

Lab Manual CS403P – Database Management Systems (Practical)



Lab No.	Lab Topic	Page No.
1	Lab 1: Installation of Microsoft SQL Server	2
2	Lab 2: Context Level DFD (Data Flow Diagram)	23
3	Lab 3: Entity Relationship Diagram	25
4	Lab 4: Super type and subtype in the ERD (Entity Relationship Diagram)	27
5	Lab 5: Relational Database	28
6	Lab 6: ERD to RDM	29
7	Lab 7: Relational Algebra Operations	30
8	Lab 8: Normalization (2NF)	33
9	Lab 9: Normalization (3NF)	36
10	Lab 10: SQL Queries (Create and Insert)	38
11	Lab 11: SQL Queries	40
12	Lab 12: SQL Queries (Select, Group By and Having clause)	43
13	Lab 13: Joins	45
14	Lab 14: Indexes	47
15	Lab 15: Views	49
16	Lab 16: Views (Continued)	50

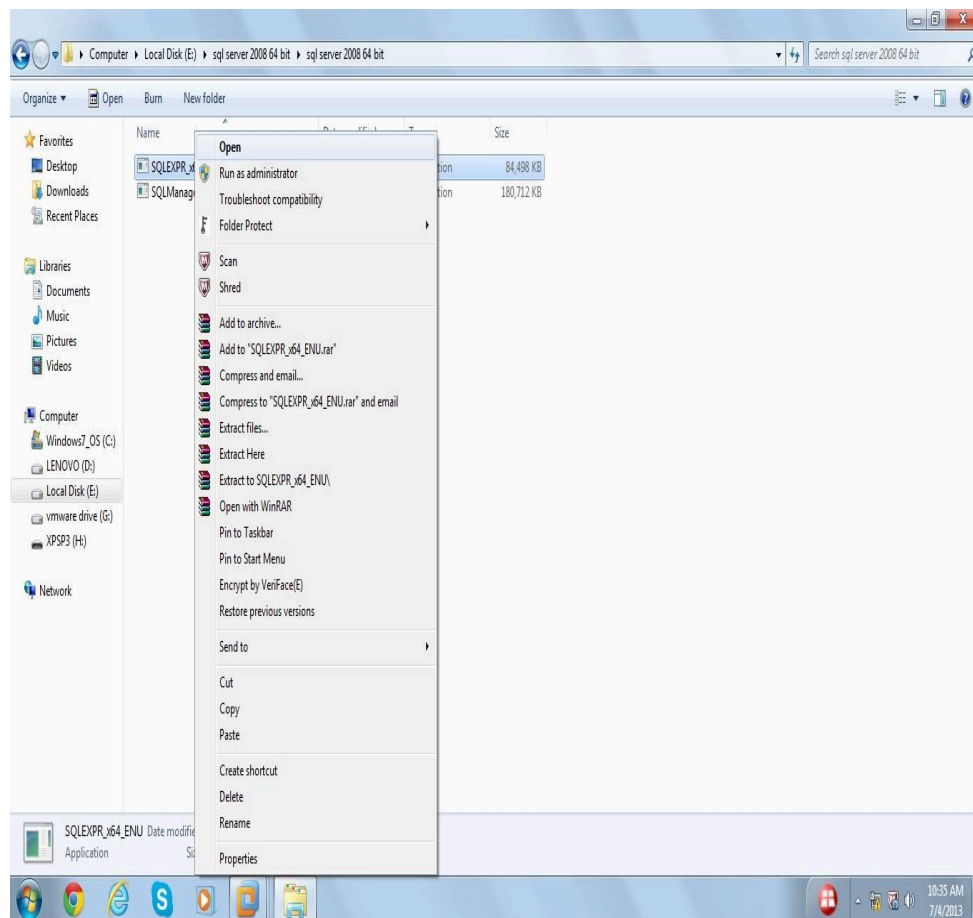
Lab 1

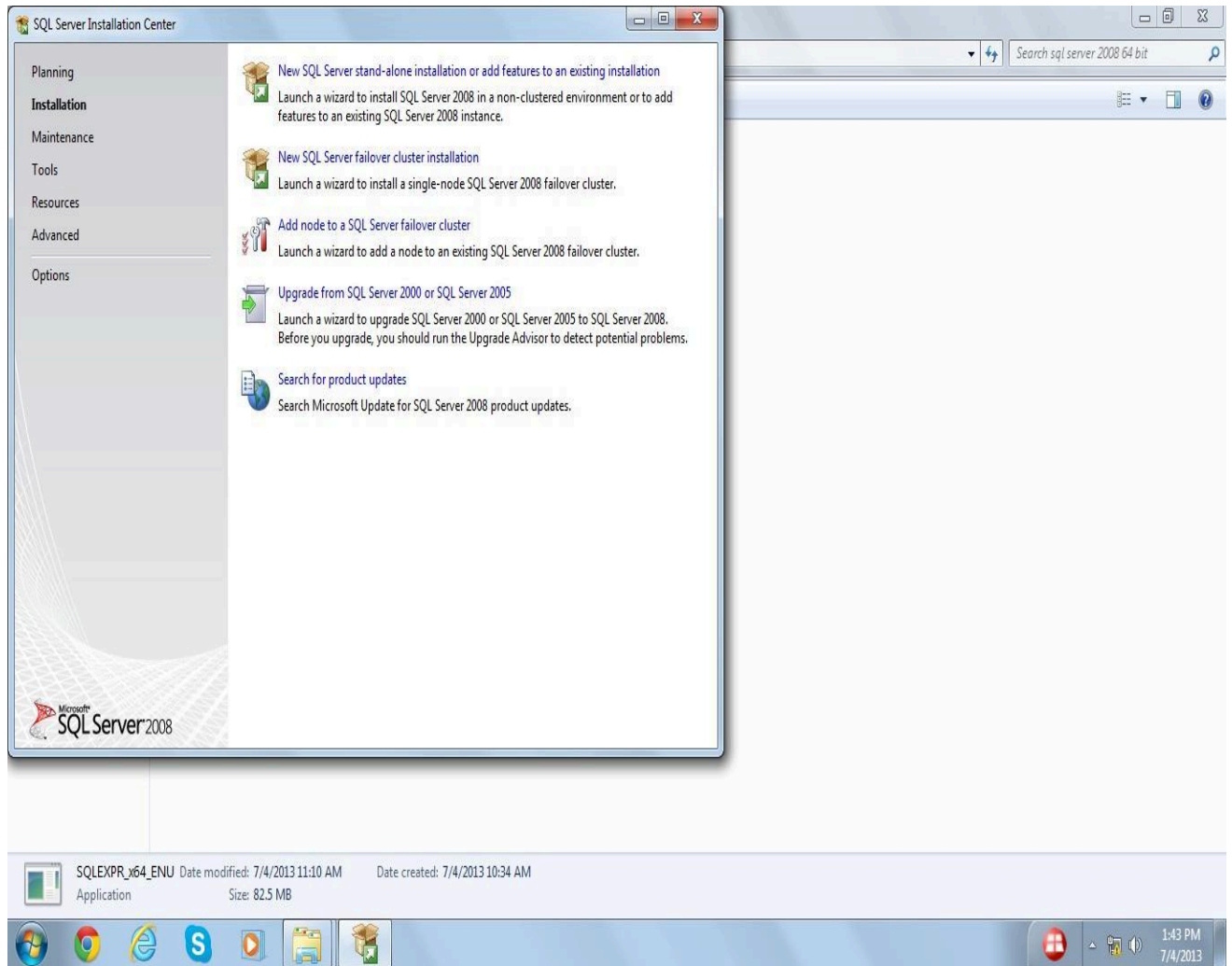
Lab Title: Installation of Microsoft SQL Server

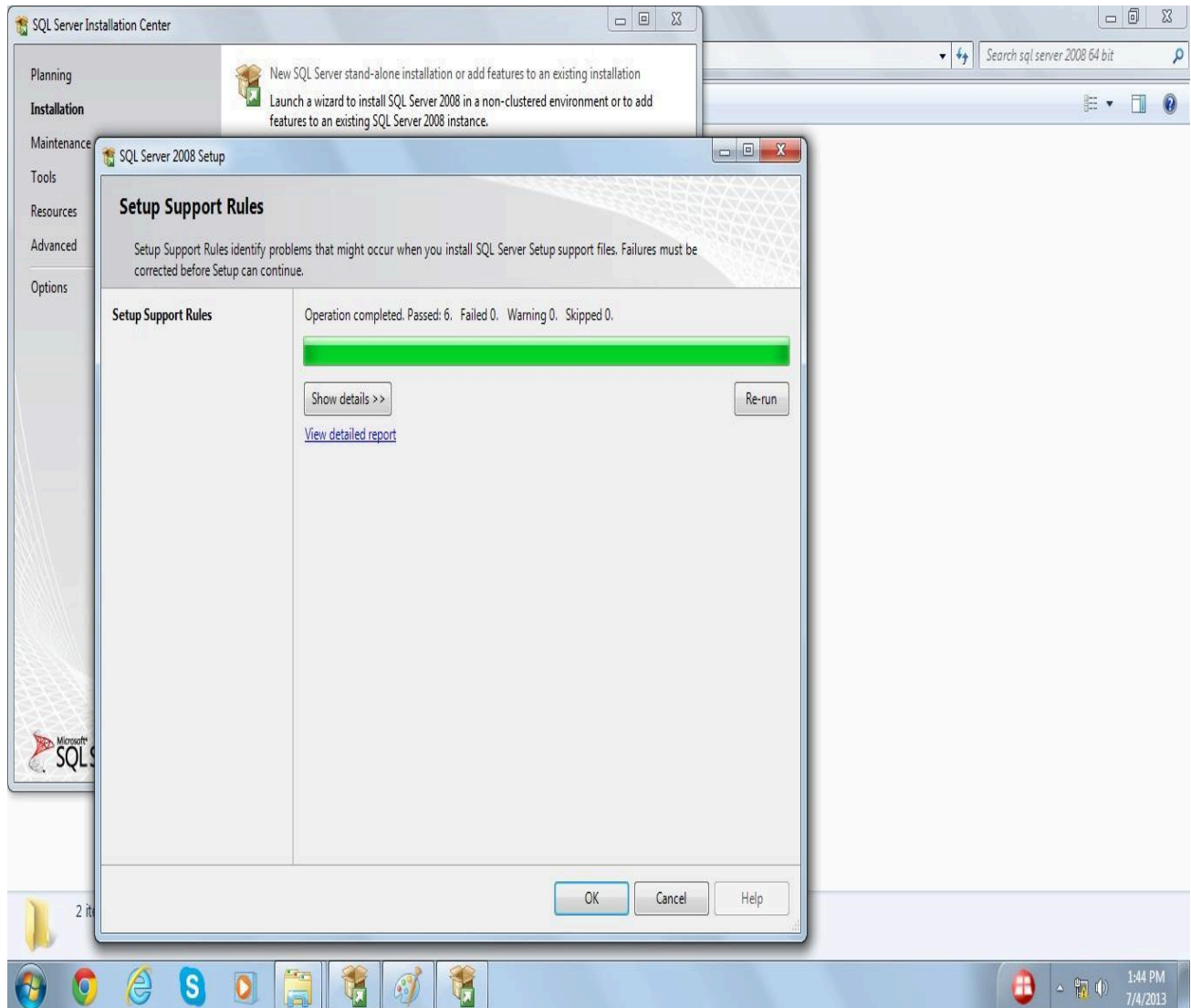
Problem Statement

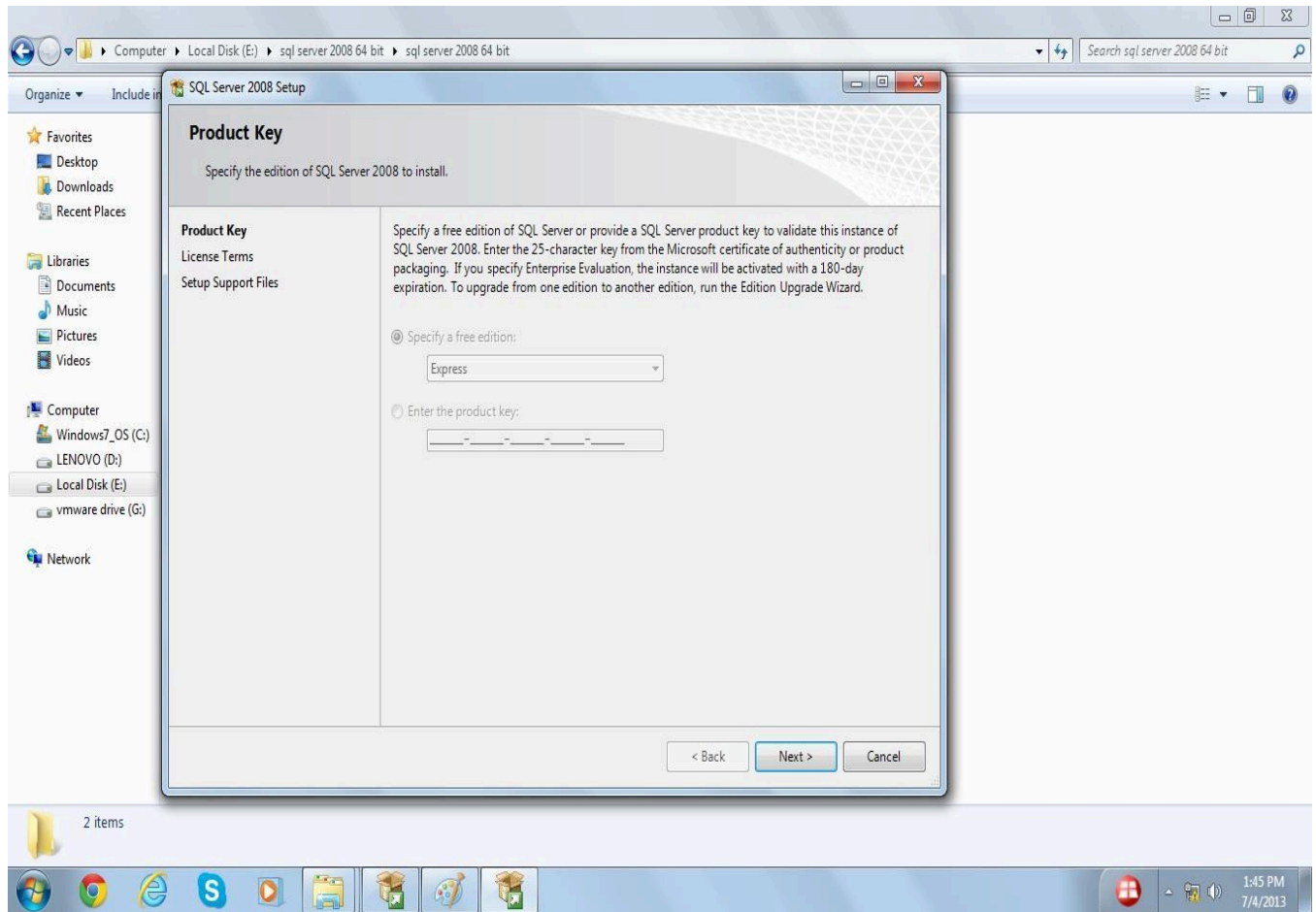
You are required to install any version of Microsoft SQL Server in your system according to your system and operating system requirements.

