# 数据库系统开发实验

姓名：卜梦煜 学号：1120192419 班级：07111905

## 实验名称

售后服务管理系统数据建模

## 实验目的

通过本实验，掌握Power Designer数据建模的方法，掌握物理模型、逻辑模型的联系、区别、转换，掌握将Power Designer的物理模型导入SQL Server数据库管理系统的方法。

## 实验内容

根据售后服务管理需求的内容，使用Power Designer数据建模工具创建售后服务的数据模型，并将其中的物理模型生成到SQL Server数据库管理系统。

## 数据模型

根据售后服务管理需求的内容，建立表结构如下：

（1）公司（公司编号，公司名称，公司负责人，电话）

（2）雇员（员工编号，姓名，性别，电话，上司的员工号）

（3）客户服务专员（员工编号，姓名，性别，电话，上司的员工号，售后电话）

（4）技术支持工程师（员工编号，姓名，性别，电话，上司的员工号）

（5）现场服务工程师（员工编号，姓名，性别，电话，上司的员工号）

（6）售后服务记录表（服务编号，顾客编号，产品编号，合同编号，客户服务专员编号，技术支持工程师编号，现场服务工程师编号，服务类型，评估结果，服务内容，下次服务编号）

（7）顾客（顾客编号，姓名，性别，电话）

（8）工厂（工厂编号，工厂名称，工厂负责人，电话）

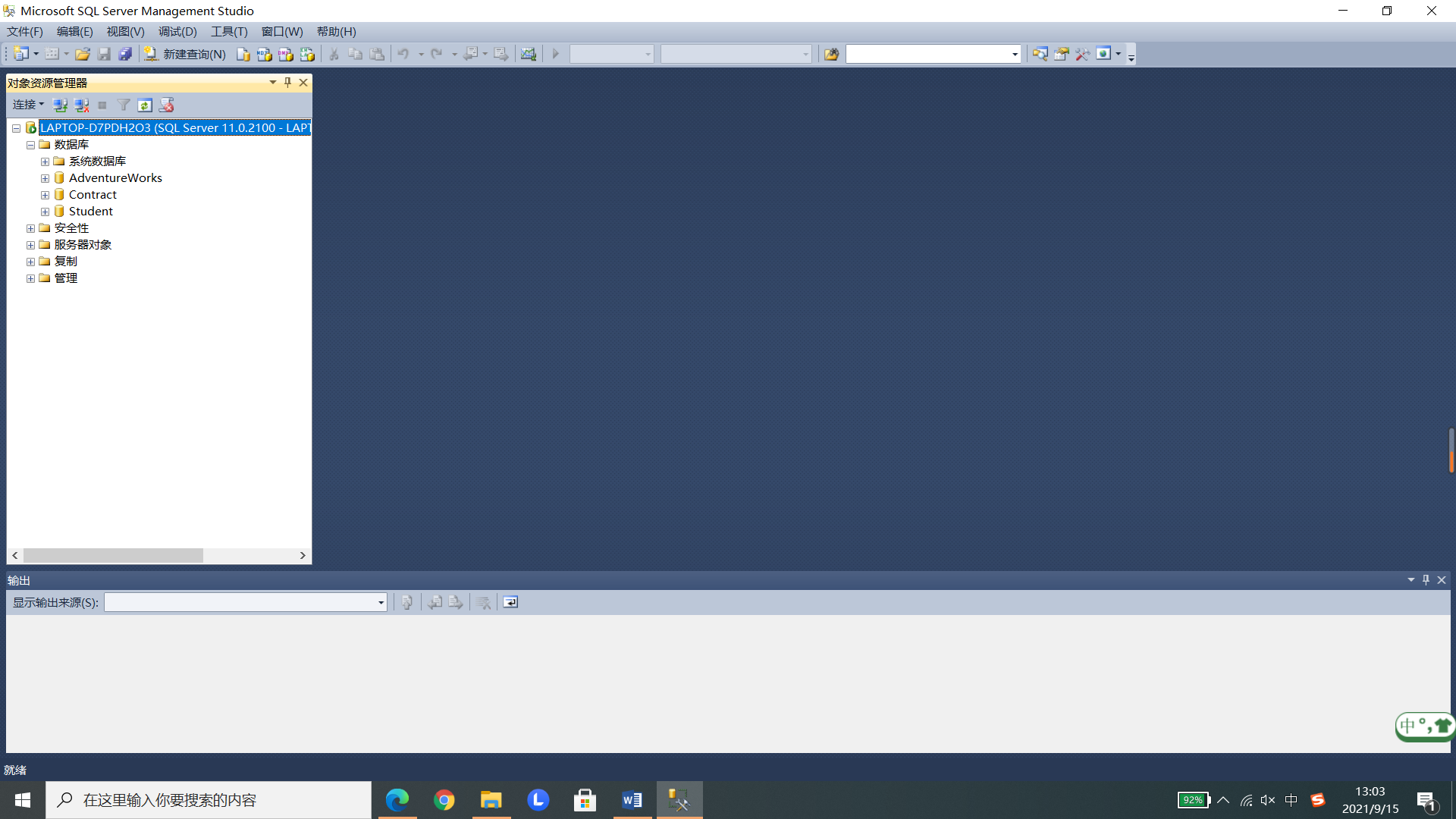
（9）产品（产品编号，工厂编号，产品名称，产品类型，产品价格）

（10）合同（合同编号，顾客编号，产品编号，合同开始日期，合同有效期，合同类型）

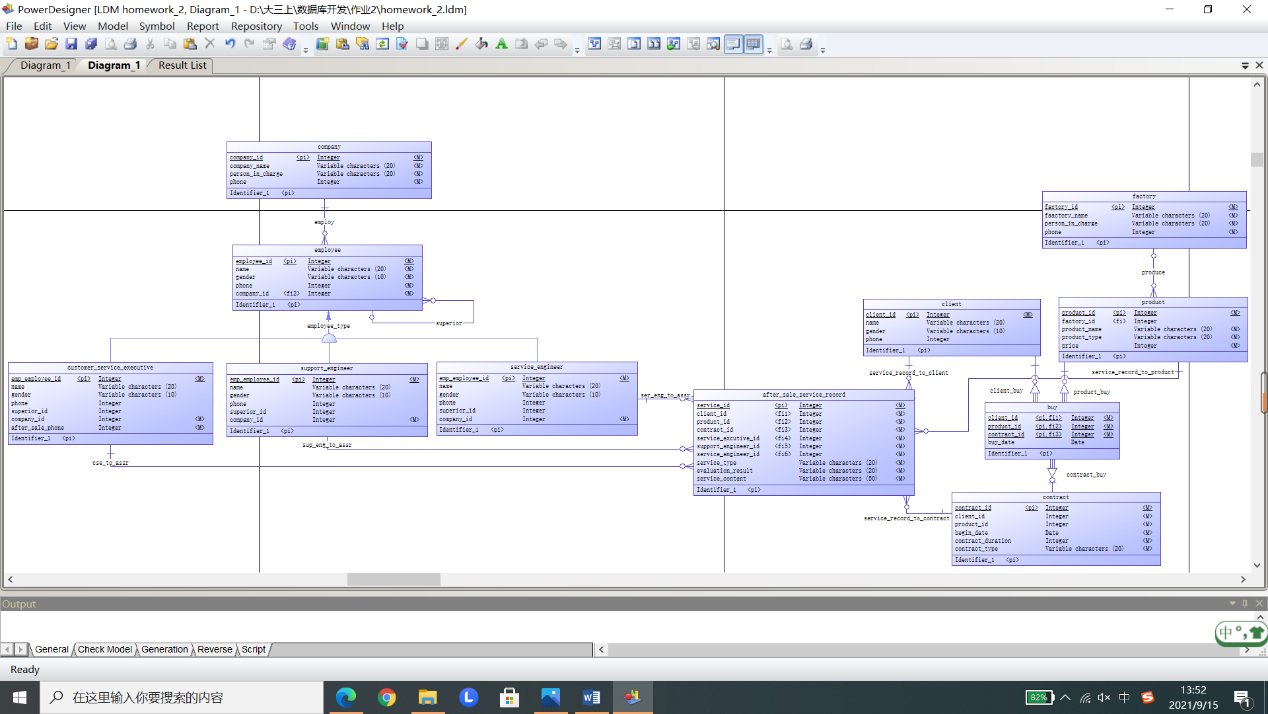
（11）购买表（顾客编号，产品编号，合同编号，购买日期）

## 实验步骤

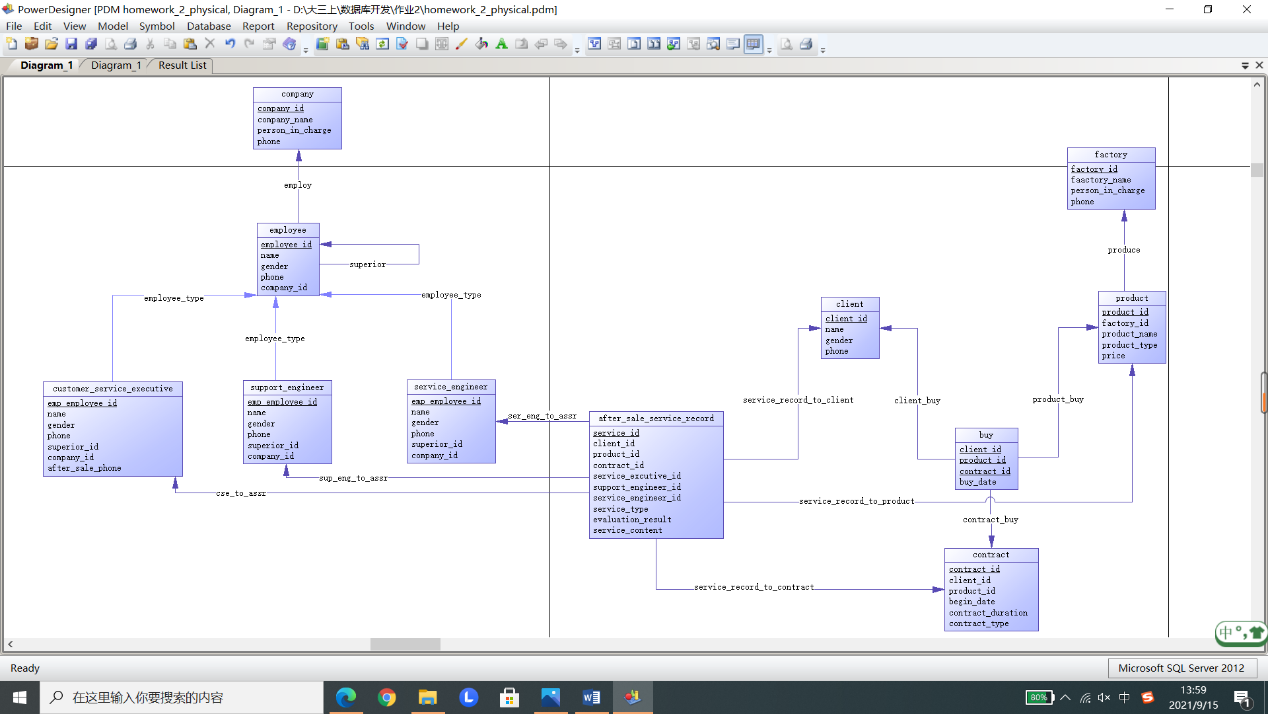
（1）使用SQL Server Management Studio创建Contract数据库。



