Ref. CompanyDB Database

1. Database Specification

(a) Taking the EMPLOYEE table as an example, we might wish to impose strict regulations as to what data can, and cannot, be stored in the table:

- An employee must have a unique SSN
- A supervisor must also be an employee
- An employee's recorded department must be valid
- Names must be stored in a standard format [first letter uppercase, others lowercase]
- Sex must be either 'F' or 'M'
- etc

I. Which of the above can be specified as database constraints? Give examples. *[3 Marks]*

II. For the regulations that cannot be specified using constraints, is there any way in which they might they be enforced? *[3 Marks]*

(b) Cascading constraint are supported by database management systems, but are rarely employed by database designers. Give an example to explain their non-use? *[3 Marks]*

2. Database Directory / Security

(a) What is the direct result on the Directory of issuing an ALTER *TABLE* statement? *[3 Marks]*

(b) Give an example of a *GRANT* statement that would give a named user a specified permission on a specified table/view. What impact would this have on Directory table(s)? *[3 Marks]*

(c) Early database management systems actively promoted direct user engagement with the database directory. This is not the case anymore. Give an example and explain why. *[3 Marks]*

(d) What validation steps would be applicable to the following SQL statement, and how exactly would they be checked? Under what conditions would the statement succeed? *[3 Marks]*

```
REVOKE INSERT
ON EMPLOYEE
FROM 'User007'
```

(e) Assume that, as a database user, you believe that you are about to have SELECT permission on the EMPLOYEE table withdrawn from you – as a result of your bad behaviour? Is there any way you can get around this, and still be able to trawl through employee data? Explain. *[3 Marks]*

3. Database Manipulation

(a) In SQL, what are the conditions that dictate that a multi-table query must be evaluated using the join technique? *[3 Marks]*

(b) Construct a command in SQL to solve the following query, using (i) the *join* method and (ii) the *subquery* method: *[3 Marks each]*

"Find the identity and name of each dependent of an employee working for the Research department"

(c) Specify the definition of a *view* that would simplify the query of (b) above. It should be of the form

DependEmpDept (Dependent_Name, SSN, Dno)

and contain details of dependents, employees and departments.

Now write the query of (b) against this view, and indicate how it would have been modified into an equivalent query against base tables. *[3 Marks each]*

(d) Construct a command in SQL to solve the following data requirements: *[3 Marks each]*

"Find the identity and name of each staff member of the Research department who has worked on no projects"

"Find the identity and name of each staff member of the Research department who has worked on every project"

4. Data Storage Technology

(a) What function does a *storage engine* play in a modern database management system? Why is it necessary? *[3 Marks]*

(b) In what way does the presence of *variable-length records* within a file impact on the subsequent processing of that file? *[3 Marks]*

(c) Under what conditions would a *serial* file suffice for database table storage? What about a *sequential* file? What about an *indexed sequential* file? *[3 Marks]*

(d) What is *multiple buffering* and what role does it play in database query processing? *[3 Marks]*

5. Database Programming

(a) PHP Language Constructs

(i) What function does each of the following PHP constructs fulfil? *[1 Mark each]*

MYSQLi_SELECT_DB

PRINT

MYSQLi_FREE_RESULT

$_GET

(ii) What is the essential difference between the *MYSQLi_FETCH_ROW* and *MYSQLi_FETCH_ASSOC* function calls? *[3 Marks]*

(iii) What precisely do we mean when we say that PHP is a *server-side* language?

[3 Marks]

(b) PHP Programming

(i) Write a fragment of PHP code to determine the name of dependents of John Smith and output the result to a user's browser. Do not worry about login, database selection, etc - focus only on executing the query and displaying the result.

[10 Marks]

(ii) Suppose you wanted the program of (b)(i) above to be available only to members of the Research Department, how would you achieve this? *[3 Marks]*

EMPLOYEE

FNAME	MINIT	LNAME	SSN	BDATE	ADDRESS	SEX	SALARY	SUPERSSN	DNO
John	B	Smith	123456789	1965-01-09	731 Fondren, Houston, TX	M	30000	333445555	5
Franklin	T	Wong	333445555	1955-12-08	638 Voss, Houston, TX	M	40000	888665555	5
Alicia	J	Zelaya	999887777	1968-07-19	3321 Castle, Spring, TX	F	25000	987654321	4
Jennifer	S	Wallace	987654321	1941-06-20	291 Berry, Bellaire, TX	F	43000	888665555	4
Ramesh	K	Narayan	666884444	1962-09-15	975 Fire Oak, Humble, TX	M	38000	333445555	5
Joyce	A	English	453453453	1972-07-31	5631 Rice, Houston, TX	F	25000	333445555	5
Ahmad	V	Jabbar	987987987	1969-03-29	980 Dallas, Houston, TX	M	25000	987654321	4
James	E	Borg	888665555	1937-11-10	450 Stone, Houston, TX	M	55000	null	1

DEPT_LOCATIONS

DNUMBER	DLOCATION
1	Houston
4	Stafford
5	Bellaire
5	Sugarland
5	Houston

DEPARTMENT

DNAME	DNUMBER	MGRSSN	MGRSTARTDATE
Research	5	333445555	1988-05-22
Administration	4	987654321	1995-01-01
Headquarters	1	888665555	1981-06-19

WORKS_ON

ESSN	PNO	HOURS
123456789	1	32.5
123456789	2	7.5
666884444	3	40.0
453453453	1	20.0
453453453	2	20.0
333445555	2	10.0
333445555	3	10.0
333445555	10	10.0
333445555	20	10.0
999887777	30	30.0
999887777	10	10.0
987987987	10	35.0
987987987	30	5.0
987654321	30	20.0
987654321	20	15.0
888665555	20	null

PROJECT

PNAME	PNUMBER	PLOCATION	DNUM
ProductX	1	Bellaire	5
ProductY	2	Sugarland	5
ProductZ	3	Houston	5
Computerization	10	Stafford	4
Reorganization	20	Houston	1
Newbenefits	30	Stafford	4

DEPENDENT

ESSN	DEPENDENT_NAME	SEX	BDATE	RELATIONSHIP
333445555	Alice	F	1986-04-05	DAUGHTER
333445555	Theodore	M	1983-10-25	SON
333445555	Joy	F	1958-05-03	SPOUSE
987654321	Abner	M	1942-02-28	SPOUSE
123456789	Michael	M	1988-01-04	SON
123456789	Alice	F	1988-12-30	DAUGHTER
123456789	Elizabeth	F	1967-05-05	SPOUSE

CompanyDB: Personnel Database of a Consultancy Company