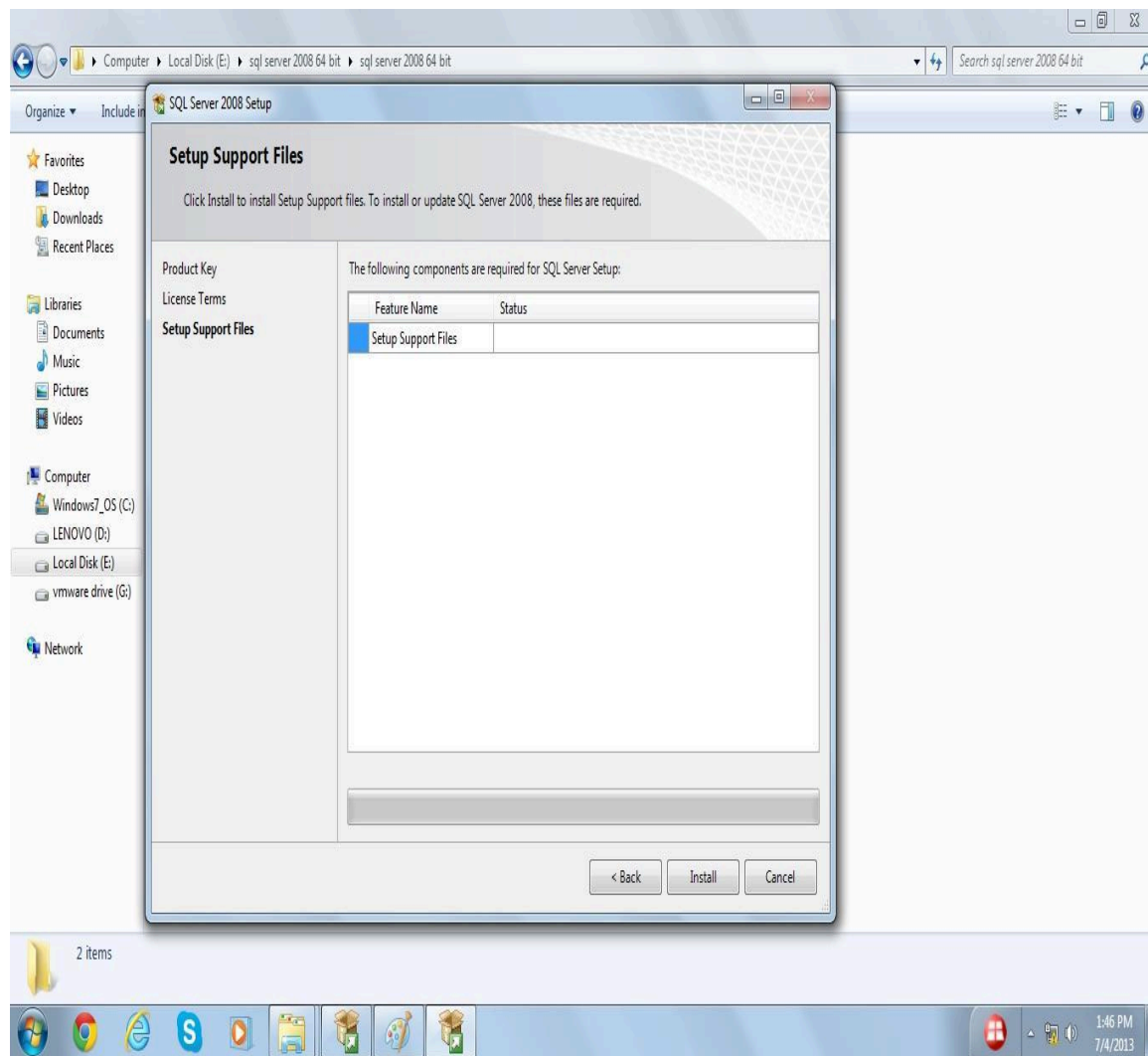
Installation Steps:

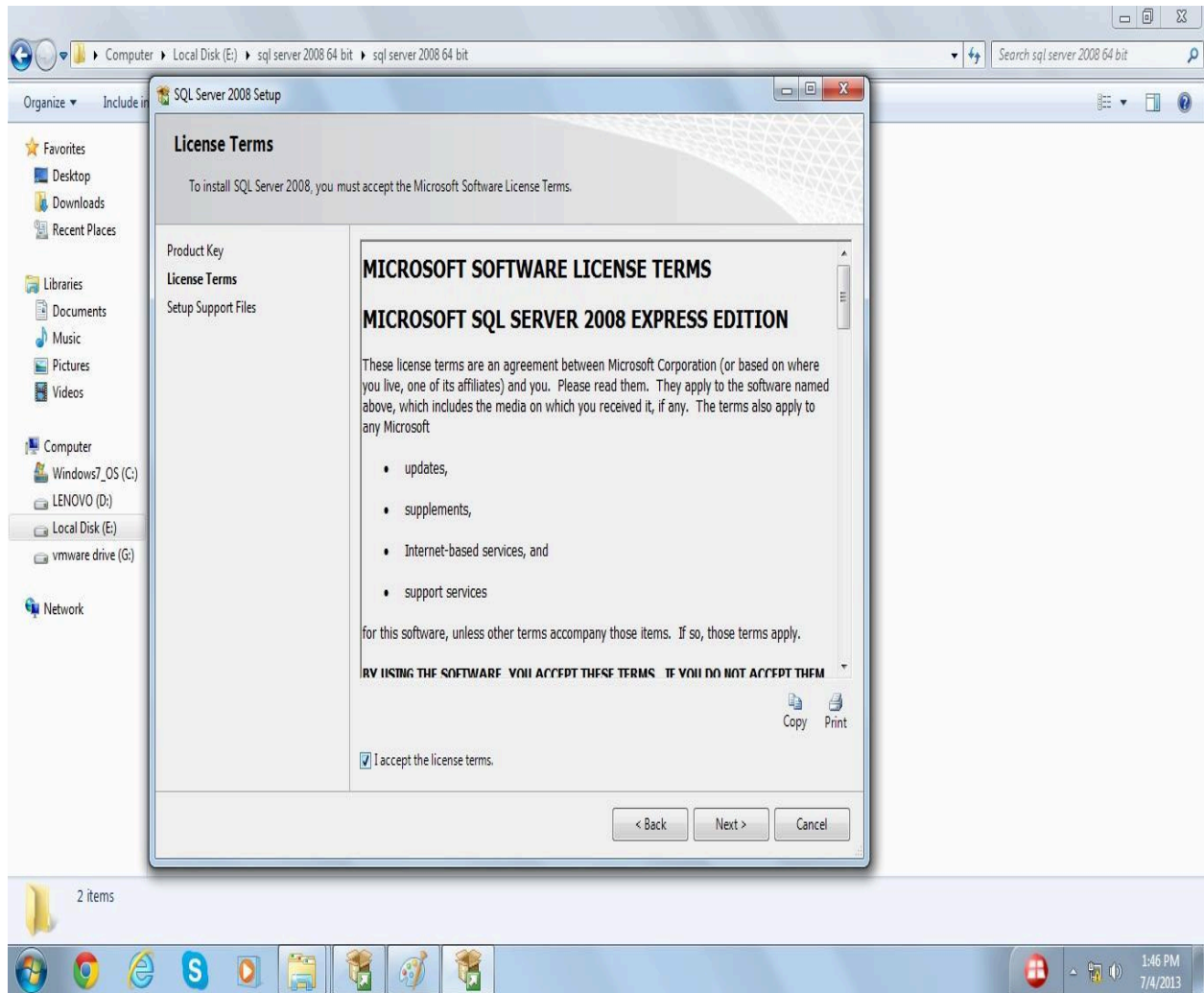


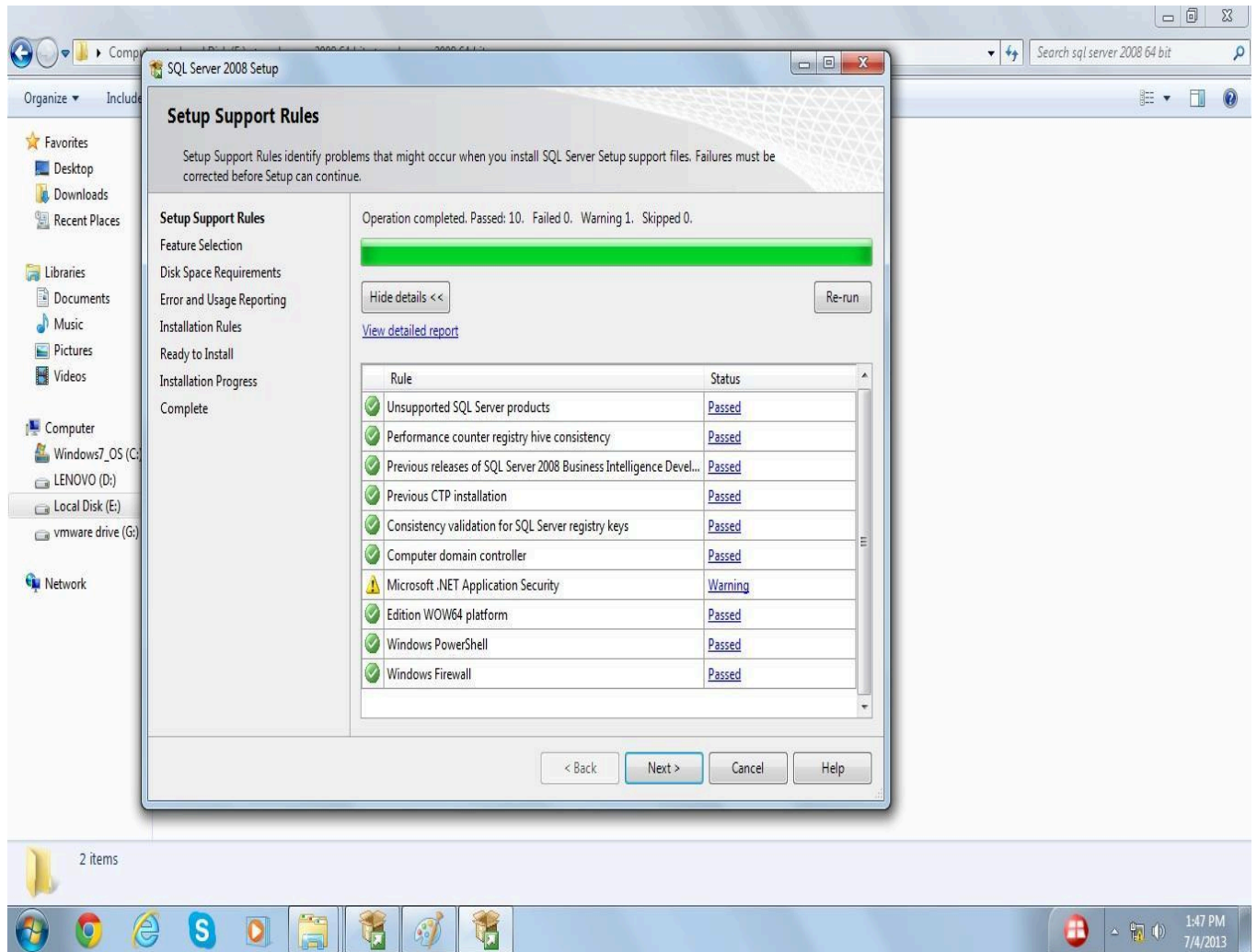


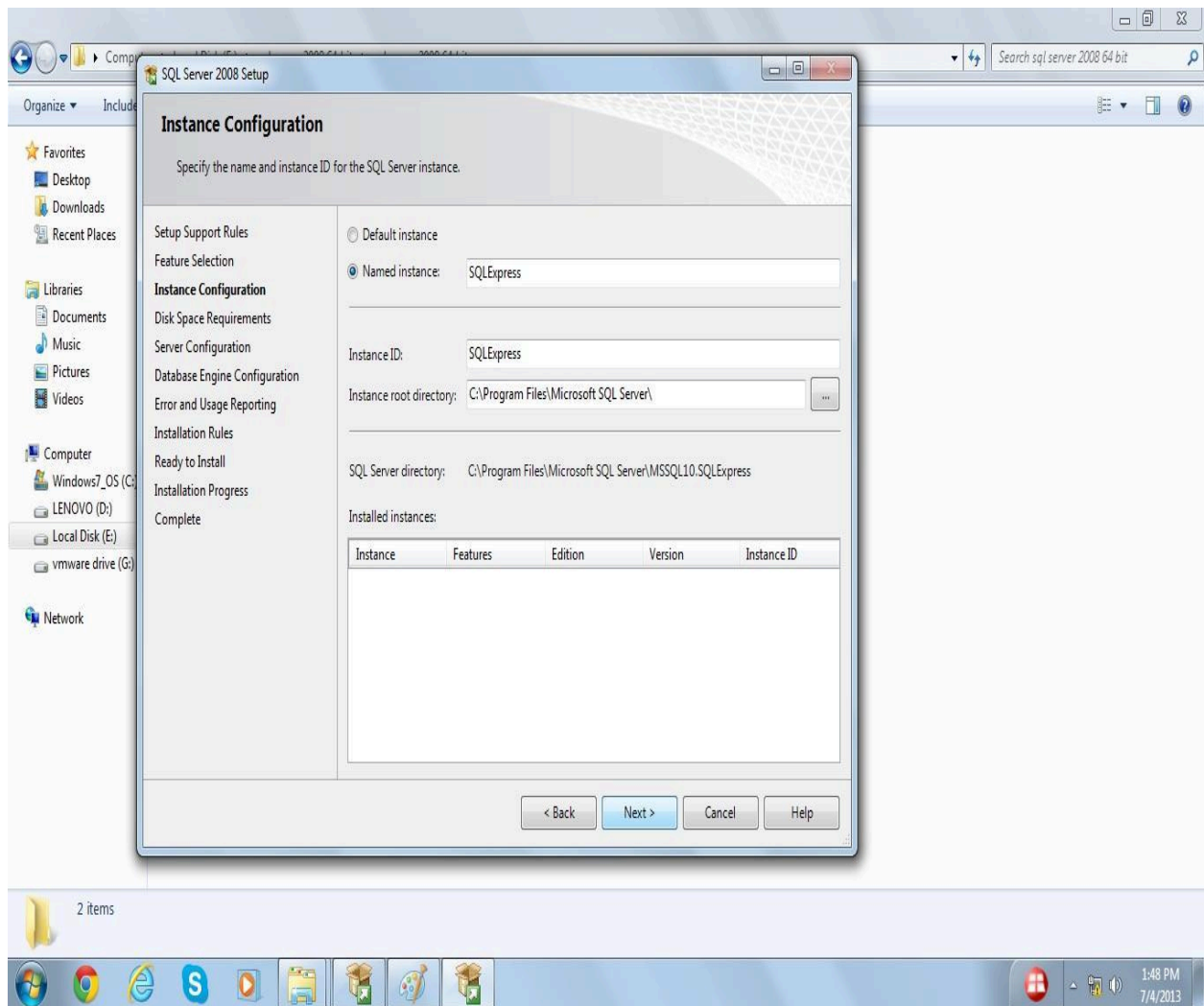


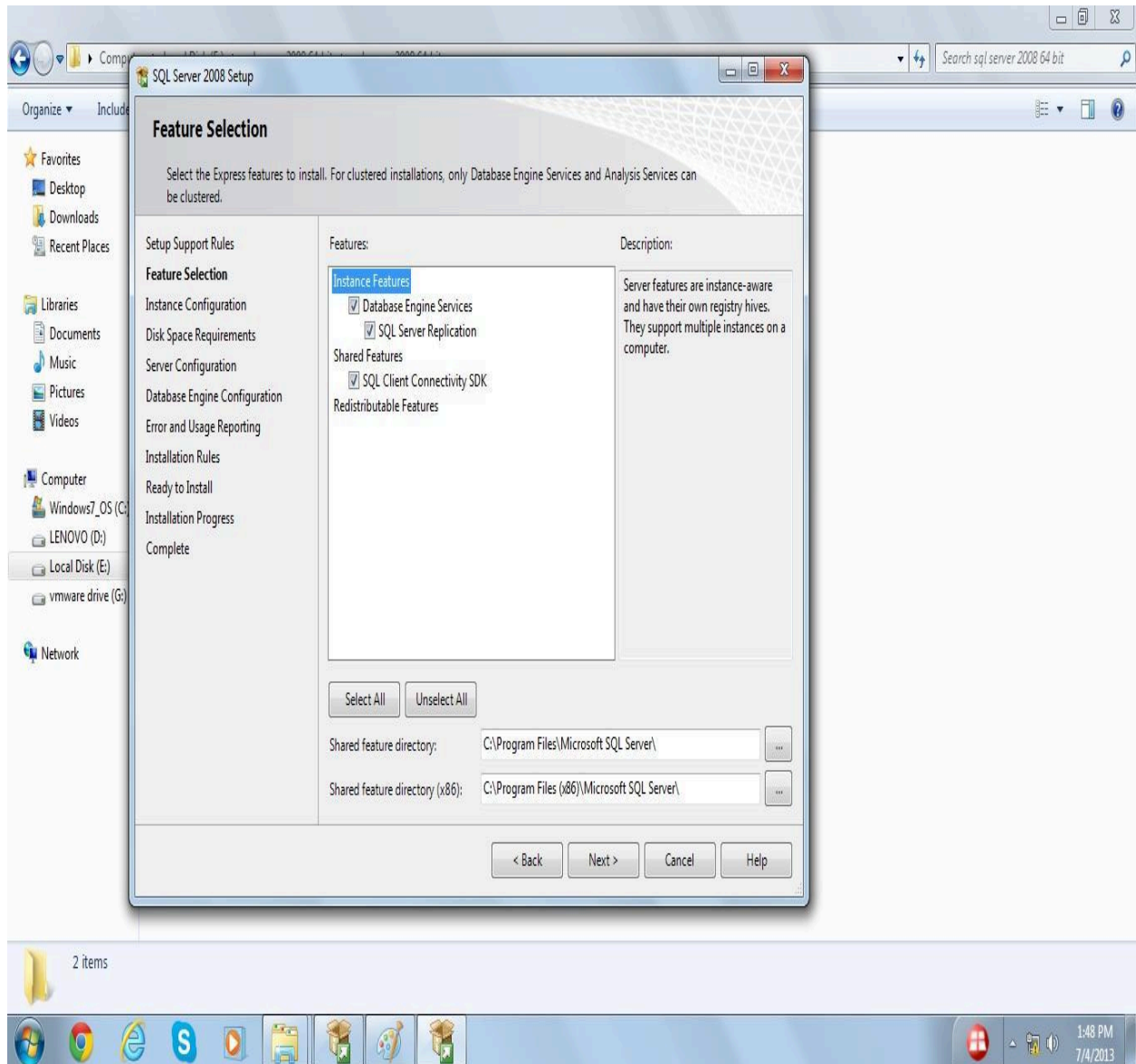


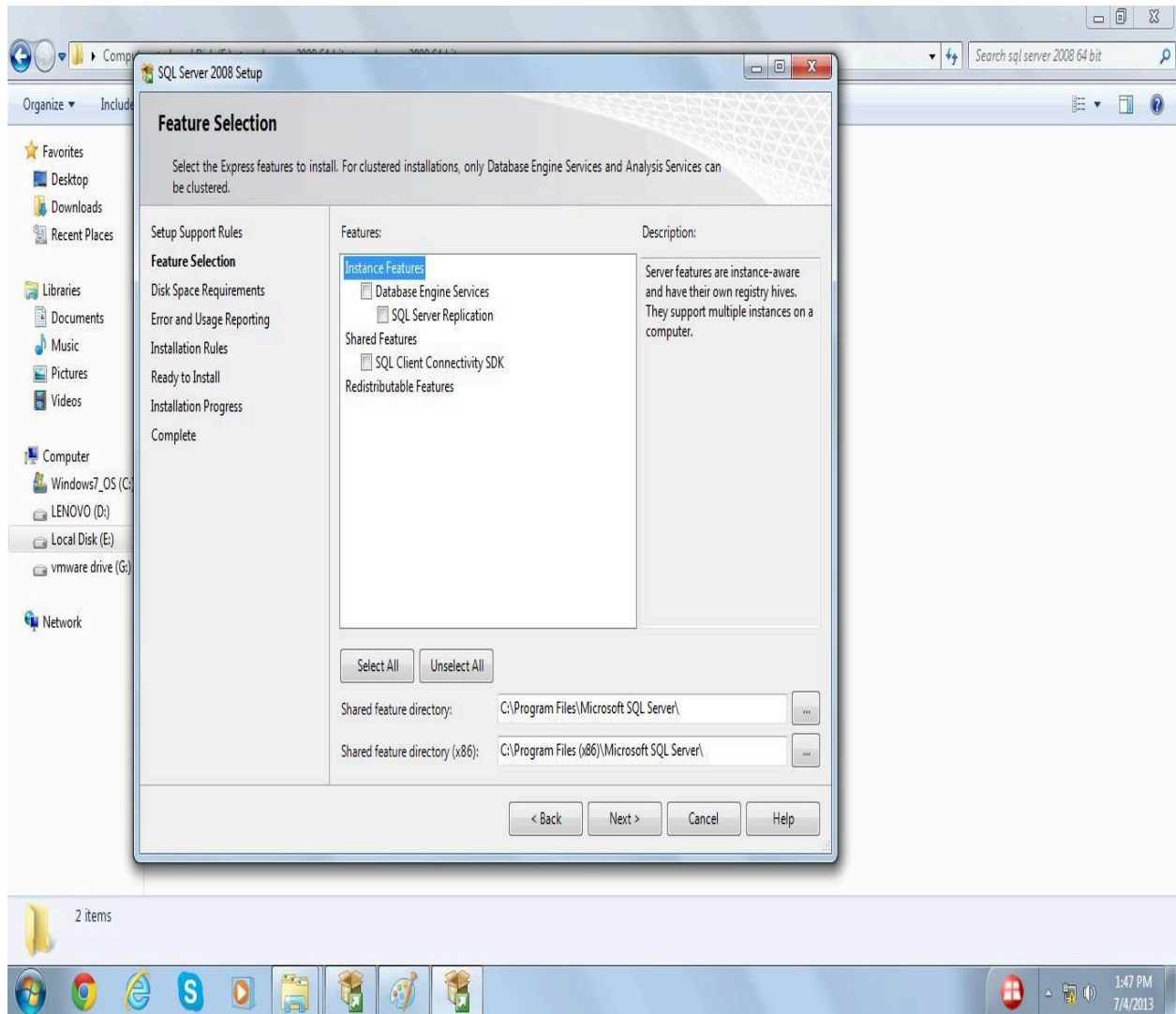


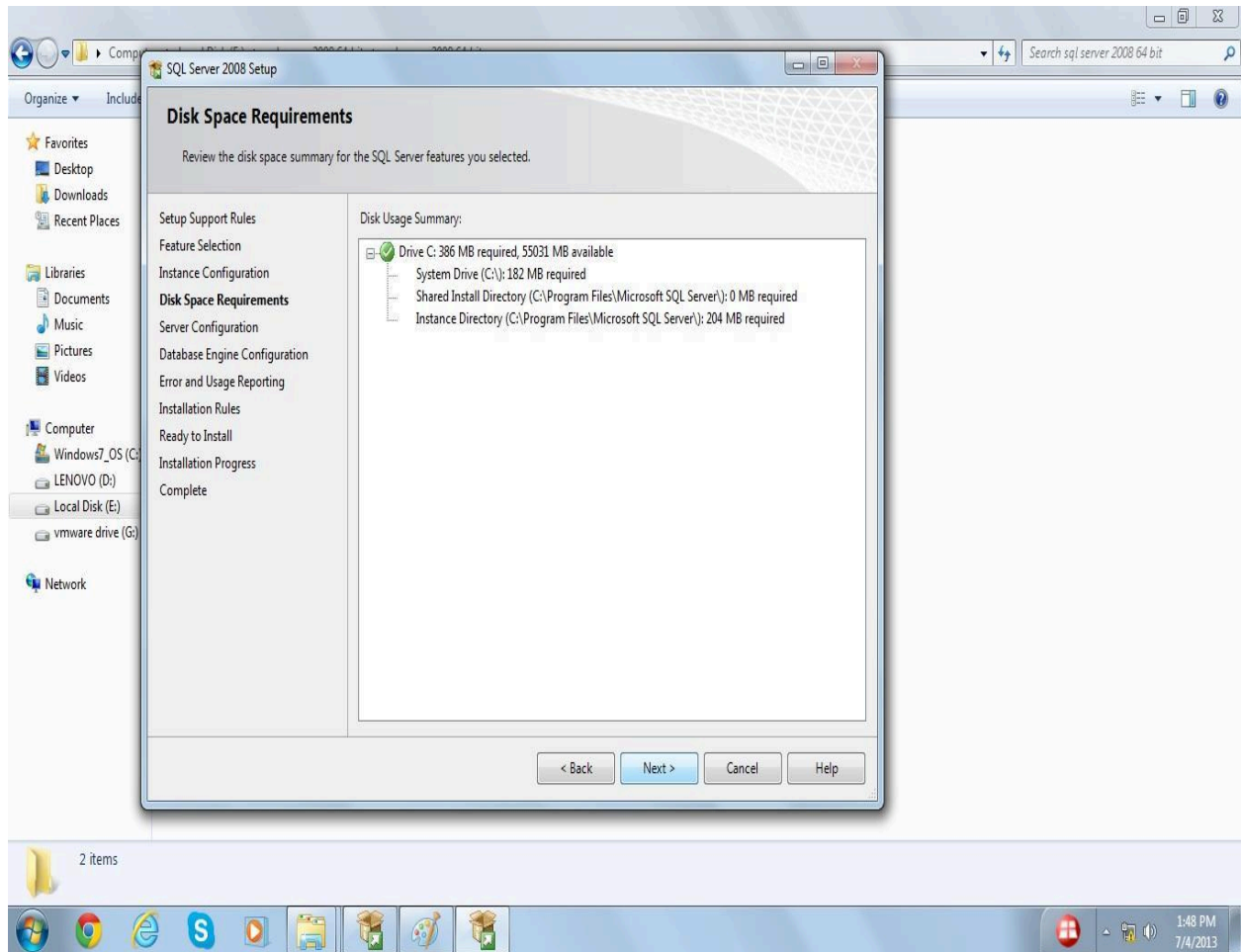


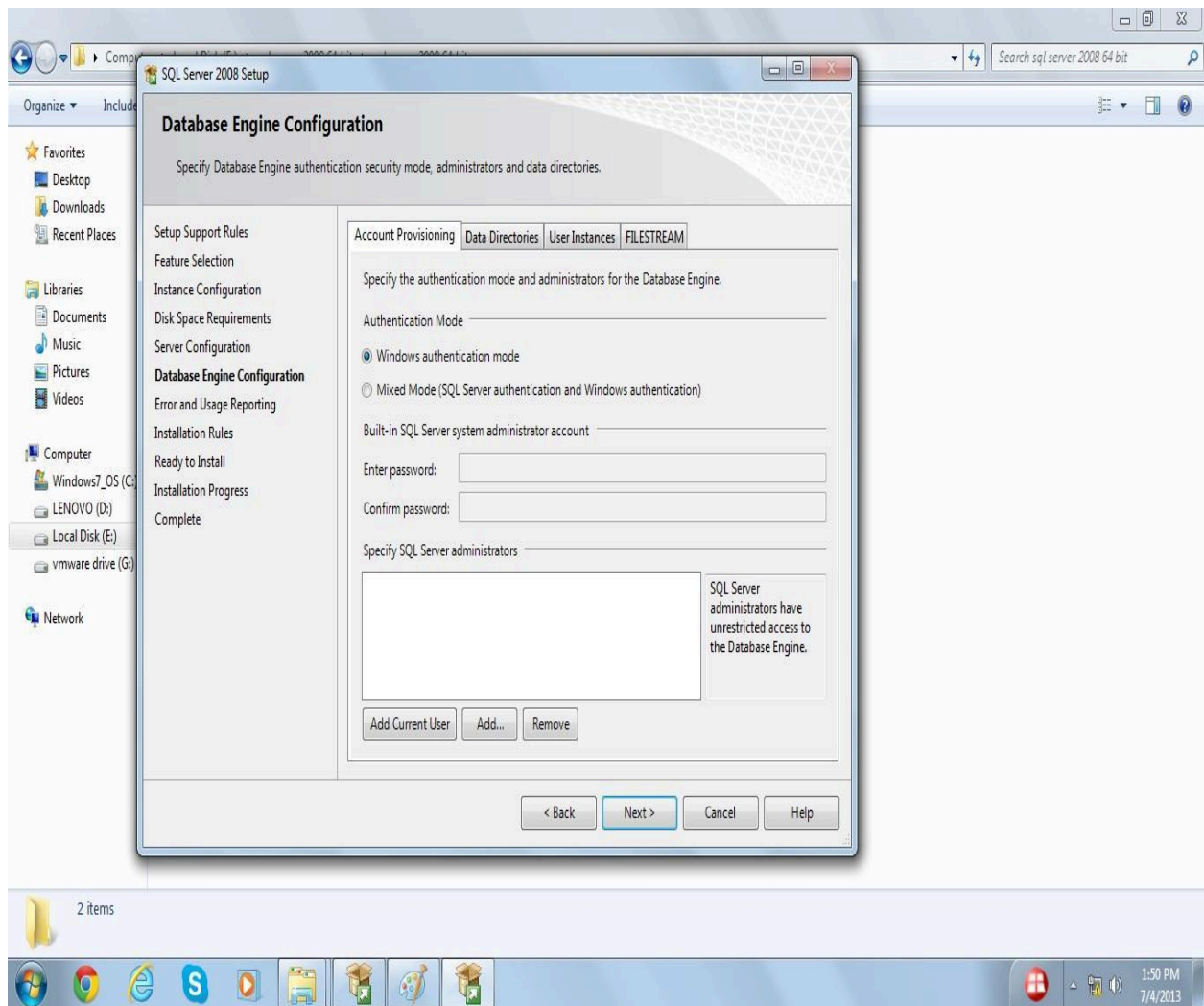


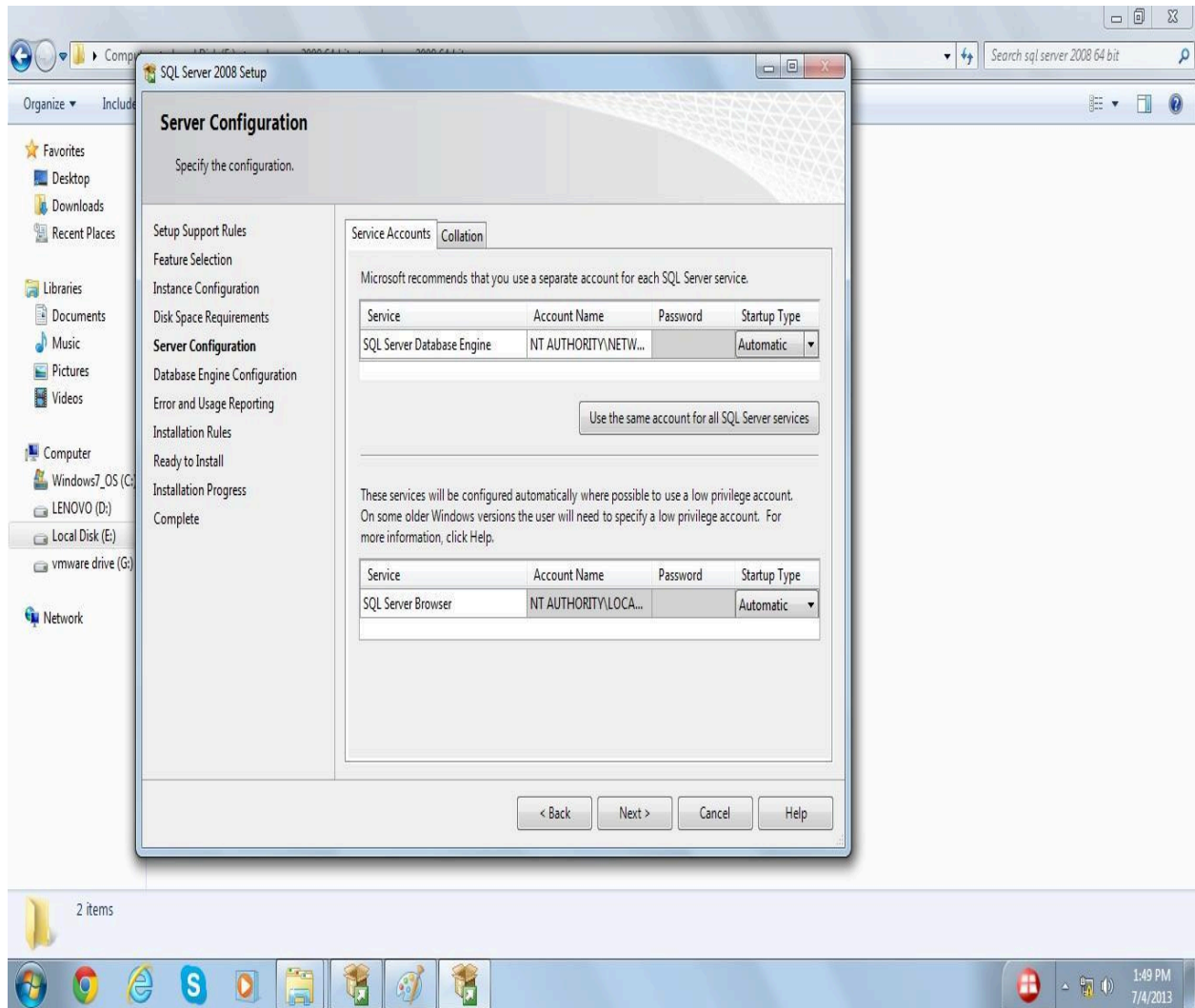


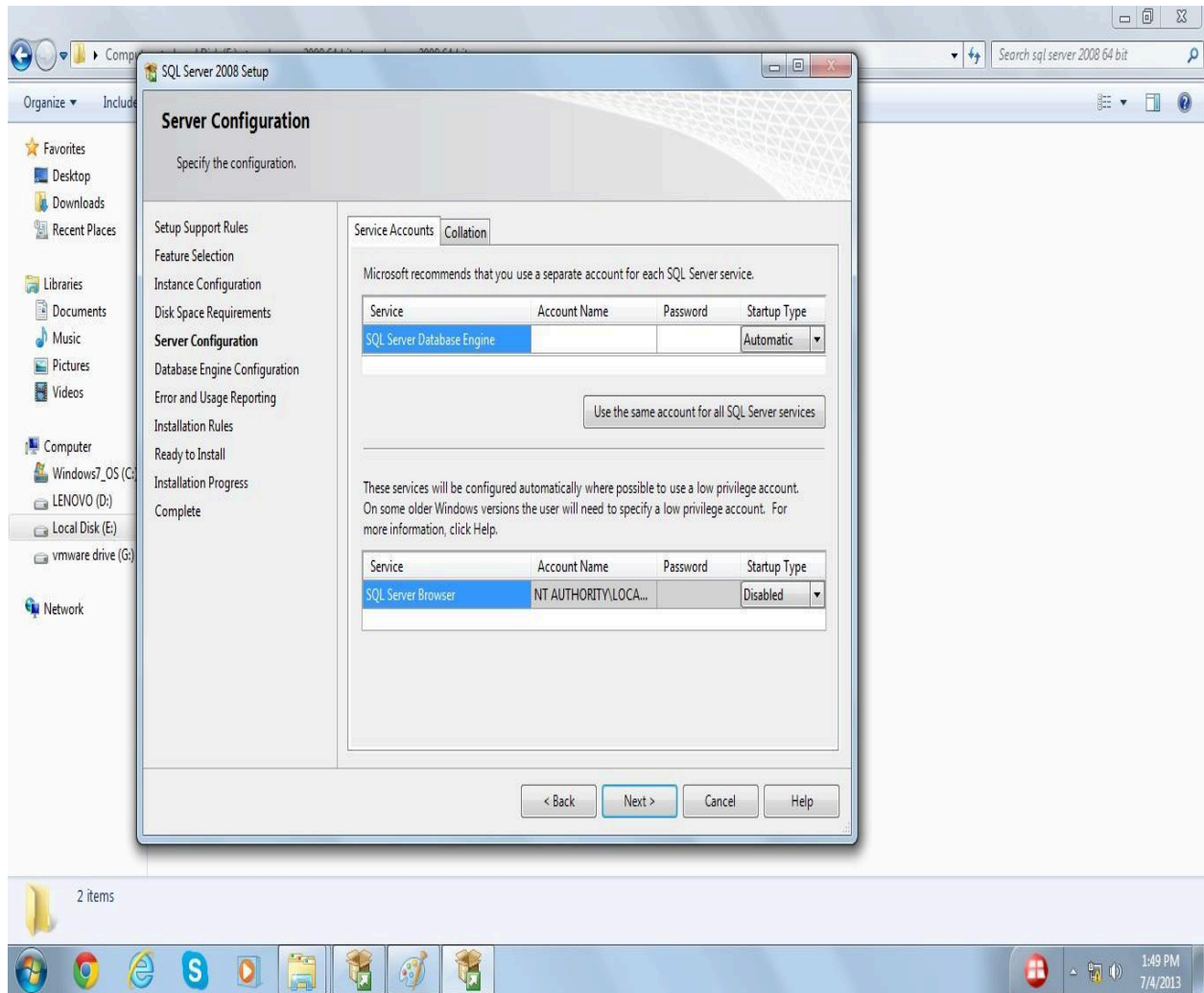