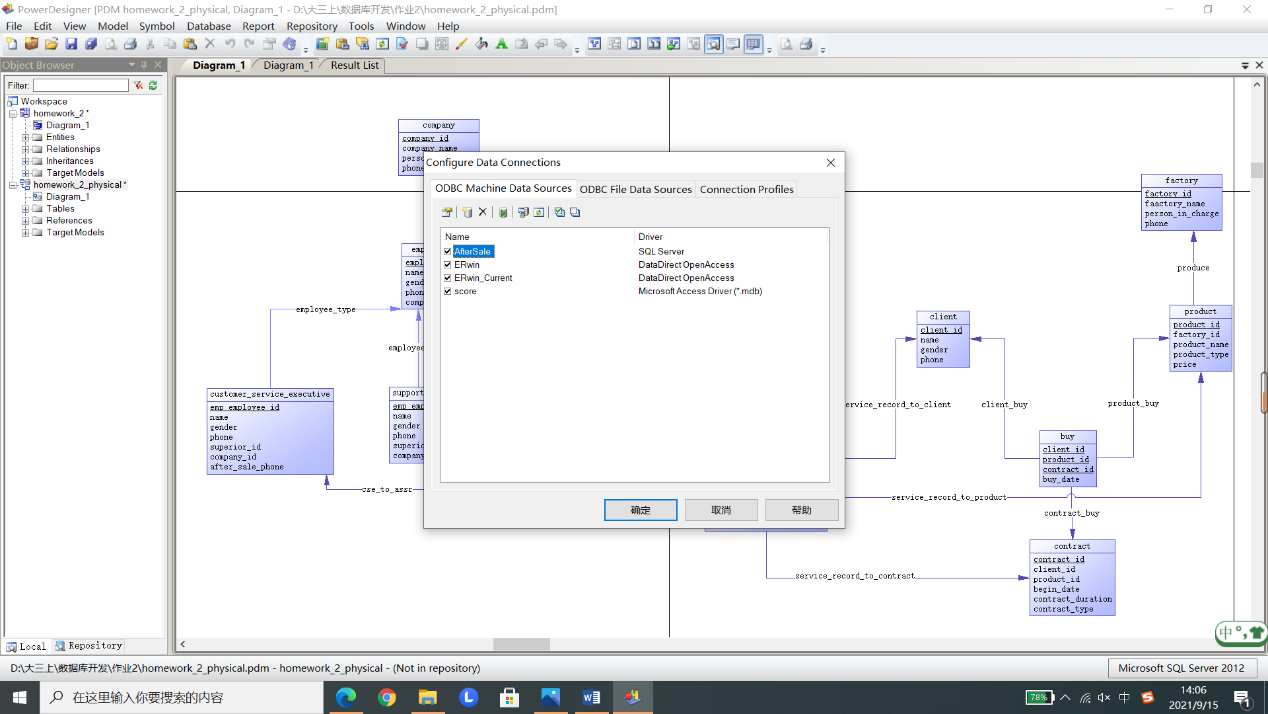
（2）根据建立的数据模型，使用Power Designer建立售后服务系统的逻辑模型，并加上实体之间的联系。



