**EMPLOYEE**

| Fname | Minit | Lname | Ssn | Bdate | Address | Sex | Salary | Super_ssn | Dno |
|---|---|---|---|---|---|---|---|---|---|

**DEPARTMENT**

| Dname | Dnumber | Mgr_ssn | Mgr_start_date |
|---|---|---|---|

**DEPT_LOCATIONS**

| Dnumber | Dlocation |
|---|---|

**PROJECT**

| Pname | Pnumber | Plocation | Dnum |
|---|---|---|---|

**WORKS_ON**

| Essn | Pno | Hours |
|---|---|---|

**DEPENDENT**

| Essn | Dependent_name | Sex | Bdate | Relationship |
|---|---|---|---|---|

**Figure 3.5**
Schema diagram for the COMPANY relational database schema.

**Figure 3.6**
One possible database state for the COMPANY relational database schema.

**EMPLOYEE**

| Fname | Minit | Lname | Ssn | Bdate | Address | Sex | Salary | Super_ssn | 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 | 1968-01-19 | 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 |

**DEPARTMENT**

| Dname | Dnumber | Mgr_ssn | Mgr_start_date |
|---|---|---|---|
| Research | 5 | 333445555 | 1988-05-22 |
| Administration | 4 | 987654321 | 1995-01-01 |
| Headquarters | 1 | 888665555 | 1981-06-19 |

**DEPT_LOCATIONS**

| Dnumber | Dlocation |
|---|---|
| 1 | Houston |
| 4 | Stafford |
| 5 | Bellaire |
| 5 | Sugarland |
| 5 | Houston |

**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 |

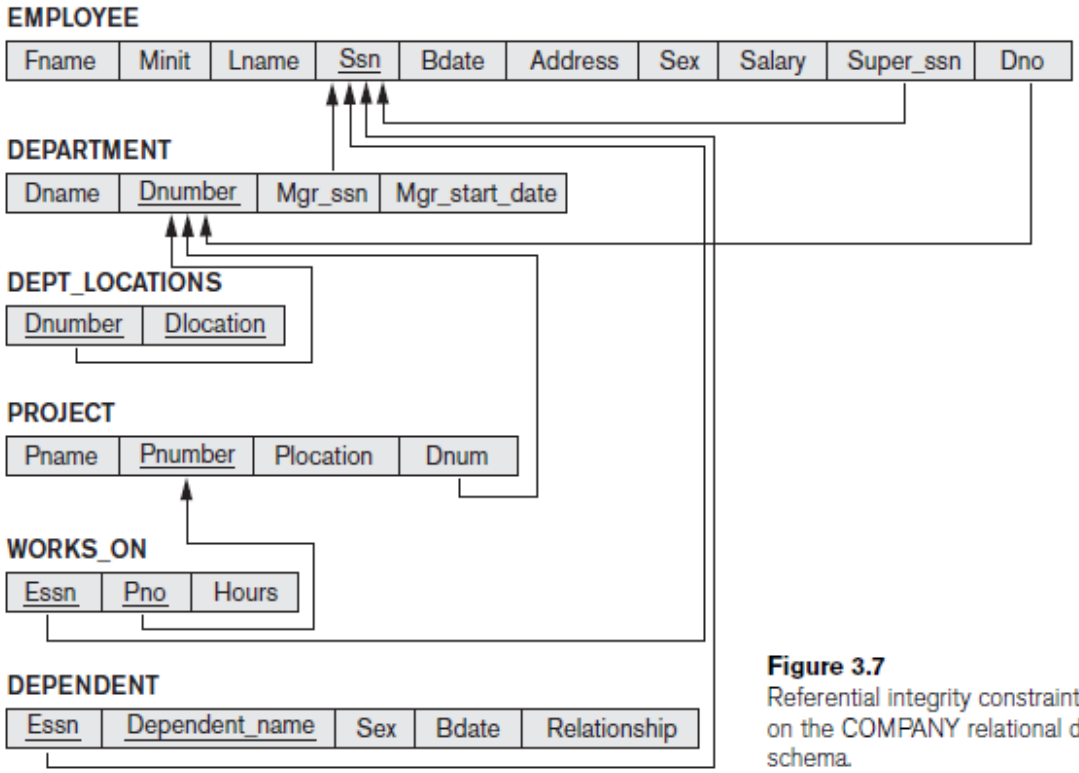


**Figure 3.7**
Referential integrity constraints displayed on the COMPANY relational database schema.

**Figure 4.3**
Results of SQL queries when applied to the COMPANY database state shown in Figure 3.6. (a) Q0. (b) Q1. (c) Q2. (d) Q8. (e) Q9. (f) Q10. (g) Q1C.