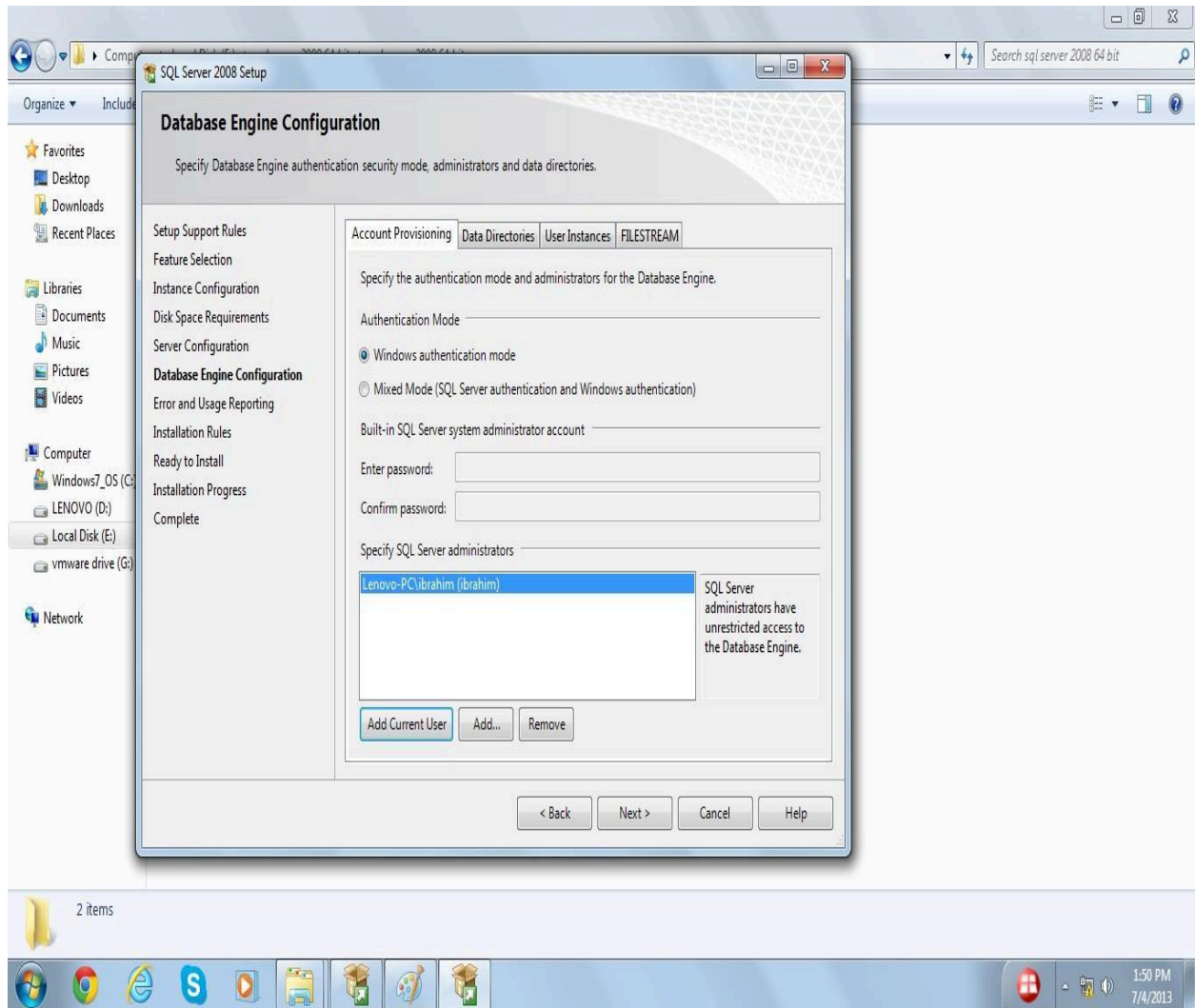


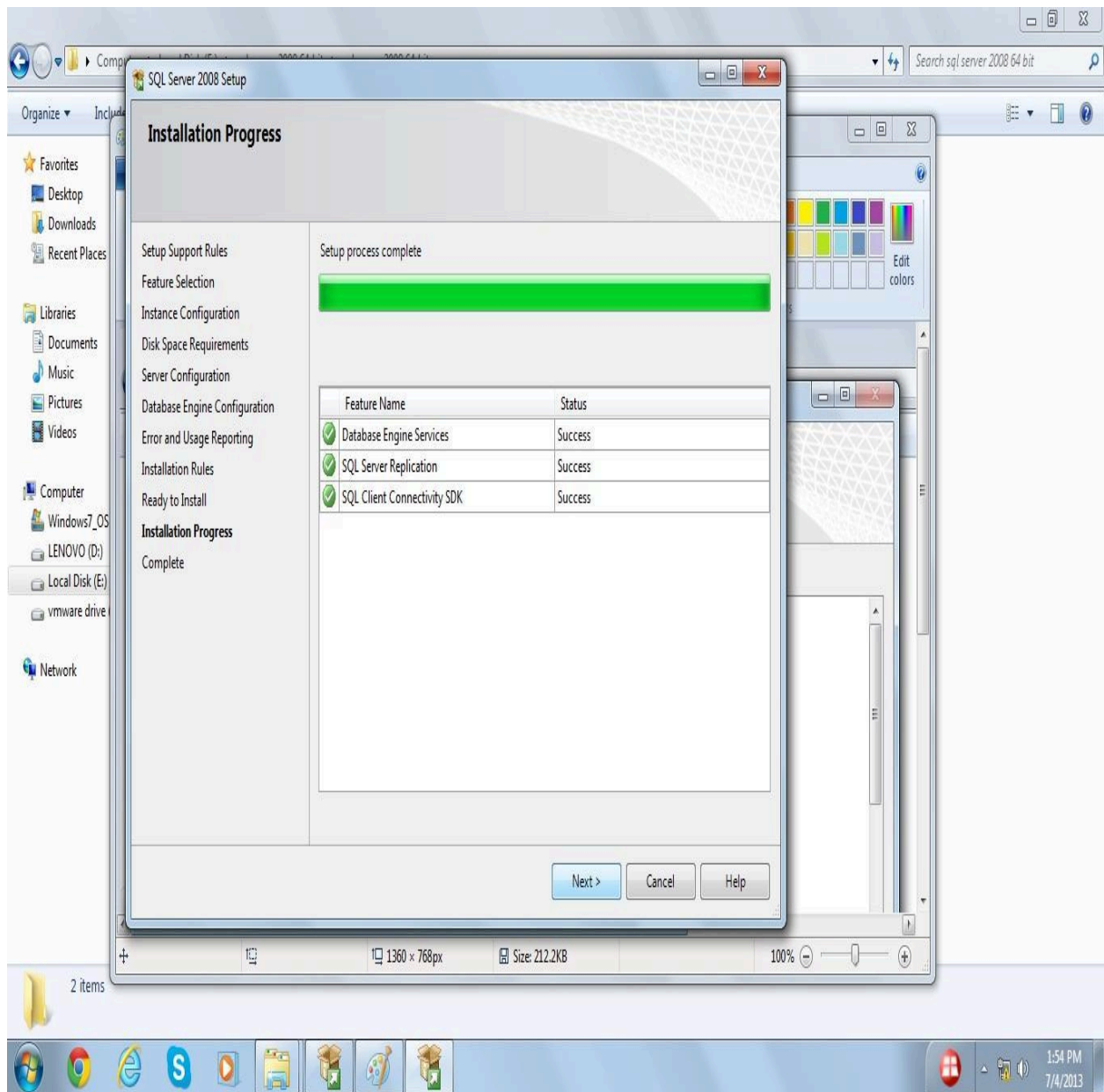


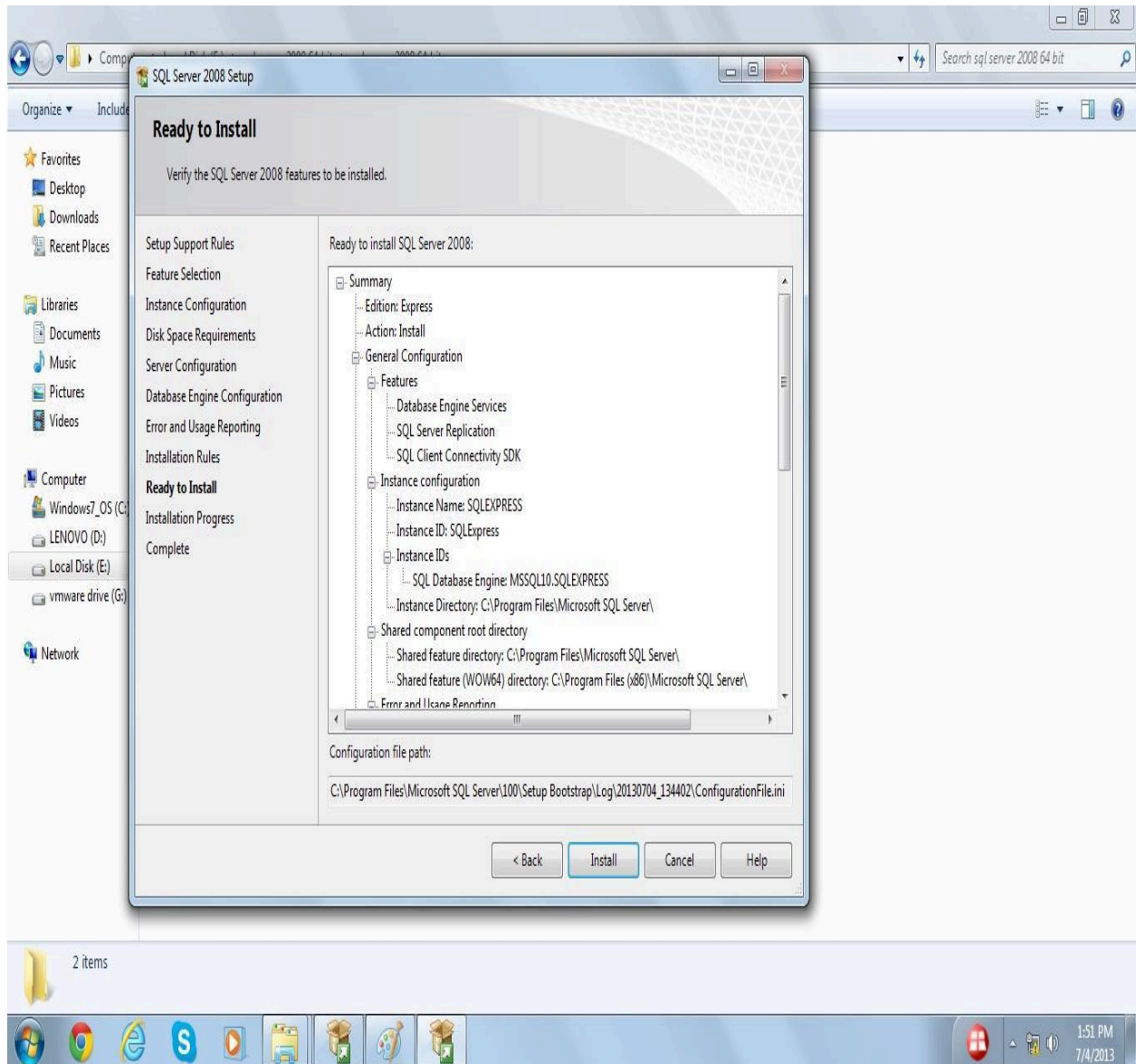


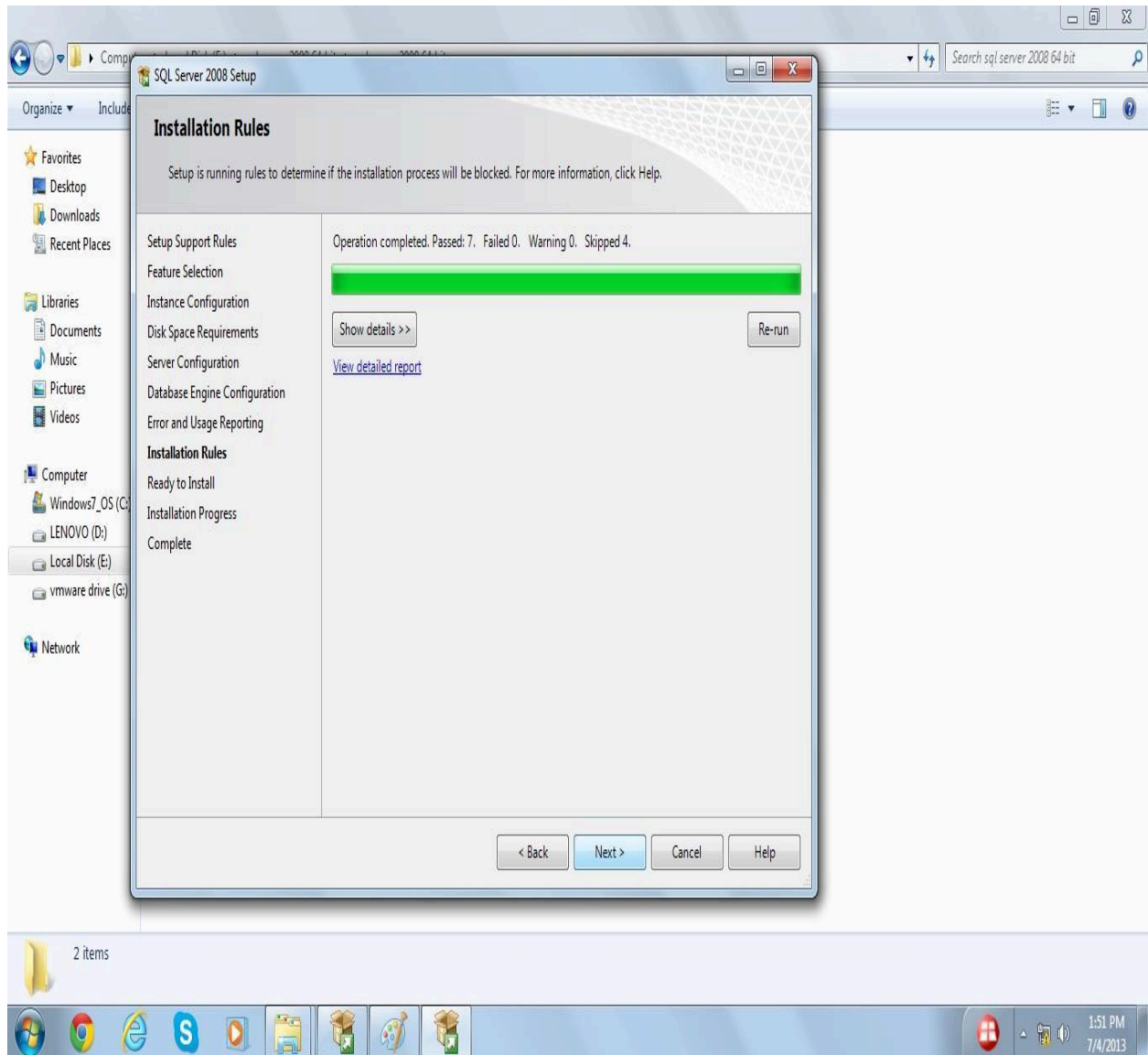


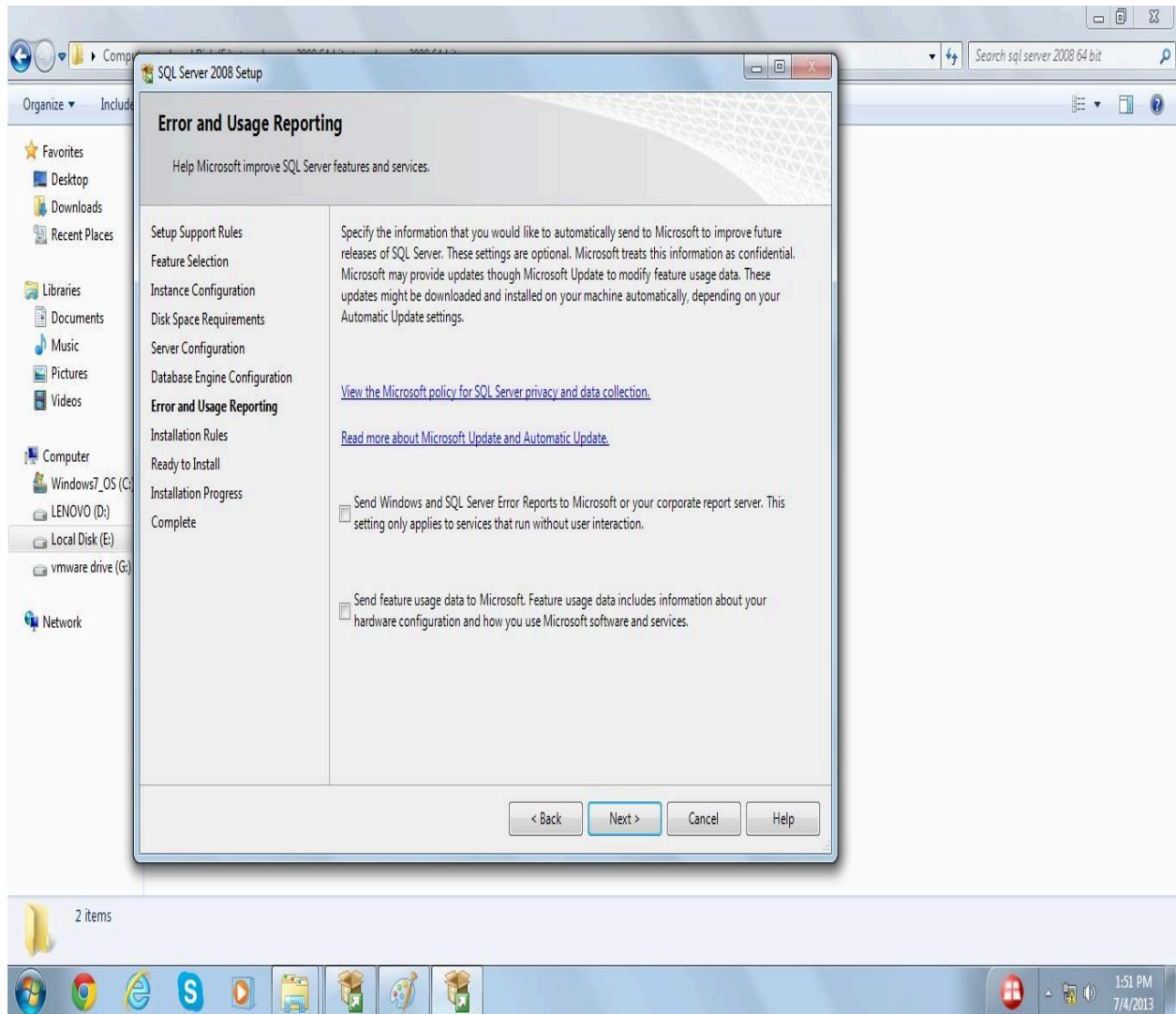


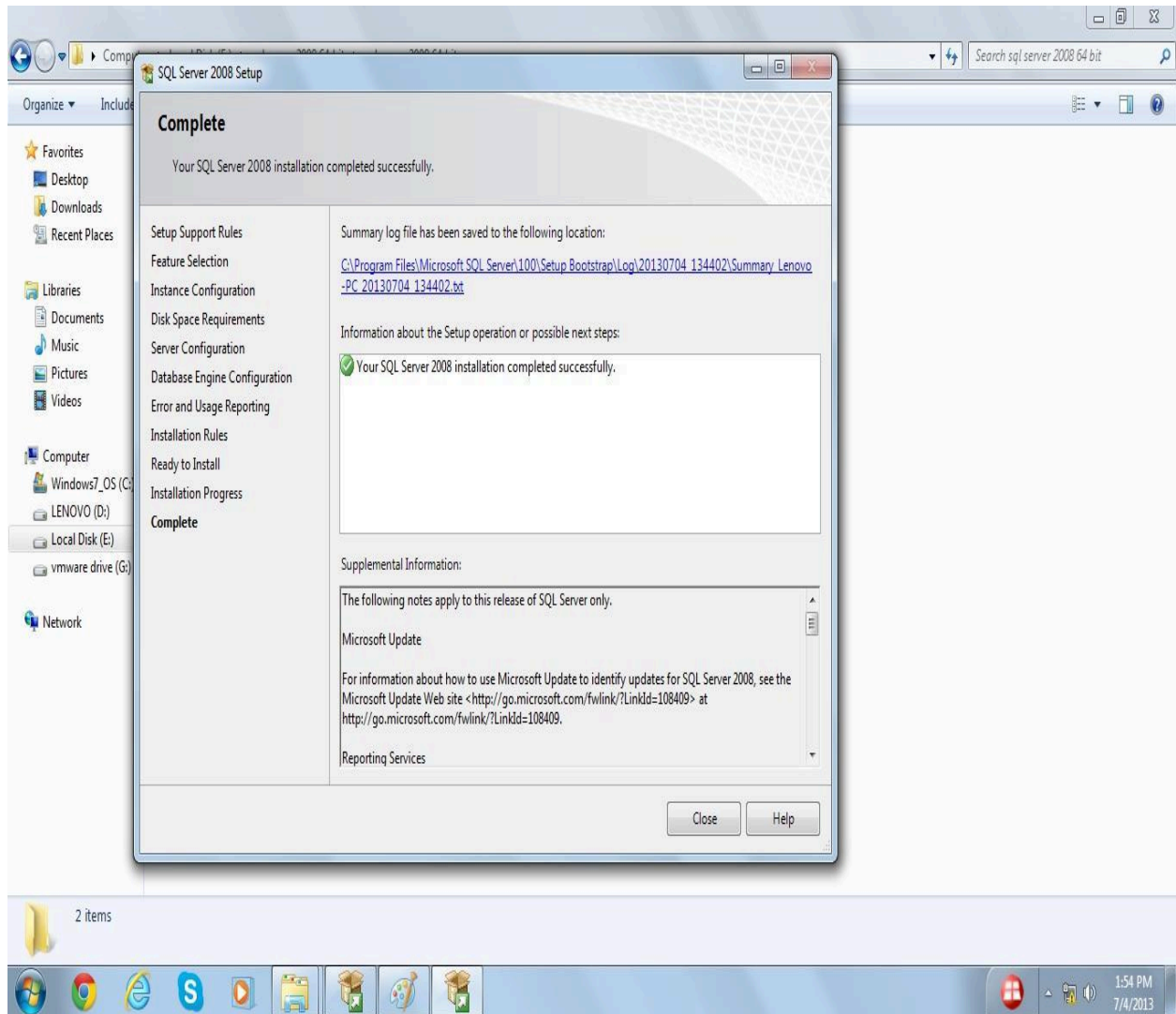












Mechanism to Conduct Lab:

Lab will be conducted via Google Meet / Zoom.

Lab 2

Lab Title: Context Level DFD (Data Flow Diagram)