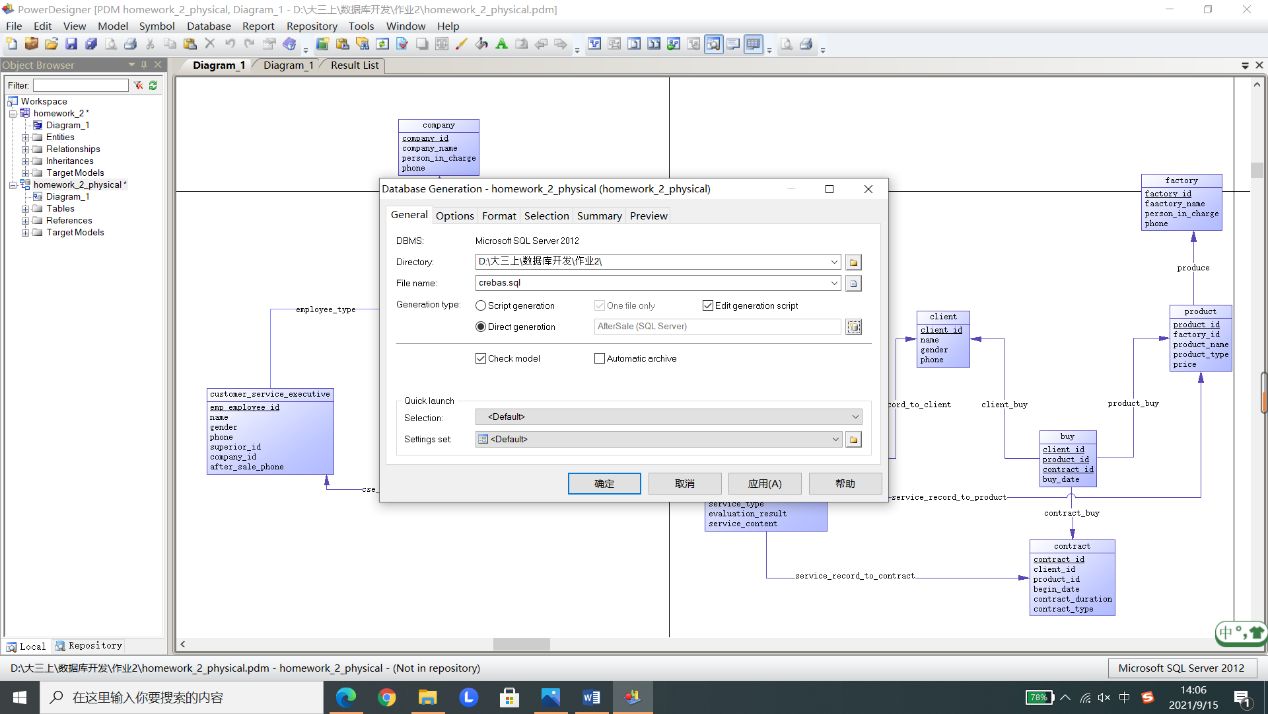
（3）点击Tool-Generate Physical Data Model，将逻辑模型转化成对应的物理模型。



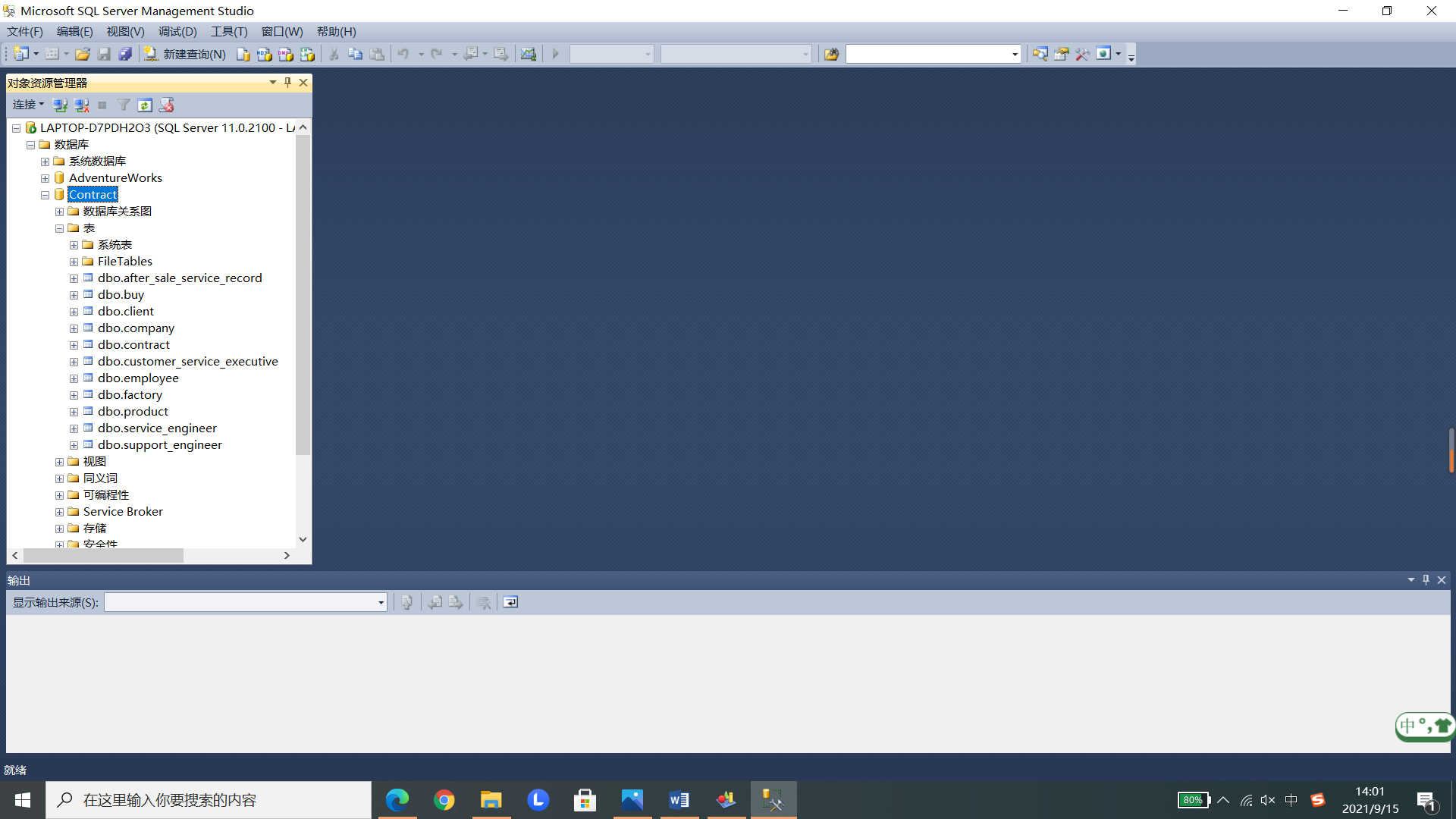
（4）点击Database-Configure Connections-Add Data Resource，创建通过SQL Server登录的连接到Contract数据表的数据源AfterSale。