**(a)**

| Bdate | Address |
|---|---|
| 1965-01-09 | 731Fondren, Houston, TX |

**(b)**

| Fname | Lname | Address |
|---|---|---|
| John | Smith | 731 Fondren, Houston, TX |
| Franklin | Wong | 638 Voss, Houston, TX |
| Ramesh | Narayan | 975 Fire Oak, Humble, TX |
| Joyce | English | 5631 Rice, Houston, TX |

**(c)**

| Pnumber | Dnum | Lname | Address | Bdate |
|---|---|---|---|---|
| 10 | 4 | Wallace | 291Berry, Bellaire, TX | 1941-06-20 |
| 30 | 4 | Wallace | 291Berry, Bellaire, TX | 1941-06-20 |

**(d)**

| E.Fname | E.Lname | S.Fname | S.Lname |
|---|---|---|---|
| John | Smith | Franklin | Wong |
| Franklin | Wong | James | Borg |
| Alicia | Zelaya | Jennifer | Wallace |
| Jennifer | Wallace | James | Borg |
| Ramesh | Narayan | Franklin | Wong |
| Joyce | English | Franklin | Wong |
| Ahmad | Jabbar | Jennifer | Wallace |

**(e)**

| E.Fname |
|---|
| 123456789 |
| 333445555 |
| 999887777 |
| 987654321 |
| 666884444 |
| 453453453 |
| 987987987 |
| 888665555 |

**(f)**

| Ssn | Dname |
|---|---|
| 123456789 | Research |
| 333445555 | Research |
| 999887777 | Research |
| 987654321 | Research |
| 666884444 | Research |
| 453453453 | Research |
| 987987987 | Research |
| 888665555 | Research |
| 123456789 | Administration |
| 333445555 | Administration |
| 999887777 | Administration |
| 987654321 | Administration |
| 666884444 | Administration |
| 453453453 | Administration |
| 987987987 | Administration |
| 888665555 | Administration |
| 123456789 | Headquarters |
| 333445555 | Headquarters |
| 999887777 | Headquarters |
| 987654321 | Headquarters |
| 666884444 | Headquarters |
| 453453453 | Headquarters |
| 987987987 | Headquarters |
| 888665555 | Headquarters |

**(g)**

| Fname | Minit | Lname | Ssn | Bdate | Address | Sex | Salary | Super_ssn | Dno |
|---|---|---|---|---|---|---|---|---|---|
| John | B | Smith | 123456789 | 1965-09-01 | 731 Fondren, Houston, TX | M | 30000 | 333445555 | 5 |
| Franklin | T | Wong | 333445555 | 1955-12-08 | 638 Voss, Houston, TX | M | 40000 | 888665555 | 5 |
| 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 |

1. **Query .** Retrieve the birth date and address of the employee(s) whose name is ‘John B. Smith’.
2. **Query .** Retrieve the name and address of all employees who work for the
‘Research’ department.

3. **Query:** For every project located in ‘Stafford’, list the project number, the controlling department number, and the department manager’s last name, address, and birth date.

4. **Query:** For each employee, retrieve the employee’s first and last name and the first and last name of his or her immediate supervisor.

5. **Query:** Write a query which is retrieves all the attribute values of any EMPLOYE who works in DEPARTMENT number 5

6. **Query:** write a query which is retrieves all the attributes of an EMPLOYEE and attributes of the DEPARTMENT in which he or she works for every employee of the ‘Research’ department,

7. **Query:** write a query which is specifies the CROSS PRODUCT of the EMPLOYEE and DEPARTMENT relations.

8. **Query:** Select all EMPLOYEE Ssns in the database.

9. **Query**: Select all EMPLOYEE Ssns

10. **Query:** Retrieve the salary of every employee .

11. **Query:** Retrieve the all distinct salary value.

12. **Query:** Make a list of all project numbers for projects that involve an employee whose last name is ‘Smith’, either as a worker or as a manager of the department that controls the project.

13. **Query:** Retrieve all employees whose address is in Houston, Texas.
14. **Query:** Find all employees who were born during the 1950s.
15. **Query:** Show the resulting salaries if every employee working on the ‘ProductX’ project is given a 10 percent raise.

16. **Query:** Retrieve all employees in department 5 whose salary is between $30,000 and $40,000.

17. **Query:** Retrieve a list of employees and the projects they are working on, ordered by department and within each department, ordered alphabetically by last name, then first name.

18. **Query:** Retrieve the name of all employees who do not have supervisors.
19. **Query:** Retrieve the name of each employee who has a dependent with the same first name and is the same sex as the employee.
20. **Query:** write a query which is retrieve In general, a query written with nested select-from-where blocks and using the = or IN comparison operators can always be expressed as a single block query.
21. **Query:** Retrieve the names of employee who have no dependents.
22. **Query:** List the name of managers who have at least one dependent.

23. **Query:** Retrieve the Social Security numbers of all employee who work on project numbers 1, 2, or 3.

24. **Query:** Find the sum of the salaries of all employees, the maximum salary, the minimum salary, and the average salary.
25. **Query:** Find the sum of the salaries of all employees of the 'Research' department, as well as the maximum salary, the minimum salary, and the average salary in this department.
26. **Query:** Retrieve the total number of employees in the company.
27. **Query:** Retrieve the total number of employees in the company and the number of employees in the 'Research' department.
28. **Query:** Count the number of distinct salary value in the database.
29. **Query:** For each department, retrieve the department number, the number of employees in the department, and their average salary.

30. **Query:** For each project, retrieve the project number, the project name, and
the number of employees who work on that project.

31. **Query:** For each project *on which more than two employees work,* retrieve the project number, the project name, and the number of employees who work on the project.
32. **Query:** For each project, retrieve the project number, the project name, and
the number of employees from department 5 who work on the project.

33. **Query:** For each department that has more than five employees, retrieve the department number and the number of its employees who are making more than $40,000.