Problem Statement

Lemon Soda Service

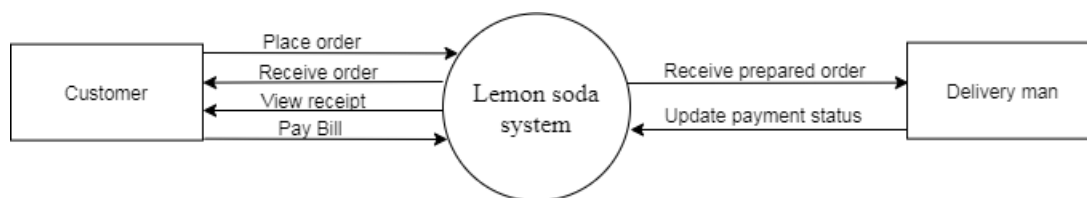
“Thela”, lemon soda offering company has decided to take orders online. By using this online system customer can place the order and view receipt generated by system. Order is prepared/processed and sent to delivery man. The delivery man will deliver order and receive payment form the customer. After receiving payment, the delivery man can update status in the system as payment received.

Identify the External Entities and processes from the above scenario and draw:

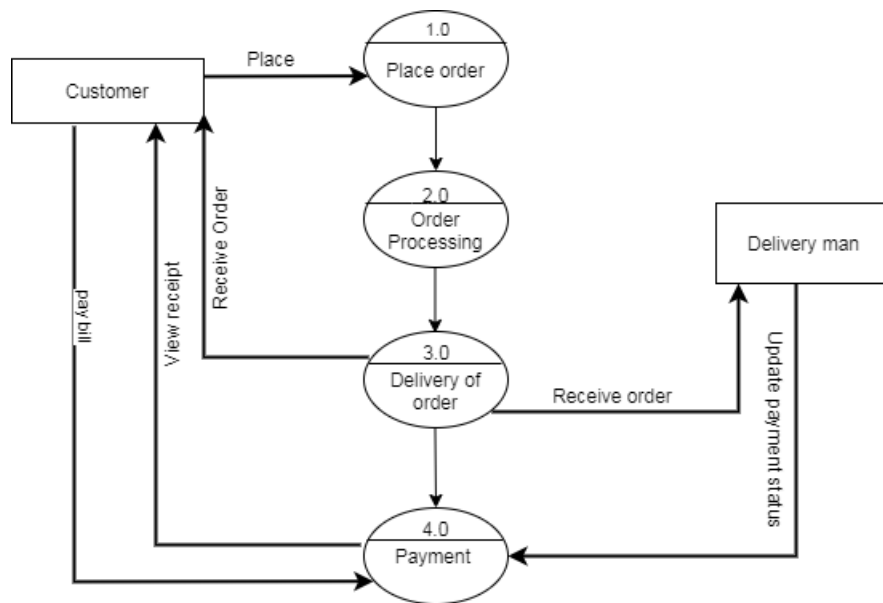
- Context Level DFD
- Level 0 DFD

Solution:

Context Level DFD



Level 0 DFD



Mechanism to Conduct Lab:

Lab will be conducted via Google Meet / Zoom.