（5）点击Database-Generate Database，利用（4）中创建的数据源AfterSale，将物理模型建立的表导入Contract数据库。



在SQL Server中验证所有表都已经成功导入Contract数据库。



## 回答问题

**（1）如何实现售后服务中的产品服务期限的？**

客户服务专员根据用户提供的用户编号、产品编号、合同编号在购买表中做验证是否有对应的购买记录，通过验证后建立售后服务记录，根据合同编号查询合同表中的合同开始日期和合同有效期，据此判断是否到达产品服务期限。

**（2）如何记录售后服务的产品信息？**

添加售后服务记录时，会将售后服务产品的产品编号填入表中，而根据产品编号又可以在产品表找到该产品的信息，由此记录售后服务的产品信息。

**（3）如何记录技术服务工程师（包括服务专员）的信息？**

定义“客户服务专员”、“技术支持工程师”、“技术服务工程师”为“雇员”下的三个派生实体，三者拥有不同的访问、修改权限，通过向对应种类的雇员表中添加信息即可记录技术服务工程师（包括服务专员）的信息。

**（4）一个完整的服务信息（如维修一个磁盘可能包括第一次打电话咨询、维修等由多**

**个小服务组成一个大服务）是如何记录的？**

服务信息表中记录了客户编号、产品编号、合同编号，并可以由这三个属性定位某个用户的某个产品的维修，因此可在服务信息表中添加一个“下次服务编号（next\_service\_id）”属性，并建立从“售后服务信息表”到“售后服务信息表”的递归联系，外键为“下次服务编号”，然后就可以通过递归查询找到某个产品的所有小服务的记录。

## 附录

（1）从物理模型转变成的SQL语句：

/\*==============================================================\*/

/\* DBMS name: Microsoft SQL Server 2012 \*/

/\* Created on: 2021/9/15 20:12:52 \*/

/\*==============================================================\*/

if exists (select 1

from sys.sysreferences r join sys.sysobjects o on (o.id = r.constid and o.type = 'F')

where r.fkeyid = object\_id('after\_sale\_service\_record') and o.name = 'FK\_AFTER\_SA\_CSE\_TO\_AS\_CUSTOMER')

alter table after\_sale\_service\_record

drop constraint FK\_AFTER\_SA\_CSE\_TO\_AS\_CUSTOMER

go

if exists (select 1

from sys.sysreferences r join sys.sysobjects o on (o.id = r.constid and o.type = 'F')

where r.fkeyid = object\_id('after\_sale\_service\_record') and o.name = 'FK\_AFTER\_SA\_SER\_ENG\_T\_SERVICE\_')

alter table after\_sale\_service\_record

drop constraint FK\_AFTER\_SA\_SER\_ENG\_T\_SERVICE\_

go

if exists (select 1

from sys.sysreferences r join sys.sysobjects o on (o.id = r.constid and o.type = 'F')

where r.fkeyid = object\_id('after\_sale\_service\_record') and o.name = 'FK\_AFTER\_SA\_SERVICE\_R\_CLIENT')

alter table after\_sale\_service\_record

drop constraint FK\_AFTER\_SA\_SERVICE\_R\_CLIENT

go

if exists (select 1

from sys.sysreferences r join sys.sysobjects o on (o.id = r.constid and o.type = 'F')

where r.fkeyid = object\_id('after\_sale\_service\_record') and o.name = 'FK\_AFTER\_SA\_SERVICE\_R\_CONTRACT')

alter table after\_sale\_service\_record

drop constraint FK\_AFTER\_SA\_SERVICE\_R\_CONTRACT

go

if exists (select 1

from sys.sysreferences r join sys.sysobjects o on (o.id = r.constid and o.type = 'F')

where r.fkeyid = object\_id('after\_sale\_service\_record') and o.name = 'FK\_AFTER\_SA\_SERVICE\_R\_PRODUCT')

alter table after\_sale\_service\_record

drop constraint FK\_AFTER\_SA\_SERVICE\_R\_PRODUCT

go

if exists (select 1

from sys.sysreferences r join sys.sysobjects o on (o.id = r.constid and o.type = 'F')

where r.fkeyid = object\_id('after\_sale\_service\_record') and o.name = 'FK\_AFTER\_SA\_SUP\_ENG\_T\_SUPPORT\_')

alter table after\_sale\_service\_record

drop constraint FK\_AFTER\_SA\_SUP\_ENG\_T\_SUPPORT\_

go

if exists (select 1

from sys.sysreferences r join sys.sysobjects o on (o.id = r.constid and o.type = 'F')

where r.fkeyid = object\_id('buy') and o.name = 'FK\_BUY\_CLIENT\_BU\_CLIENT')

alter table buy

drop constraint FK\_BUY\_CLIENT\_BU\_CLIENT

go

if exists (select 1

from sys.sysreferences r join sys.sysobjects o on (o.id = r.constid and o.type = 'F')

