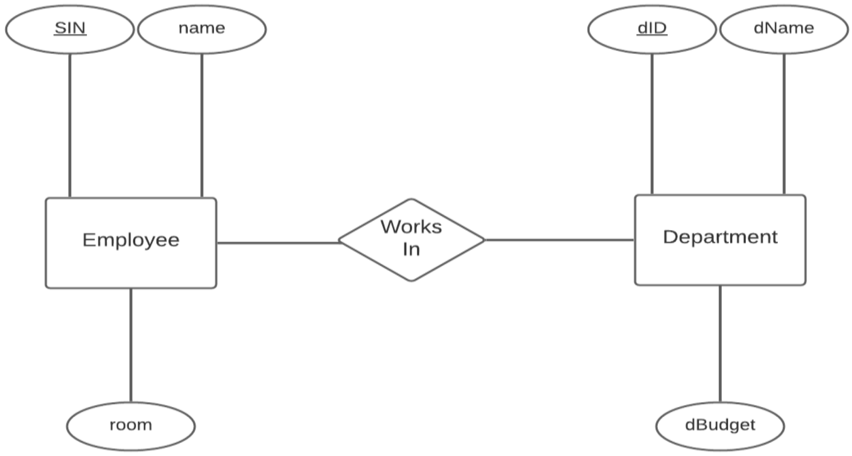
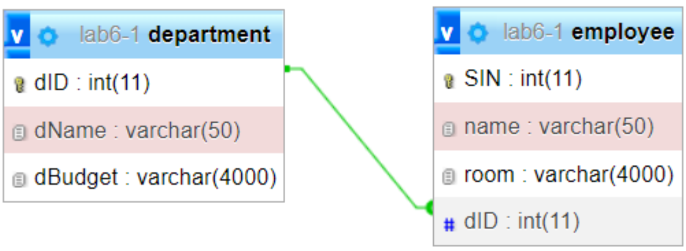


The “Works In” relationship above can be efficiently represented in different ways in our SQL code.

Approach 1: Using a foreign key
Assumption: *Employee* and *Department* tables have a 1:N (one-to-many) relationship i.e., one employee works in one department, but one department can have many employees.
SQL Queries:

```
CREATE TABLE Employee (
        SIN     INT                 NOT NULL     PRIMARY KEY,
        name  VARCHAR(50)           NOT NULL,
        room    VARCHAR(4000)       NOT NULL,
        dID  INT,
        FOREIGN KEY (dID) REFERENCES Department (dID)
);

CREATE TABLE Department (
        dID             INT                 NOT NULL     PRIMARY KEY ,
        dName           VARCHAR(50)    NOT NULL,
        dBudget         VARCHAR(4000)  NOT NULL
);
```



In the *Department* table, *dID* is the primary key followed by *dName* and *DBudget* which are non-prime attributes.
In the *Employee* table, *SIN* is a primary key followed by *name* and *room* which are non-prime attributes. *dID* is the foreign key referencing the primary key from the *Department* table, used

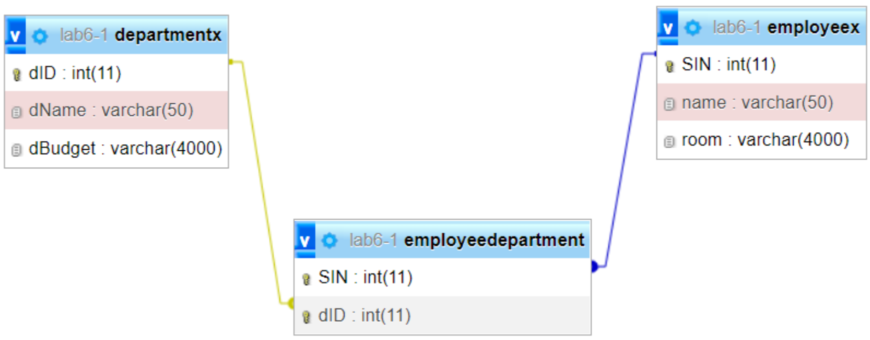
to link the two tables together. The *dID* column is very crucial as it prevents broken relationships between the two tables and orphan rows (i.e., referential integrity).

Approach 2: Using a junction table
Assumption: *Employee* and *Department* tables have a N:M (many-to-many) relationship i.e., one employee can work in multiple departments and, one department can have many employees.
SQL Queries:

```
CREATE TABLE Employeex
(
            SIN     INT             NOT NULL    PRIMARY KEY,
            name  VARCHAR(50)       NOT NULL,
            room   VARCHAR(4000)    NOT NULL
);

CREATE TABLE Departmentx
(
            dID     INT             NOT NULL    PRIMARY KEY,
            dName       VARCHAR(50)       NOT NULL,
            dBudget     VARCHAR(4000)     NOT NULL
);

CREATE TABLE EmployeeDepartment
(
            SIN INT NOT NULL,
            dID INT NOT NULL,
            CONSTRAINT PK_EmpDept PRIMARY KEY (SIN, dID),
            FOREIGN KEY (SIN) REFERENCES Employeex(SIN),
            FOREIGN KEY (dID) REFERENCES Departmentx(dID)
);
```



As there is an N:M (many-to-many) relationship between the tables *Employeex* and *Departmentx*, we created a third table *EmployeeDepartment* which holds a composite primary key with *SIN* and *dID*. Here, the foreign key *SIN* refers to the primary key from *Employeex* table whereas the foreign key *dID* refers to the primary key from *Departmentx* table.

Explanation:
In terms of design principles, if the relationship is 1:N, it makes no sense to create a third table (junction table) since a foreign key can do the job better. In the case of an N:M relationship, the existing tables should be broken down into smaller tables or a junction table connecting

the main tables, to achieve normalization. Considering the relationship between the tables is crucial to implementing an efficient approach. However, under certain constraints, the contents of the junction table can be folded down into one of the base tables as additional columns, improving efficiency.

When two alternatives for a database design exist, it would be wise to examine which alternative more closely fits the underlying conceptual and relational models, which can entail performance advantages and space savings.