Lab 3

Lab Title: Entity Relationship Diagram

Problem Statement

Lemon Soda Service

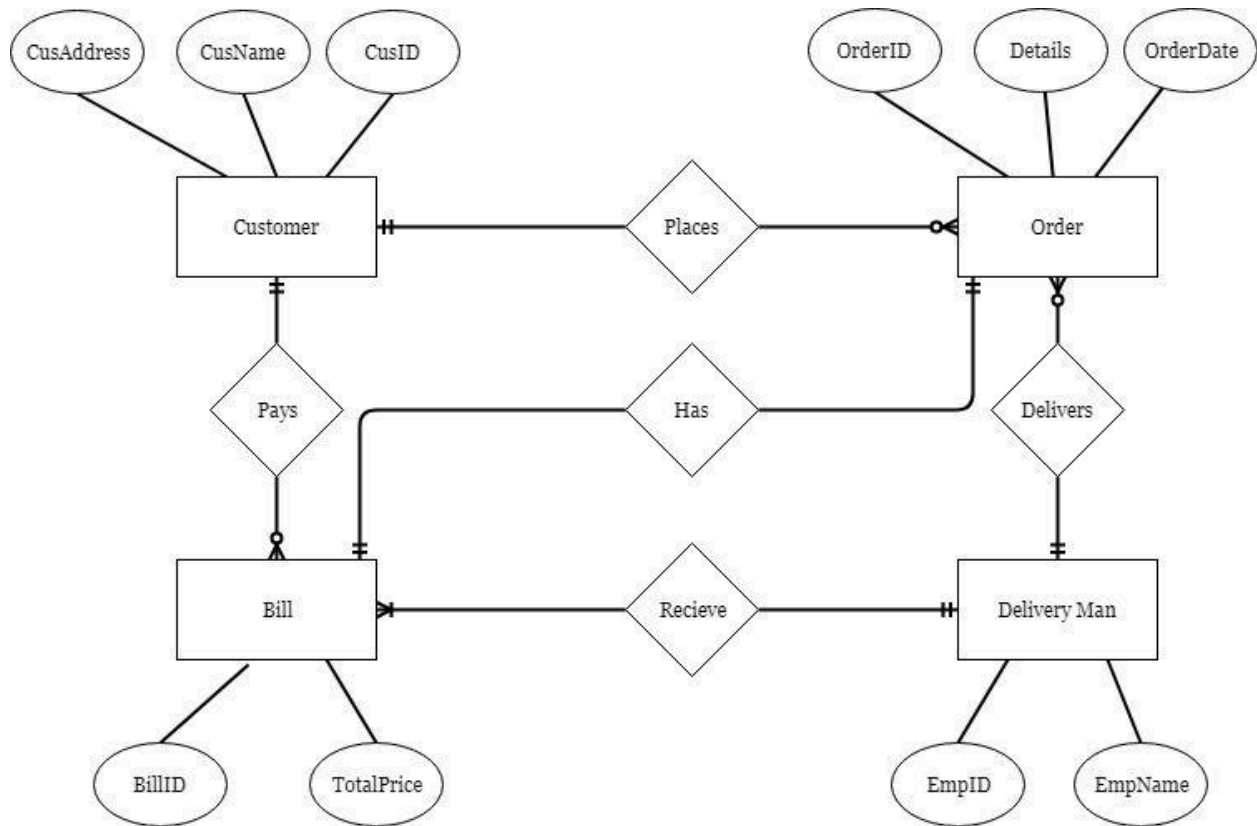
“Thela”, lemon soda offering company has decided to take orders online. Customer places the order online and at the time of delivery pays the bill. Order is prepared and delivered by the delivery man to the customer. Customer pays the bill to the delivery man.

Perform the following tasks on the given scenario:

- Identify Entities.
- Identify the attributes of the entities.
- Identify the relationships between the entities.
- Draw the Entity Relationship diagram from the information extracted in first three tasks.

Solution:

ERD:



Mechanism to Conduct Lab: Lab will be conducted via Google Meet / Zoom.

Lab 4

Lab Title: Super type and subtype in the ERD (Entity Relationship Diagram)

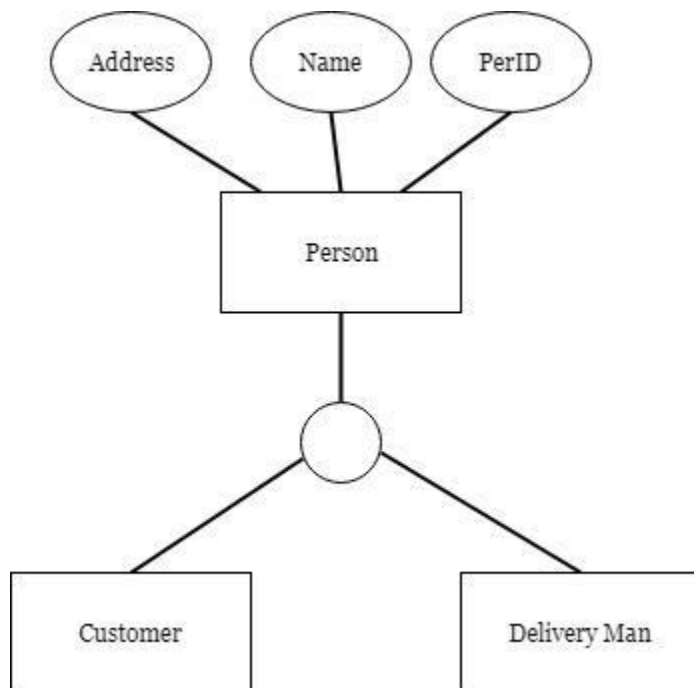
Problem Statement

Lemon Soda Service

“Thela”, lemon soda offering company has decided to take orders online. Customer places the order online and at the time of delivery pays the bill. Order is prepared and delivered by the delivery man to the customer. Customer pays the bill to the delivery man.

Customer and Delivery man both are the person. Introduce the concept of super type and subtype in the ERD drawn in Lab 3.

Solution



Mechanism to Conduct Lab:

Lab will be conducted via Google Meet / Zoom.

Lab 5

Lab Title: Relational Database

Problem Statement

Consider the following relation scheme of “Candidate” entity in the domain of Election Commission of Pakistan (ECP).

Candidate Scheme = (CandName : Text , Constituency : Text , Age : Number , Qualification : Text)

You are required to perform the following task:

1. A database relation having 4 tuples.
2. Represent the database relation created in 1 as a two dimensional structure called Table.

Solution:

1. Database relation:

Candidate = { (Rana Maqsood, NA-45, 40, BA) , (Sohail Khan, NA-16, 55, MA), (Shiraz Hussain Dar, NA-21, 37, MS) ,(Asad Ullah, NA-65, 35, M.Sc) }

2. Table

CandName	Constituency	Age	Qualification
Rana Maqsood	NA-45	40	BA
Sohail Khan	NA-16	55	MA
Shiraz Hussain Dar	NA-21	37	MS
Asad Ullah	NA-65	35	M.Sc

Mechanism to Conduct Lab:

Lab will be conducted via Google Meet / Zoom.

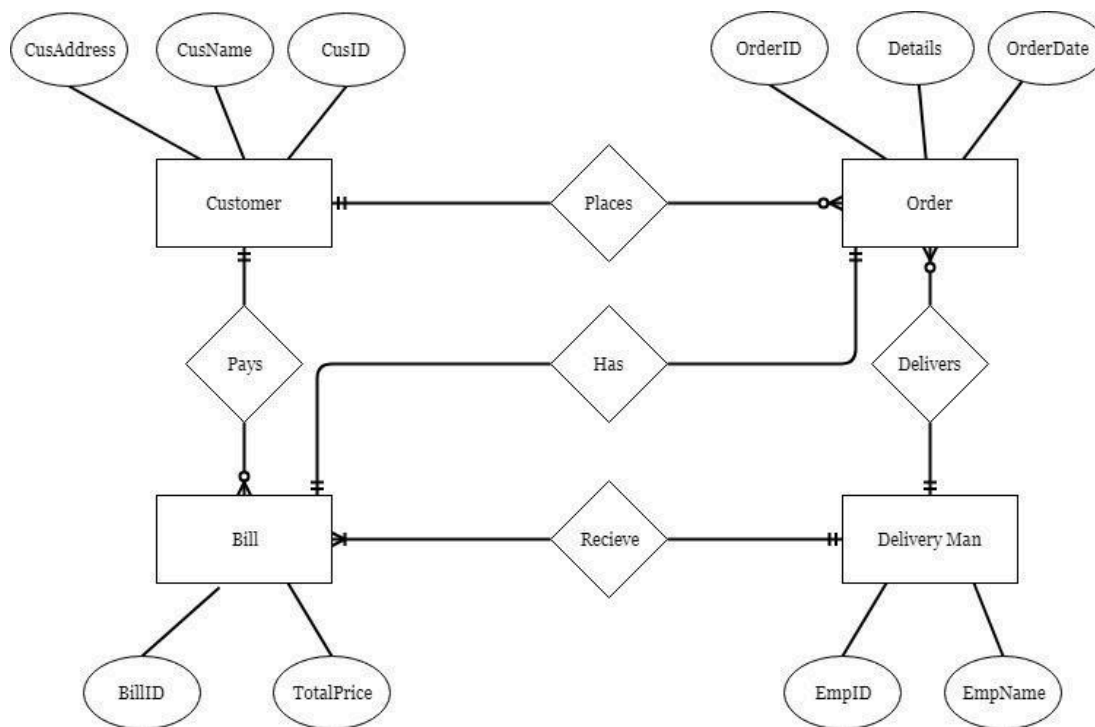
Lab 6

Lab Title: ERD to RDM

Problem Statement

You are required to transform the following ERD (Entity Relationship Diagram) to Relational Data model using the transforming/mapping rules taught in the video lectures and handouts. You also have to show the primary keys and foreign keys.

ERD:



Solution:

Customer (CusID, CusName, CusAddress)

Order (OrderID, OrderDate, Details, CusID, EmpID)

Bill (BillID, TotalPrice, CusID, EmpD, OrderID)

DeliveryMan (EmpID, EmpName)

Mechanism to Conduct Lab: Lab will be conducted via Google Meet / Zoom.

Lab 7

Lab Title: Relational Algebra Operations

Problem Statement

Consider the following two relations:

Employee 1:

EmpName	Designation	Age	Salary
Khalid Khan	Director	38	65000
Tariq Khan	Supervisor	27	16000
Sadiq Amin	Account Officer	28	28000
Shabir Hussain	Manager	35	40000
Tanveer Ahmad	Admin Officer	30	30000
Farooq	Clerk	25	12000

Employee 2:

EmpName	Designation	Age	Salary
Farukh	Lecturer	27	25000
Waqar Shah	Assistant Professor	35	45000
Jibran Akhtar	Network Admin	28	27000
Yasir Zaib	HR Manager	35	42000

You are required to perform the following relational algebra operations.

1. σ Salary >20000 (Employee 1)
2. σ Salary <40000 (Employee 2)
3. Π EmpName, Salary (Employee 2)
4. Employee 1 $\cup$ Employee 2

Solution:

1

EmpName	Designation	Age	Salary
Khalid Khan	Director	38	65000
Sadiq Amin	Account Officer	28	28000
Shabir Hussain	Manager	35	40000
Tanveer Ahmad	Admin Officer	30	30000

2

EmpName	Designation	Age	Salary
Farukh	Lecturer	27	25000
Jibran Akhtar	Network Adin	28	27000

3

EmpName	Salary
Farukh	25000
Waqar Shah	45000
Jibran Akhtar	27000
Yasir Zaib	42000

EmpName	Designation	Age	Salary
Khalid Khan	Director	38	65000
Tariq Khan	Supervisor	27	16000
Sadiq Amin	Account Officer	28	28000
Shabir Hussain	Manager	35	40000
Tanveer Ahmad	Admin Officer	30	30000
Farooq	Clerk	25	12000
Farukh	Lecturer	27	25000
Waqar Shah	Assistant Professor	35	45000
Jibran Akhtar	Network Adin	28	27000
Yasir Zaib	HR Manager	35	42000

Mechanism to Conduct Lab:

Lab will be conducted via Google Meet / Zoom.

Lab 8

Lab Title: Normalization (2NF)

Problem Statement

You have studied the concept of normalization (and different normal forms) in this course. Following relation is already in First Normal Form. You are required to convert it into Second Normal Form using the techniques you have studied so far.

<u>EmpID</u>	Name	DeptName	salary	CourseTitle	DateCompleted
101	Latif	Marketing	35000	Advertising	15/03/2010
101	Latif	Marketing	35000	Survey	15/03/2010
103	Mukhtar	Accounting	47000	MS Excel	10/06/2011
104	Zafar	IT	57000	Oracle	18/04/2009
104	Zafar	IT	57000	Java	14/09/2007
106	Nasir	Finance	70000	Investment	19/08/2008
107	Ali	Marketing	35000	Advertising	15/03/2010
107	Ali	Marketing	35000	ecommerce	21/05/2012

The above relation contains different redundancies. The relation can be expressed in a shorthand notation as follows:

EMPLOYEE (EmpID, Name, DeptName, Salary, CourseTitle, DateCompleted)

The above relation contains a composite primary key of **EmpID** and **CourseTitle**. The functional dependencies in this relation are as follows:

EmpID □ Name, DeptName, Salary

EmpID, CourseTitle □ DateCompleted

Solution:

All the partially dependent attributes are removed and placed in another relation when a relation is converted from 1NF to 2NF. The decomposition must satisfy one of the following conditions.

A relation will be in 2NF if any of the following conditions are met:

1. The primary key consists of only one attribute
2. No non-key attributes exist in the relation
3. Every non-key attribute is functionally dependent on the full set of primary key attributes.

The EMPLOYEE relation can be divided into two relations EMPLOYEE and COURSE as follows:

EMPLOYEE (EmpID, Name, DeptName, Salary)

EmpID	Name	DeptName	Salary
101	Latif	Marketing	35000
103	Mukhtar	Accounting	47000
104	Zafar	IT	57000
106	Nasir	Finance	70000
107	Ali	Marketing	35000

COURSE: (EmpID, CourseTitle, DateCompleted)

<u>EmpID</u>	CourseTitle	DateCompleted
101	Advertising	15/03/2010
101	Survey	15/03/2010
103	MS Excel	10/06/2011
104	Oracle	18/04/2009
104	Java	14/09/2007
106	Investment	19/08/2008
107	Advertising	15/03/2010
107	ecommerce	21/05/2012

The primary key in EMPLOYEE relation consists of only one attribute. It satisfies the first condition. The attribute DateCompleted in COURSE relation is fully functionally depends on whole composite key. It satisfies the third condition. It means that both relations are in second normal forms.

Mechanism to Conduct Lab:

Lab will be conducted via Google Meet / Zoom.

Lab 9

Lab Title: Normalization (3NF)

Problem Statement

Following relation is already in Second Normal Form. You are required to convert it into Third Normal Form using the techniques you have studied so far.