where r.fkeyid = object\_id('buy') and o.name = 'FK\_BUY\_CONTRACT\_\_CONTRACT')

alter table buy

drop constraint FK\_BUY\_CONTRACT\_\_CONTRACT

go

if exists (select 1

from sys.sysreferences r join sys.sysobjects o on (o.id = r.constid and o.type = 'F')

where r.fkeyid = object\_id('buy') and o.name = 'FK\_BUY\_PRODUCT\_B\_PRODUCT')

alter table buy

drop constraint FK\_BUY\_PRODUCT\_B\_PRODUCT

go

if exists (select 1

from sys.sysreferences r join sys.sysobjects o on (o.id = r.constid and o.type = 'F')

where r.fkeyid = object\_id('customer\_service\_executive') and o.name = 'FK\_CUSTOMER\_EMPLOYEE\_\_EMPLOYEE')

alter table customer\_service\_executive

drop constraint FK\_CUSTOMER\_EMPLOYEE\_\_EMPLOYEE

go

if exists (select 1

from sys.sysreferences r join sys.sysobjects o on (o.id = r.constid and o.type = 'F')

where r.fkeyid = object\_id('employee') and o.name = 'FK\_EMPLOYEE\_EMPLOY\_COMPANY')

alter table employee

drop constraint FK\_EMPLOYEE\_EMPLOY\_COMPANY

go

if exists (select 1

from sys.sysreferences r join sys.sysobjects o on (o.id = r.constid and o.type = 'F')

where r.fkeyid = object\_id('employee') and o.name = 'FK\_EMPLOYEE\_SUPERIOR\_EMPLOYEE')

alter table employee

drop constraint FK\_EMPLOYEE\_SUPERIOR\_EMPLOYEE

go

if exists (select 1

from sys.sysreferences r join sys.sysobjects o on (o.id = r.constid and o.type = 'F')

where r.fkeyid = object\_id('product') and o.name = 'FK\_PRODUCT\_PRODUCE\_FACTORY')

alter table product

drop constraint FK\_PRODUCT\_PRODUCE\_FACTORY

go

if exists (select 1

from sys.sysreferences r join sys.sysobjects o on (o.id = r.constid and o.type = 'F')

where r.fkeyid = object\_id('service\_engineer') and o.name = 'FK\_SERVICE\_\_EMPLOYEE\_\_EMPLOYEE')

alter table service\_engineer

drop constraint FK\_SERVICE\_\_EMPLOYEE\_\_EMPLOYEE

go

if exists (select 1

from sys.sysreferences r join sys.sysobjects o on (o.id = r.constid and o.type = 'F')

where r.fkeyid = object\_id('support\_engineer') and o.name = 'FK\_SUPPORT\_\_EMPLOYEE\_\_EMPLOYEE')

alter table support\_engineer

drop constraint FK\_SUPPORT\_\_EMPLOYEE\_\_EMPLOYEE

go

if exists (select 1

from sysindexes

where id = object\_id('after\_sale\_service\_record')

and name = 'ser\_eng\_to\_assr\_FK'

and indid > 0

and indid < 255)

drop index after\_sale\_service\_record.ser\_eng\_to\_assr\_FK

go

if exists (select 1

from sysindexes

where id = object\_id('after\_sale\_service\_record')

and name = 'sup\_eng\_to\_assr\_FK'

and indid > 0

and indid < 255)

drop index after\_sale\_service\_record.sup\_eng\_to\_assr\_FK

go

if exists (select 1

from sysindexes

where id = object\_id('after\_sale\_service\_record')

and name = 'cse\_to\_assr\_FK'

and indid > 0

and indid < 255)

drop index after\_sale\_service\_record.cse\_to\_assr\_FK

go

if exists (select 1

from sysindexes

where id = object\_id('after\_sale\_service\_record')

and name = 'service\_record\_to\_contract\_FK'

and indid > 0

and indid < 255)

drop index after\_sale\_service\_record.service\_record\_to\_contract\_FK

go

if exists (select 1

from sysindexes

where id = object\_id('after\_sale\_service\_record')

and name = 'service\_record\_to\_product\_FK'

and indid > 0

and indid < 255)

drop index after\_sale\_service\_record.service\_record\_to\_product\_FK

go

if exists (select 1

from sysindexes

where id = object\_id('after\_sale\_service\_record')

and name = 'service\_record\_to\_client\_FK'

and indid > 0

and indid < 255)

drop index after\_sale\_service\_record.service\_record\_to\_client\_FK

go

if exists (select 1

from sysobjects

where id = object\_id('after\_sale\_service\_record')

and type = 'U')

drop table after\_sale\_service\_record

go

if exists (select 1

from sysindexes

where id = object\_id('buy')

and name = 'contract\_buy\_FK'

and indid > 0

and indid < 255)

drop index buy.contract\_buy\_FK

go

if exists (select 1

from sysindexes

where id = object\_id('buy')

and name = 'product\_buy\_FK'

and indid > 0

and indid < 255)

drop index buy.product\_buy\_FK

go

if exists (select 1

from sysindexes

where id = object\_id('buy')

and name = 'client\_buy\_FK'

and indid > 0

and indid < 255)

drop index buy.client\_buy\_FK

go

if exists (select 1

from sysobjects

where id = object\_id('buy')

and type = 'U')

