Part A: Database Design

IMPORTANT NOTE: For all of the multiple-choice questions, **zero or more** choices may be correct. You are required to **choose all correct and none of the incorrect answers** for these questions in order to get a full point in each question.

1. (**5 pts**) Given schema R = {A, B, C, D, E}, and functional dependencies F = {AB→C, DC→E, D→B}. Which of the following functional dependencies are in F^+?

I. AD→E, DC→BC
II. BC→E, DB→A
III. BC→E, DC→BC
IV. AD→E, DB→A
V. II and III
VI. None of the above

Answer(s): I

2. (**5 pts**) Consider schema R = {A, B, C, D, E} and functional dependencies F={A→BC, CD→E, B→D, E→A}.
Which of the following functional dependencies are in the closure of F?

I. $A \rightarrow E$
II. $BC \rightarrow CD$
III. $CE \rightarrow B$
IV. $A \rightarrow ABCDE$
V. All of the above
VI. None of the above

Answer(s): I, II, III, IV, V

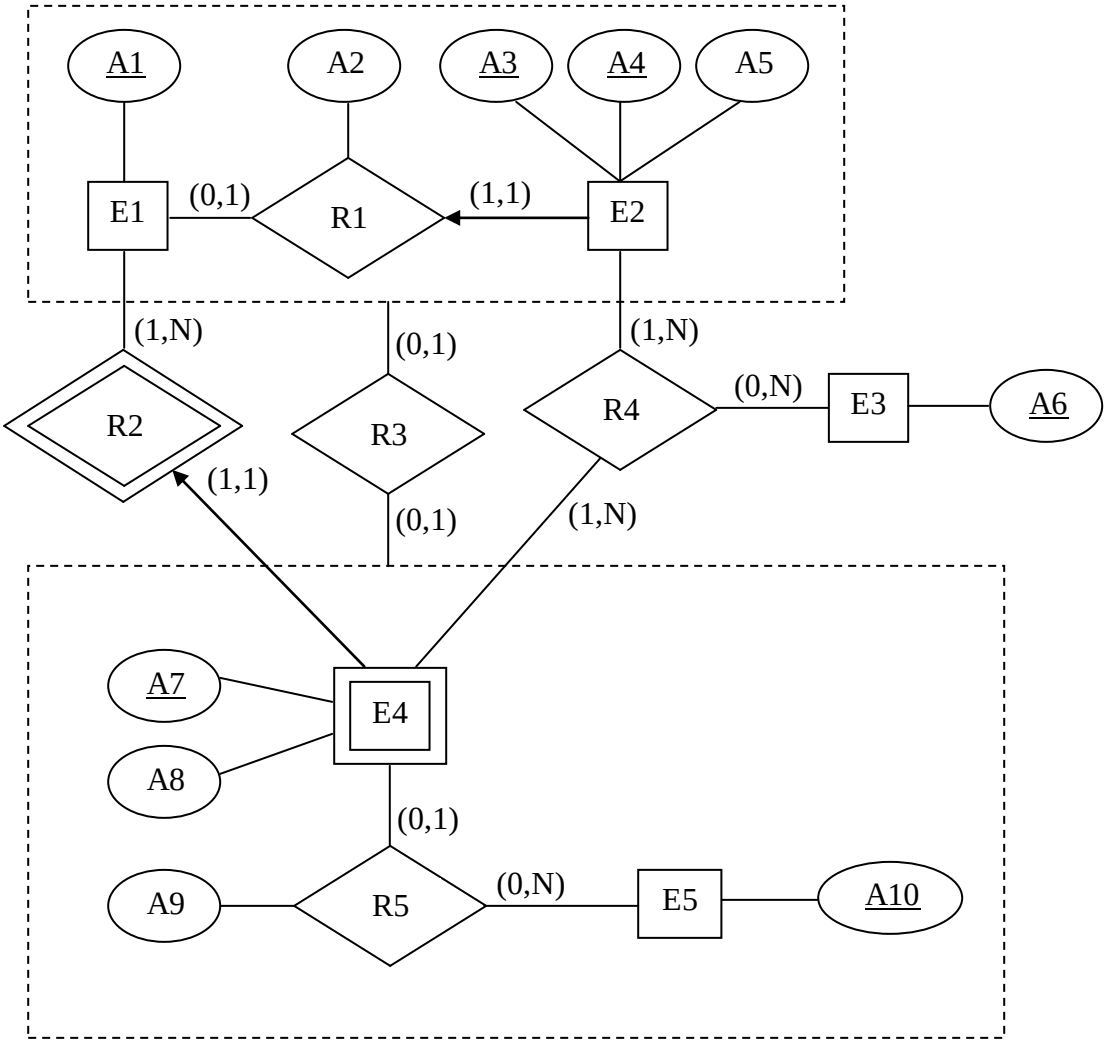
3. (**5 pts**) Consider relation R = {A, B, C, D, E} and functional dependencies F={A→BC, CD→E, B→D, E→A}
Which of the following subset of attributes are candidate keys of R?

