Database Management, 2019 Midterm 2

Q1. Consider the following set of simplified requirements for a *System-info* database that is used to keep track of the usages of (software) systems in a company.

1. Each department has a unique name and a unique number. A department may use several systems. The database keeps track of the number of hours per week that a department uses each system.
2. Each system has a unique name, a unique number, and a particular administrator who manages the system. A system may be used by a number of departments.
3. The database stores each administrator’s name, unique identifier and e-mail address. Each administrator must manage at least one system.
4. (8%) Draw an ER (Entity-Relationship) schema diagram for this application. You need to clearly indicate the cardinality ratio (1:1, 1:N, or M:N) and participation constraints (total or partial) of each relationship. (State clearly any additional assumptions you make)
5. (6%) Map the ER schema into the corresponding relational database schema diagram. Specify all primary keys and foreign keys.

Suppose that it is also necessary to keep track of different types of systems (Internet systems and Intranet systems), in which an Internet system may serve several customers (cooperative companies). Each customer has a unique name, a unique identifier, and an address. A customer may be served by several Internet systems. Notably, a system may be a member of Internet systems, Intranet systems or both. Every system in the company is a member of Internet or Intranet systems.

1. (4%) Modify the ER schema in (a) according to the above requirements, using ER and Enhanced ER concepts of specialization and generalization. You need to clearly indicate the disjointness and completeness constraints. (State clearly any additional assumptions you make)

Q2.

1. (4%) Mapping the EER diagram of the following Figure to relations by using option 8d.

BUILDING

APARTMENT

VILLA

FACTORY\_FOOD

FACTORY\_CHEMISTRY

d

d

RESIDENCE

Floor

1. (4%) Draw the set diagram of the following figure.

Q3.

1. (4%) Explain the differences between superclass/subclass and category in EER model regarding the subclass’s inheritance of attributes/relationships from its superclasses.
2. (3%) Describe the drawbacks for the mapping of superclass/subclass with overlapping constraints to relations by using the approach of multiple relations for subclass relations only.
3. (3%) Explain how to derive the primary key of the relation mapping from a weak entity type.

Q4. (10%) Consider the following ER diagram for part of a Department database. Each department can employ several full-time teachers, and each full-time teacher can teach several courses. Each student can take several courses, and each course can have several registered students. (1) Specify the cardinality ratio of each relationship type in this ER diagram. (2) Derive the relational database schema from this ER diagram using ER-to-Relational Mapping.



Q5.

(a) (3%) How to distinguish the program variables with TABLE attributes in an embedded SQL statement? Write a sample code to retrieve the attribute values into the program variables by using the SELECT … INTO … FROM … clause in embedded SQL.

(b) (4%) Describe the concept of a cursor and how it is used in embedded SQL.

(c) (3%) Explain the usage of $\_POST variable in PHP.

Q6. (a) (6%) Explain each layer of the three-tier client/server architecture.

1. (3%) What are the advantages of using the three-tier client/server architecture in comparison with the two-tier client/server architecture?

Q7. (6%) Explain how the application programs are processed into compiled transactions. Use an example to explain the usages of precompiler, host language compiler and DML compiler.

Q8. The following is a Java JDBC database program, choose the correct answer to fill in the blank:

class getEmpInfo{

public static void main (String args []) throws SQLException, IOException {

try{

(1) ;

}catch(ClassNotFoundException x){

System.out.println("Driver could not be loaded");}

String dbacct,passwrd,ssn,lname;

Double salary; String sex; String dno;

dbacct = readentry("Enter database account:");

passwrd = readentry("Enter password:");

(2)

String stmt1 = "select Lname, Salary from EMPLOYEE where DNO = ? and SEX = ? and Salary>?";

PreparedStatement p = conn.prepareStatement(stmt1);

dno = readentry("Enter a Department Number:");

sex = readentry(“Enter SEX - Male or Female:”);

sal = readentry(“Enter the amount of Salary Threshold to be greater than”);

(3)

(4)

ResultSet r = p.executeQuery();

while(r.next()){

(5)

system.out.printline(Lname+ salary);

}

}

}

(a) (10%) Fill the blanks with appropriate codes.

(b) (4%) Explain the concept of conn.prepareStatement(stmt1) and r.next().

Q9. Assume that the array variable $managing is associative, and each element in $managing associates a project name (key) with the manager of the project. Suppose that the associations of projects and managers are as follows. ‘Kevin’ is the manager of ‘AI’ project; ‘Smith’ is the manager of ‘IOT’; ‘Mary’ is the manager of ‘5G’.

1. (4%) Write a PHP function project\_manager($managing, $project) to return the project manager of $project by checking whether the $project exists in $managing.
2. (2%) Write a PHP statement to assign the project-manager associations to the array variable $managing.
3. (3%) Write a PHP statement to print the manager of project ‘IOT’ by calling the project\_manager function. Write a PHP statement to print the manager of project ‘eCommerce’ by calling the project\_manager function.

Q10. Given the following PHP program:

|  |
| --- |
| . . . . . .  print <<<\_HTML\_  <FORM method = “post” action =“$\_SERVER[‘PHP\_SELF’]”>  Enter student major: <INPUT type =“text” name=“stu\_major”> <BR/>  Enter student year: <INPUT type =“text” name=“stu\_year”> <BR/>  <INPUT type=”submit” value=”submit your input”>  </FORM>  \_HTM\_;  . . . . .  $q = $d->query(‘SELECT Name, Grade, Address FROM STUDENT WHERE Major = ? AND Year = ?’, (1) );  print “students in department (2) with year (3) : \n”  // OUTPUT CODE BLOCK 1 to print the Name, Grade and Address of students who satisfy the conditions.  $allresult = $d->getAll(‘SELECT Cname, Credits, CDesc FROM COURSE’);  // OUTPUT CODE BLOCK 2 to print the course name, credits, and description. |

1. (3%) Fill in the blanks of (1).
2. (2%) Fill in the blanks of (2) and (3).
3. (3%) Write the codes for the OUTPUT CODE BLOCK 1 to print out all the records of the query result by using the while loop, $q->fetchRow() and print functions to print the Name, Grade and Address of students who satisfy the conditions.
4. (3%) Write a PHP program for the OUTPUT CODE BLOCK 2 by looping through all the records in $allresult using the **foreach** construct, and printing each record on a separate line.