drop table buy

go

if exists (select 1

from sysobjects

where id = object\_id('client')

and type = 'U')

drop table client

go

if exists (select 1

from sysobjects

where id = object\_id('company')

and type = 'U')

drop table company

go

if exists (select 1

from sysobjects

where id = object\_id('contract')

and type = 'U')

drop table contract

go

if exists (select 1

from sysobjects

where id = object\_id('customer\_service\_executive')

and type = 'U')

drop table customer\_service\_executive

go

if exists (select 1

from sysindexes

where id = object\_id('employee')

and name = 'employ\_FK'

and indid > 0

and indid < 255)

drop index employee.employ\_FK

go

if exists (select 1

from sysindexes

where id = object\_id('employee')

and name = 'superior\_FK'

and indid > 0

and indid < 255)

drop index employee.superior\_FK

go

if exists (select 1

from sysobjects

where id = object\_id('employee')

and type = 'U')

drop table employee

go

if exists (select 1

from sysobjects

where id = object\_id('factory')

and type = 'U')

drop table factory

go

if exists (select 1

from sysindexes

where id = object\_id('product')

and name = 'produce\_FK'

and indid > 0

and indid < 255)

drop index product.produce\_FK

go

if exists (select 1

from sysobjects

where id = object\_id('product')

and type = 'U')

drop table product

go

if exists (select 1

from sysobjects

where id = object\_id('service\_engineer')

and type = 'U')

drop table service\_engineer

go

if exists (select 1

from sysobjects

where id = object\_id('support\_engineer')

and type = 'U')

drop table support\_engineer

go

/\*==============================================================\*/

/\* Table: after\_sale\_service\_record \*/

/\*==============================================================\*/

create table after\_sale\_service\_record (

service\_id int not null,

client\_id int not null,

product\_id int not null,

contract\_id int not null,

service\_excutive\_id int not null,

support\_engineer\_id int not null,

service\_engineer\_id int not null,

service\_type varchar(20) not null,

evaluation\_result varchar(20) not null,

service\_content varchar(50) not null,

constraint PK\_AFTER\_SALE\_SERVICE\_RECORD primary key nonclustered (service\_id)

)

go

/\*==============================================================\*/

/\* Index: service\_record\_to\_client\_FK \*/

/\*==============================================================\*/

create index service\_record\_to\_client\_FK on after\_sale\_service\_record (

client\_id ASC

)

go

/\*==============================================================\*/

/\* Index: service\_record\_to\_product\_FK \*/

/\*==============================================================\*/

create index service\_record\_to\_product\_FK on after\_sale\_service\_record (

product\_id ASC

)

go

/\*==============================================================\*/

/\* Index: service\_record\_to\_contract\_FK \*/

/\*==============================================================\*/

create index service\_record\_to\_contract\_FK on after\_sale\_service\_record (

contract\_id ASC

)

go

/\*==============================================================\*/

/\* Index: cse\_to\_assr\_FK \*/

/\*==============================================================\*/

create index cse\_to\_assr\_FK on after\_sale\_service\_record (

service\_excutive\_id ASC

)

go

/\*==============================================================\*/

/\* Index: sup\_eng\_to\_assr\_FK \*/

/\*==============================================================\*/

create index sup\_eng\_to\_assr\_FK on after\_sale\_service\_record (

support\_engineer\_id ASC

)

go

/\*==============================================================\*/

/\* Index: ser\_eng\_to\_assr\_FK \*/

/\*==============================================================\*/

create index ser\_eng\_to\_assr\_FK on after\_sale\_service\_record (

service\_engineer\_id ASC

)

go

/\*==============================================================\*/

/\* Table: buy \*/

/\*==============================================================\*/

create table buy (

client\_id int not null,

product\_id int not null,

contract\_id int not null,

buy\_date datetime null,

constraint PK\_BUY primary key nonclustered (client\_id, product\_id, contract\_id)

)

go

/\*==============================================================\*/

/\* Index: client\_buy\_FK \*/

/\*==============================================================\*/

create index client\_buy\_FK on buy (

client\_id ASC

)

go

/\*==============================================================\*/

/\* Index: product\_buy\_FK \*/

/\*==============================================================\*/

create index product\_buy\_FK on buy (

product\_id ASC

)

go

/\*==============================================================\*/

/\* Index: contract\_buy\_FK \*/

/\*==============================================================\*/

create index contract\_buy\_FK on buy (

contract\_id ASC

)

go

/\*==============================================================\*/

/\* Table: client \*/

/\*==============================================================\*/

create table client (

client\_id int not null,

name varchar(20) null,

gender varchar(10) null,

phone int null,

constraint PK\_CLIENT primary key nonclustered (client\_id)

)

go

/\*==============================================================\*/

/\* Table: company \*/

/\*==============================================================\*/

create table company (

company\_id int not null,

company\_name varchar(20) not null,

person\_in\_charge varchar(20) not null,

phone int not null,

constraint PK\_COMPANY primary key nonclustered (company\_id)

)

go

/\*==============================================================\*/

/\* Table: contract \*/

/\*==============================================================\*/

create table contract (

contract\_id int not null,

client\_id int not null,

product\_id int not null,

begin\_date datetime not null,

contract\_duration int not null,

contract\_type varchar(20) not null,

constraint PK\_CONTRACT primary key nonclustered (contract\_id)