I. BD
II. A
III. CD
IV. C
V. BCDE
VI. AE
VII. All of the above
VIII. None of the above

Answer(s): II, III

Part A: Database Design (continued)

4. (**5 pts**) How many tables are in the relational schema that is derived from the translation of the following ER diagram *based on the instructions specified in class*?



I. Less than 5
II. 5
III. 6
IV. 7
V. 8
VI. More than 8

Answer(s): V

5. (**5 pts**) The number of tables that are derived from an ER diagram during the schema-mapping process can never be greater than the number of entities plus the number of relationships that are part of the diagram being mapped.

I. True
II. False
III. Cannot be determined from the premise.

Answer(s): II

Part B: Constraints

1. (**5 pts**) Consider the following statement:

```
create table Manager
(     employee_name char(20) not null,
      manager_name char(20) not null,
      primary key employee_name,
      foreign key (manager_name) references Manager on delete cascade);
```

What happens when a tuple in the relation Manager is deleted?

I. The deletion is not allowed in any case.
II. The deletion is not allowed if the employee_name of that tuple is the manager of 1 or more employees.
III. The deletion is allowed if the employee_name of that tuple does not have a manager.
IV. The deletion is allowed if the employee_name of that tuple is not a manager of any other employee.
V. The deletion is allowed if the employee_name of that tuple is a manager of 1 or more employees; and, the tuples of all employees of the manager, at all levels, get deleted as well.
VI. None of the above

Answer(s): IV, V

2. (**5 pts**) Consider the following schema for relation Food

Food (Name, Cuisine, Type)

What does the following statement mean?

```
CREATE ASSERTION checkFood CHECK
 (EXISTS
     ((SELECT * FROM food)
      EXCEPT
      (SELECT * FROM food WHERE name = name OR cuisine = cuisine)));
```

I. It makes sure that relation Food is empty
II. It makes sure that relation Food is not empty
III. It makes sure that no tuple of relation Food has NULL values for both attributes Name and Cuisine.
IV. It makes sure that no tuple of relation Food has NULL values for attribute Name or attribute Cuisine.
V. I and II
VI. I and III
VII. II and IV
VIII. None of the above

Answer(s): III

Part C: Understanding of SQL expressions

Consider the following relational schema:

Sailors(sid: Char(10), sname: Char(20), slevel: integer, sage: integer);
Boats(bid: Char(9), bname: Char(20), bcolor: Char(5), blength : integer);
Reserves(sid: Char(10) , bid: Char(9), day: Date, start: Time, end: Time);

For each of the following queries, find the SQL expression(s) that computes it.

1. (**5 pts**) Find the names of sailors who have reserved a red boat.

I. **Select** S.sname **From** Sailors **as** S, Reserves **as** R, Boats **as** B **where** S.sid = R.sid **and** R.bid = B.bid **and** B.bcolor = 'red';	III. **Select** S.sname **From** Sailors **as** S **Where** S.sid **IN** (**Select** R.sid **From** Reserves **as** R **Where** R.bid IN (**Select** B.bid **From** Boats as B **Where** B.bcolor ='red'))
II. **Select** R.sname **From** (Sailors **natural inner join** Boats) **AS** R **Where** R.bcolor = 'red';	IV. Both I and III V. All of the above VI. None of the above

Answer(s): I, III, IV

2. (**5 pts**) Find the names of sailors who have reserved at least one boat

I. **Select** S.sname **From** Sailors **as** S, Reserves **as** R **Where** S.sid = R.sid **Having** count(R.bid) >=1;	III. **Select** S.sname, count(R.bid) **From** Sailors **as** S, Reserves **as** R **Where** S.sid = R.sid **Having** count(R.bid) >=1;
II **Select** distinct S.sname **From** Sailors **as** S, Reserves **as** R **Where** S.sid = R.sid;	IV. None of the above

Answer(s): II

Part C: Understanding of SQL expressions (continued)

3. (5 pts) Find the names and age of sailors who have reserved boat 103.