<u>CustomerID</u>	Name	SalesMan	Region
11	Hamza	Khalid	South
21	Shoaib	Umair	West
31	Shahbaz	khalid	South
44	Salman	Zulfiqar	East
51	Rizwan	Umair	West
61	Farooq	Uzair	North

The relation can be expressed in a shorthand notation as follows:

SALES (CustomerID, Name, SalesMan, Region)

The attribute CustomerID is used as primary key. Each salesman is assigned a unique region.

The above relation contains the following functional dependencies:

CustomerID $\rightarrow$ Name, SalesMan

SalesMan $\rightarrow$ Region

The above relation is in 2NF because the primary key consists of single attribute. A transitive dependency exists in the relation. The Region (a non-key attribute) is dependent on another non-key attribute (SalesMan) and SalesMan is functionally dependent on CustomerID. It means that region is transitively dependent on CustomerID.

Solution:

Transitive dependency exists if a non-key attribute depends on any other non-key attribute.

The transitive dependency can be removed by decomposing the above relation into two relations as follows:

<u>CustomerID</u>	Name	SalesMan
11	Hamza	Khalid
21	Shoaib	Umair
31	Shahbaz	khalid
44	Salman	Zulfiqar
51	Rizwan	Umair
61	farooq	Uzair

SALES (CustomerID, Name, SalesMan)

<u>SalesMan</u>	Region
Khalid	South
Umair	West
Zulfiqar	East
Uzair	North

SALESMAN (SalesMan, Region)

Both relations are now in 3NF. There is no transitive dependency in these relations.

The determinant attribute in transitive dependency becomes the primary key in **SALESMAN** relation.

Mechanism to Conduct Lab:

Lab will be conducted via Google Meet / Zoom.

Lab 10

Lab Title: SQL Queries (Create and Insert)

Problem Statement

Consider the following tables:

Teacher:

TeacherID	Name	Office	Phone	Salary	Email
T001	Dr. Najma Waheed	F001	9125	150000	najma@uni.edu.pk
T002	Dr. Nouman Masood	F003	5291	175000	nouman@uni.edu.pk
T003	Dr. Farhana Khan	F001	9222	125000	farhana@uni.edu.pk

Class:

ClassID	CourseCode	DayofWeek	StartTime	EndTime	Venue
A001	CS403	Monday	09:00 AM	10:00 AM	A Block
B002	CS301	Tuesday	09:00 AM	10:00 AM	B Block
C003	CS201	Monday	10:30 AM	12:00 PM	C Block

Consider the above given tables and perform the following Tasks;

1. Write the query to create the above tables in SQL Server.
2. Insert the records given in the above tables.

Solution:

```
CREATE TABLE Teacher(  
TeacherID varchar(5) primary key,  
Name varchar(30),  
Office varchar(10),  
Phone smallint,  
Salary int,  
Email varchar(20)  
);
```

```
CREATE TABLE Class(  
ClassID varchar(5) primary key,  
CourseCode varchar(10),  
DayofWeek varchar(10),  
StartTime time,  
EndTime time,  
Venue varchar(10)  
);
```

```
INSERT INTO Teacher(TeacherID, Name, Office, Phone, Salary, Email)  
VALUES('T001','Dr. Najma Waheed','F001', 9125, 150000,'najma@uni.edu.pk');
```

```
INSERT INTO Teacher(TeacherID, Name, Office, Phone, Salary, Email)  
VALUES('T002','Dr. Nouman Masood','F003', 5291, 175000,'nouman@uni.edu.pk');
```

```
INSERT INTO Teacher(TeacherID, Name, Office, Phone, Salary, Email)  
VALUES('T003','Dr. Farhana Khan','F001', 9222, 125000,'farhana@uni.edu.pk');
```

```
INSERT INTO class(ClassID, CourseCode, DayofWeek, StartTime, EndTime, Venue)  
VALUES('A001','CS403','Monday', '09:00:00', '10:00:00','A Block');
```

```
INSERT INTO class(ClassID, CourseCode, DayofWeek, StartTime, EndTime, Venue)  
VALUES('B002','CS301','Tuesday', '09:00:00', '10:00:00','B Block');
```

```
INSERT INTO class(ClassID, CourseCode, DayofWeek, StartTime, EndTime, Venue)  
VALUES('C003','CS201','Monday', '10:30:00', '12:00:00','C Block');
```

Mechanism to Conduct Lab:

Lab will be conducted via Google Meet / Zoom.

Lab 11

Lab Title: SQL Queries

Problem Statement

Given are the tables of Teacher and Class:

TeacherID	Name	Office	Phone	Email
T001	Dr. Najma Waheed	F001	9125	najma@uni.edu.pk
T002	Dr. Nouman Masood	F003	NULL	nayyer@uni.edu.pk
T003	Dr. Farhana Khan	F002	9222	farhana@uni.edu.pk
T004	Dr. Tayyaba Ali	F005	9325	tayyaba@uni.edu.pk
T005	Mr. Nouman Ahmad	F006	9145	nouman@uni.edu.pk
T006	Mr. Waqass Raheem	F004	NULL	waqas@uni.edu.pk

ClassID	CourseCode	DayofWeek	TimeStart	TimeEnd	Venue	TeacherID
A001	CS403	Monday	09:00 AM	10:00 AM	A Block	T003
B002	CS301	Tuesday	09:00 AM	10:00 AM	B Block	T005
A001	CS304	Tuesday	14:00 PM	15:00 PM	A Block	T002
C003	CS201	Monday	10:30 AM	12:00 PM	C Block	T006
C003	CS301	Friday	12:00 PM	13:00 PM	C Block	T005
B005	CS403	Friday	12:30 PM	14:00 PM	B Block	T003

Consider the above given tables and perform the following Tasks;

1. Display all the records of the class whose start time is between 09:00 and 12:00
2. Retrieve the details of teachers with first name Dr.
3. On which days classes of CS403 are scheduled at 09:00 AM?
4. List down the Subjects which are taught in B Block.
5. Select the course code from Class table, avoiding the duplicate values.
6. Display all the records of the class whose start time is 09:00 or 12:00 and end time is less than 14:00

Solution:

1:

```
Select *  
From Classes  
Where StartTime Between '09:00' and '12:00'
```

2:

```
Select * from Teacher  
Where Name Like 'Dr.%'
```

3:

```
Select DayofWeek  
From Classes  
Where CourseCode='CS403' AND StartTime='09:00'
```

4:

```
Select CourseCode
From Classes
Where Venue='B Block'
```

5:

```
Select distinct CourseCode
From Classes
```

6:

```
Select *
From Classes
Where (StartTime='09:00' OR StartTime='12:00') AND EndTime<'14:00'
```

Mechanism to Conduct Lab:

Lab will be conducted via Google Meet / Zoom.

Lab 12

Lab Title: SQL Queries (Select, Group By and Having clause)

Problem Statement

Teacher:

TeacherID	Name	Office	Phone	Salary	Email
T001	Dr. Najma Waheed	F001	9125	150000	najma@uni.edu.pk
T002	Dr. Nouman Masood	F003	5291	175000	nouman@uni.edu.pk
T003	Dr. Farhana Khan	F001	9222	125000	farhana@uni.edu.pk

Class:

ClassID	CourseCode	DayofWeek	StartTime	EndTime	Venue
A001	CS403	Monday	09:00 AM	10:00 AM	A Block
B002	CS301	Tuesday	09:00 AM	10:00 AM	B Block
C003	CS201	Monday	10:30 AM	12:00 PM	C Block

Consider the above given tables and perform the following Tasks;

1. Count the number of teachers
2. Count the unique courses from Classes table

3. List subject-wise classes according to earlier end time.
4. Calculate the average salary of the teachers sitting in the same office with office not null.

Solution:

1:

```
Select count(*) from Teacher;
```

2:

```
Select count(distinct CourseCode) As All_Courses  
from Class;
```

3:

```
Select Min(EndTime) As Late_Classes  
from Class  
GROUP BY CourseCode;
```

4:

```
Select AVG(Salary)  
From Teacher  
GROUP BY Office  
Having Office IS NOT NULL;
```

Mechanism to Conduct Lab:

Lab will be conducted via Google Meet / Zoom.

Lab 13

Lab Title: Joins

Problem Statement

<u>TeacherID</u>	Name	Office	Phone	Email
T001	Dr. Najma Waheed	F001	9125	najma@uni.edu.pk
T002	Dr. Nouman Masood	F003	NULL	nayyer@uni.edu.pk
T003	Dr. Farhana Khan	F002	9222	farhana@uni.edu.pk
T004	Dr. Tayyaba Ali	F005	9325	tayyaba@uni.edu.pk
T005	Mr. Nouman Ahmad	F006	9145	nouman@uni.edu.pk
T006	Mr. Waqass Raheem	F004	NULL	waqas@uni.edu.pk

<u>ClassID</u>	CourseCode	DayofWeek	TimeStart	TimeEnd	Venue	<u>TeacherID</u>
A001	CS403	Monday	09:00 AM	10:00 AM	A Block	T003
B002	CS301	Tuesday	09:00 AM	10:00 AM	B Block	T005
C003	CS201	Tuesday	14:00 PM	15:00 PM	A Block	T002
D004	CS501	Monday	10:30 AM	12:00 PM	C Block	T006
E005	CS401	Friday	12:00 PM	13:00 PM	C Block	T005

F006	CS402	Friday	12:30 PM	14:00 PM	B Block	T003
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Consider the above given tables and apply the following types of joins:

1. Inner join
2. Full Outer join
3. Right Outer join
4. Left Outer join

Solution:

1. **SELECT * FROM** Teacher **INNER JOIN** Class **ON**
Teacher.TeacherID=Class.TeacherID;
2. **SELECT * FROM** Teacher **FULL OUTER JOIN** Class **ON**
Teacher.TeacherID=Class.TeacherID;
3. **SELECT * FROM** Teacher **RIGHT OUTER JOIN** Class **ON**
Teacher.TeacherID=Class.TeacherID;
4. **SELECT * FROM** Teacher **LEFT OUTER JOIN** Class **ON**
Teacher.TeacherID=Class.TeacherID;

Mechanism to Conduct Lab:

Lab will be conducted via Google Meet / Zoom.

Lab 14

Lab Title: Indexes

Problem Statement

Consider the following table:

TEACHER:

<u>TeacherID</u>	Name	Office	Phone	Email
T001	Dr. Najma Waheed	F001	9125	najma@uni.edu.pk
T002	Dr. Nouman Masood	F003	NULL	nayyer@uni.edu.pk
T003	Dr. Farhana Khan	F002	9222	farhana@uni.edu.pk
T004	Dr. Tayyaba Ali	F005	9325	tayyaba@uni.edu.pk
T005	Mr. Nouman Ahmad	F006	9145	nouman@uni.edu.pk
T006	Mr. Waqass Raheem	F004	NULL	waqas@uni.edu.pk

You are required to perform the following tasks:

1. Write SQL query to create a UNIQUE INDEX on the “**TeacherID**” column of the given table in Descending order.
2. Write SQL query to create a UNIQUE INDEX on the “**Name**” and “**Office**” columns of the given table in ascending order.

Solution:**1**

```
CREATE UNIQUE INDEX Teacher_Index1  
On TEACHER (TeacherID DESC);
```

2

```
CREATE UNIQUE INDEX Teacher_Index2  
On TEACHER (Name, Office ASC);
```

Mechanism to Conduct Lab:

Lab will be conducted via Google Meet / Zoom.

Lab 15

Lab Title: Views

Problem Statement

Class:

<u>ClassID</u>	CourseCode	DayofWeek	TimeStart	TimeEnd	Venue	<u>TeacherID</u>
A001	CS403	Monday	09:00 AM	10:00 AM	A Block	T003
B002	CS301	Tuesday	09:00 AM	10:00 AM	B Block	T005
C003	CS201	Tuesday	14:00 PM	15:00 PM	A Block	T002
D004	CS501	Monday	10:30 AM	12:00 PM	C Block	T006
E005	CS401	Friday	12:00 PM	13:00 PM	C Block	T005
F006	CS402	Friday	12:30 PM	14:00 PM	B Block	T003

You are required to write an SQL query to create a “View” on this table having **ClassID**, **CourseCode** and **Venue** columns. Furthermore, the view would have information for only those classes conducted in the “A Block” venue.

Solution:

```
CREATE VIEW Class_View AS
SELECT ClassID, CourseCode, Venue
FROM CLASS
WHERE Venue='A Block';
```

Mechanism to Conduct Lab:

Lab will be conducted via Google Meet / Zoom.

Lab 16

Lab Title: Views (Continued)

Problem Statement

Consider the following table:

Products:

ProductName	Purchase_Price	Sale_Price	Stock_Qty
Bread	20	25	50
French Pastry	17	25	35
Slice	20	25	20
Large Cake	50	60	30
Dairy Cream Cake	40	47	40
Pastry	10	15	70
Biscuit	15	20	45
Rolls	25	30	65
Lays Chips (small size)	18	20	115
Lays Chips (Medium size)	47	50	100
Lays Chips (Large size)	92	100	80

You are required to write an SQL query to create a “View” on this table having **ProductName**, **Sale_Price** and **Stock_Qty** columns. Furthermore, the view would have information for only those products having Sale price greater than the average sale price in the given table.

Solution:

```
CREATE VIEW Product_View AS  
SELECT ProductName, Sale_Price, Stock_Qty  
FROM Products  
WHERE Sale_Price > (SELECT AVG(Sale_Price) FROM Products) ;
```

Mechanism to Conduct Lab:

Lab will be conducted via Google Meet / Zoom.