)

go

/\*==============================================================\*/

/\* Table: customer\_service\_executive \*/

/\*==============================================================\*/

create table customer\_service\_executive (

emp\_employee\_id int not null,

name varchar(20) null,

gender varchar(10) null,

phone int null,

superior\_id int null,

company\_id int not null,

after\_sale\_phone int not null,

constraint PK\_CUSTOMER\_SERVICE\_EXECUTIVE primary key nonclustered (emp\_employee\_id)

)

go

/\*==============================================================\*/

/\* Table: employee \*/

/\*==============================================================\*/

create table employee (

employee\_id int not null,

name varchar(20) not null,

gender varchar(10) not null,

phone int not null,

superior\_id int null,

company\_id int not null,

constraint PK\_EMPLOYEE primary key nonclustered (employee\_id)

)

go

/\*==============================================================\*/

/\* Index: superior\_FK \*/

/\*==============================================================\*/

create index superior\_FK on employee (

superior\_id ASC

)

go

/\*==============================================================\*/

/\* Index: employ\_FK \*/

/\*==============================================================\*/

create index employ\_FK on employee (

company\_id ASC

)

go

/\*==============================================================\*/

/\* Table: factory \*/

/\*==============================================================\*/

create table factory (

factory\_id int not null,

factory\_name varchar(20) not null,

person\_in\_charge varchar(20) not null,

phone int not null,

constraint PK\_FACTORY primary key nonclustered (factory\_id)

)

go

/\*==============================================================\*/

/\* Table: product \*/

/\*==============================================================\*/

create table product (

product\_id int not null,

factory\_id int null,

product\_name varchar(20) not null,

product\_type varchar(20) not null,

price int not null,

constraint PK\_PRODUCT primary key nonclustered (product\_id)

)

go

/\*==============================================================\*/

/\* Index: produce\_FK \*/

/\*==============================================================\*/

create index produce\_FK on product (

factory\_id ASC

)

go

/\*==============================================================\*/

/\* Table: service\_engineer \*/

/\*==============================================================\*/

create table service\_engineer (

emp\_employee\_id int not null,

name varchar(20) null,

gender varchar(10) null,

phone int null,

superior\_id int null,

company\_id int not null,

constraint PK\_SERVICE\_ENGINEER primary key nonclustered (emp\_employee\_id)

)

go

/\*==============================================================\*/

/\* Table: support\_engineer \*/

/\*==============================================================\*/

create table support\_engineer (

emp\_employee\_id int not null,

name varchar(20) null,

gender varchar(10) null,

phone int null,

superior\_id int null,

company\_id int not null,

constraint PK\_SUPPORT\_ENGINEER primary key nonclustered (emp\_employee\_id)

)

go

alter table after\_sale\_service\_record

add constraint FK\_AFTER\_SA\_CSE\_TO\_AS\_CUSTOMER foreign key (service\_excutive\_id)

references customer\_service\_executive (emp\_employee\_id)

go

alter table after\_sale\_service\_record

add constraint FK\_AFTER\_SA\_SER\_ENG\_T\_SERVICE\_ foreign key (service\_engineer\_id)

references service\_engineer (emp\_employee\_id)

go

alter table after\_sale\_service\_record

add constraint FK\_AFTER\_SA\_SERVICE\_R\_CLIENT foreign key (client\_id)

references client (client\_id)

go

alter table after\_sale\_service\_record

add constraint FK\_AFTER\_SA\_SERVICE\_R\_CONTRACT foreign key (contract\_id)

references contract (contract\_id)

go

alter table after\_sale\_service\_record

add constraint FK\_AFTER\_SA\_SERVICE\_R\_PRODUCT foreign key (product\_id)

references product (product\_id)

go

alter table after\_sale\_service\_record

add constraint FK\_AFTER\_SA\_SUP\_ENG\_T\_SUPPORT\_ foreign key (support\_engineer\_id)

references support\_engineer (emp\_employee\_id)

go

alter table buy

add constraint FK\_BUY\_CLIENT\_BU\_CLIENT foreign key (client\_id)

references client (client\_id)

go

alter table buy

add constraint FK\_BUY\_CONTRACT\_\_CONTRACT foreign key (contract\_id)

references contract (contract\_id)

go

alter table buy

add constraint FK\_BUY\_PRODUCT\_B\_PRODUCT foreign key (product\_id)

references product (product\_id)

go

alter table customer\_service\_executive

add constraint FK\_CUSTOMER\_EMPLOYEE\_\_EMPLOYEE foreign key (emp\_employee\_id)

references employee (employee\_id)

go

alter table employee

add constraint FK\_EMPLOYEE\_EMPLOY\_COMPANY foreign key (company\_id)

references company (company\_id)

go

alter table employee

add constraint FK\_EMPLOYEE\_SUPERIOR\_EMPLOYEE foreign key (superior\_id)

references employee (employee\_id)

go

alter table product

add constraint FK\_PRODUCT\_PRODUCE\_FACTORY foreign key (factory\_id)

references factory (factory\_id)

go

alter table service\_engineer

add constraint FK\_SERVICE\_\_EMPLOYEE\_\_EMPLOYEE foreign key (emp\_employee\_id)

references employee (employee\_id)

go

alter table support\_engineer

add constraint FK\_SUPPORT\_\_EMPLOYEE\_\_EMPLOYEE foreign key (emp\_employee\_id)

references employee (employee\_id)

go