I. **Select** S.sname, S.sage **From** Sailors **as** S, Reserves **as** R **Where** S.sid = R.sid **and** R.bid = '103';	III. **Select** S.sname, S.sage **From** (Reserves **natural inner join** Sailors) **as** S **Where** S.bid = '103'
II. Select S.sname, S.sage **From** (Sailors **natural inner join** Reserves) **as** S **Where** S.bid = '103'	IV. All of the above V. None of the above

Answer(s): I or (IV if ignore the syntax error)

4. (**5pts**) Find the names of sailors who are older than the oldest sailor with a sailor level of 10.

I. **Select** S.sname, **From** Sailors **as** S, Sailors **as** S2 **Where** S.age > MAX(S2.age)	III. **Select** S.sname, **From** Sailors **as** S **Having** S.sage > MAX(S.sage) **And** S.slevel = 10.
II. **Select** S.sname, **From** Sailors **as** S **Where** S.age >= MAX(S.age) **And** S.slevel = 10	IV. Both II and III V. None of the above

Answer(s): V

Part D: Web Applications

1. (**5 pts**) Student Bob Ferrington is attempting to write a Servlet that finds if the name of a person in a request is Bob or not. If the name is Bob, the name is set in the session, and the request is forwarded to a JSP page called bob.jsp, which prints the name in big fonts and colors. If not, the request is sent to another page called notbob.jsp which prints an error message. This is the code student Bob wrote:

```
protected void doGet(HttpServletRequest request,
   HttpServletResponse response) throws ServletException, IOException {
         HttpSession session = new HttpSession();
         String name  = request.getParameter("personname");
         if (name.equals("Bob")){
                     session.setAttribute("name", name);
                     //set up addr to forward request to the bob.jsp page
                     addr = "./bob.jsp";
               }
               else {
                     // set up addr to forward request to the not.jsp page
                     addr = "./notbob.jsp";
               }
         }
         // forward the request to the page previously determined
         RequestDispatcher dispatcher =request.getRequestDispatcher(addr);
         dispatcher.forward(request, response);
   }
```

Will this code send the name correctly to the bob.jsp page?

I. Yes.
II. No, the function cannot create the session.
III. No, the function cannot compare name with the string "Bob" without first storing the string "Bob" in a variable.
IV. No, the function cannot store a Java string in the session, only Beans can be stored.
V. Both III and IV
VI. Cannot be determined from the premise.
VII. None of the above

Answer(s): II

2. (**5 pts**) In the MVC pattern, the Java Servlet is the controller, a JSP is the View and the Model is implemented with Java Beans. Hence, no Beans from the Model can be used in the View.

I. True
II. False
III. Cannot be determined from the premise.

Answer(s): II

The Beans from the Model are used to display results in the view. But, the view should not access any method in a Bean that launches business logic operations. The view should only access methods in a Bean that provide access to the current values of the instance fields.

Part E: Constraints and update operations

Consider relation x (a,b) with the following instance:

X

a	b
1	3
4	7

Also assume the following trigger exists:

```
CREATE TRIGGER t
AFTER INSERT ON x
REFERENCING NEW ROW AS n
FOR EACH ROW
WHEN (n.a * n.b > 8)
INSERT INTO x VALUES (n.a-1, n.b+1);
```

What would be the tuples of x after each of the following operations?
Complete relation x in each of the following parts, independently.

Note. This is not a multiple choice question.

1) (**5 pts**) `UPDATE x SET a=a+2;`

X

A	B
3	3
6	7

2) (**5 pts**) `INSERT INTO x VALUES (3,5);`

X

A	B
1	3
4	7
3	5
2	6
1	7

3) (**5 pts**) `INSERT INTO x VALUES (2,4);`

X

A	B
1	3
4	7
2	4

4) (**5 pts**) `DELETE FROM x WHERE a=4;`

X

A	B
1	3