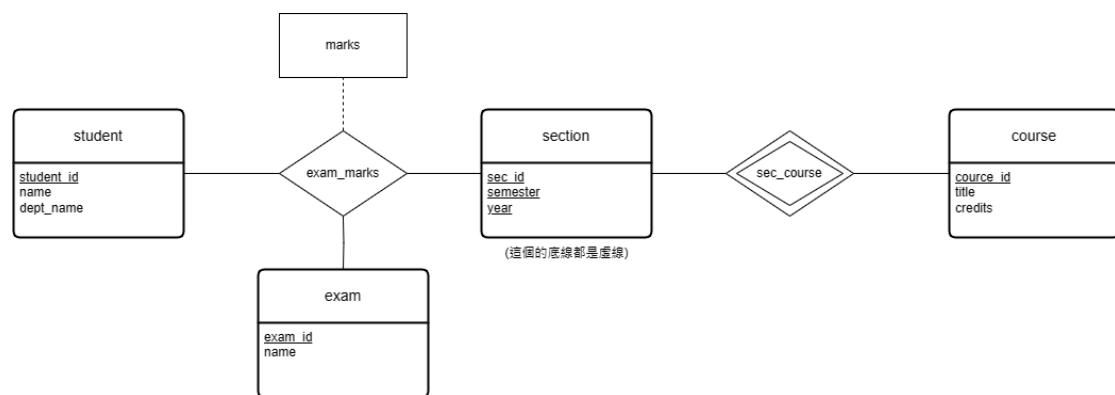
7. (5%) If the DBA wants to allow the user "U1" to see the content of the view "testview", which of the following SQL command is correct? (a) grant select on testview to UU; (b) grant query on testview to 'UU'; (c) create index UU on testview; (d) revoke select on testview from 'UU';

8. (5%) If we want to specify a constraint on the account relation that each account has exactly one balance, which of the following functional dependency should we use? (a) account → balance (b) balance → account (c) number → balance (d) balance → number

9. (5%) Which of the following statement is NOT correct about normalization? (a) Normalization can reduce repetition (重複) of information. (b) Normal forms include 1NF, 2NF, 3NF, BCNF, etc. (c) Normalization is mainly used to improve query efficiency. (d) If a schema is in BCNF, it will always be in 3NF.

Answer Questions 10-12 based on the E-R diagram in Figure 2.

Figure 2:



10. (9%) Based on the E-R diagram, determine if each of the following statements is correct (O) or not (X), respectively. (1) A "student" can have many "exams" in a "section". (2) "course" is modeled as a weak entity set. (3) Each "section" can only belong to one "course".

11. (16%) Represent this E-R diagram as a set of relational schemas. For each schema, list its attributes and identify its primary key.
12. (10%) Extend this diagram to represent a specialization of the "student" entity set based on the following description: (Note: You only need to draw the part of the E-R diagram related to this question.)
- The first sub-group is called "graduate" with the attribute "advisor".
 - The second sub-group is called "undergraduate" with the attribute "activity".
 - This specialization is disjoint and total.
13. (20%) Consider the schema $R = (L, M, N, O, P)$ and the following set F of functional dependencies: $F = \{M \rightarrow O, NO \rightarrow P, P \rightarrow LM\}$ (1) Compute M' and explain why the schema R is NOT in BCNF. (2) Give a loss-less join decomposition into BCNF for schema R step by step. You need to show that each final schema is in BCNF. (3) Show that "NO" is a candidate key of R . (4) Suppose that the original schema R only has two candidate keys: "NO" and "PN". Determine if R is in 3NF. You need to explain your answer.