Competency Assessment

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Answer to Question No: 1(a)

Question:

1. Consider the following register. Holy Family Red Cross Hospital is using this register to manage doctors' lists, their contact numbers, and the departments to which the doctors belong. With this register, the hospital is also managing doctor's service points within the hospital.

a. Apply the normalization rule to normalize this register up to the 3rd normal form.

Doctor	Contact Number	Service Points	Department
Dr. Lissa Mwenda	+260766219936	Antenatal Care, Family Planning, Postnatal Care	Gynecology
Dr. Yvonne Sishuwa	+260766219937	Family Planning, Postnatal Care	Pediatrics
Dr. Machalo Mbale	+260766219938	Antenatal Care	Radiology and Imaging

Answer:

Normalization is the process of organizing data in a relational database to eliminate redundancy and dependency. Here is the summary of the normalization step:

- ✓ In 1NF, columns will have only atomic values.
- ✓ in 2NF, there will be no partial dependencies.
- ✓ in 3NF, there will be no transitive dependencies.

So, I'm going to break this table up into 3rd normal form. For a better explanation, I'll break down the whole process as small as possible which is not required and recommended for larger database normalization scenarios.

1. **First Normal Form (1NF):** Let's ensure that each column contains only indivisible values. So, there is no repeating group of columns.

Doctor	Contact Number	Service Points	Department
Dr. Lissa Mwenda	+260766219936	Antenatal Care	Gynecology
Dr. Lissa Mwenda	+260766219936	Family Planning	Gynecology
Dr. Lissa Mwenda	+260766219936	Postnatal Care	Gynecology
Dr. Yvonne Sishuwa	+260766219937	Family Planning	Pediatrics
Dr. Yvonne Sishuwa	+260766219937	Postnatal Care	Pediatrics
Dr. Machalo Mbale	+260766219938	Antenatal Care	Radiology and Imaging

Ok, the 1NF target is achieved. But now, I'm seeing repetitive data. Let's simply break the table.

Doctor ID (PK)	Doctor	Contact Number
1	Dr. Lissa Mwenda	+260766219936
2	Dr. Yvonne Sishuwa	+260766219937
3	Dr. Machalo Mbale	+260766219938

Service Point
Antenatal Care
Family Planning
Postnatal Care

Department
Gynecology
Pediatrics
Radiology and Imaging

2. **Second Normal Form (2NF):** I have to eliminate all partial dependencies. That means non-key attributes are fully functionally dependent on the primary key. So, let's create a separate table.

Department Table:

Department ID (PK)	Department Name
1	Gynecology
2	Pediatrics
3	Radiology and Imaging

ServicePoint Table:

Service Point ID (PK)	Service Point Name
1	Antenatal Care
2	Family Planning
3	Postnatal Care

3. **Third Normal Form (3NF):** Let's remove transitive dependencies. So, I'm ensuring that no column is dependent on another non-key attribute. Currently, our dependency looks like:
   - Doctor -> Department
   - Doctor -> Service Points
   - Department -> Service Points (Transitive Dependency)

Updated Doctor Table: One-To-One relationship with Department Table

DoctorID (PK)	Doctor	Department ID (FK)	Department Name
1	Dr. Lissa Mwenda	1	Gynecology
2	Dr. Yvonne Sishuwa	2	Pediatrics
3	Dr. Machalo Mbale	3	Radiology & Imaging

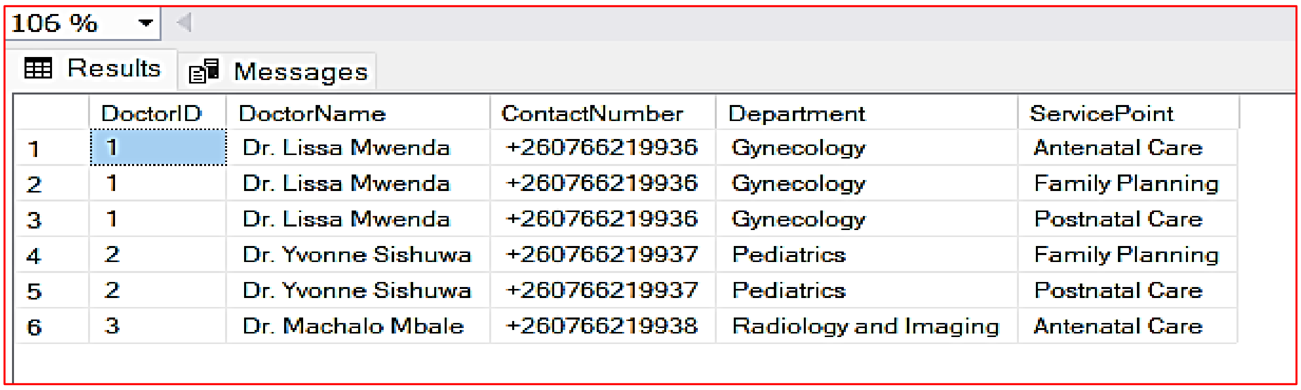
DoctorServicePoint (Intermediate Table) __ Many-To-Many relationship

DoctorID (PK)	Doctor	ServicePointID (PK)	Service Points
1	Dr. Lissa Mwenda	1	Antenatal Care
1	Dr. Lissa Mwenda	2	Family Planning
1	Dr. Lissa Mwenda	3	Postnatal Care
2	Dr. Yvonne Sishuwa	2	Family Planning
2	Dr. Yvonne Sishuwa	3	Postnatal Care
3	Dr. Machalo Mbale	1	Antenatal Care

Now 3rd Normalization is Complete!

By following this structure SQL is returning data exactly like 1NF. Here is the Join Query Code:

```
SELECT
    d.DoctorID,
    d.Name AS DoctorName,
    d.ContactNumber,
    dp.Name AS Department,
    sp.Name AS ServicePoint
FROM
    Doctor d
JOIN
    DoctorServicePoint dsp ON d.DoctorID = dsp.DoctorID
JOIN
    ServicePoints sp ON dsp.ServicePointID = sp.ServicePointID
JOIN
    Department dp ON d.DepartmentID = dp.DepartmentID;
```


106 % Results Messages

	DoctorID	DoctorName	ContactNumber	Department	ServicePoint
1	1	Dr. Lissa Mwenda	+260766219936	Gynecology	Antenatal Care
2	1	Dr. Lissa Mwenda	+260766219936	Gynecology	Family Planning
3	1	Dr. Lissa Mwenda	+260766219936	Gynecology	Postnatal Care
4	2	Dr. Yvonne Sishuwa	+260766219937	Pediatrics	Family Planning
5	2	Dr. Yvonne Sishuwa	+260766219937	Pediatrics	Postnatal Care
6	3	Dr. Machalo Mbale	+260766219938	Radiology and Imaging	Antenatal Care

Please Find the SQL script file in the Folder.

Answer to Question No: 1(b)

b. After normalization, draw Entity Relationship Diagram and show the degree of cardinality among entities using crow's foot notation.

Answer:

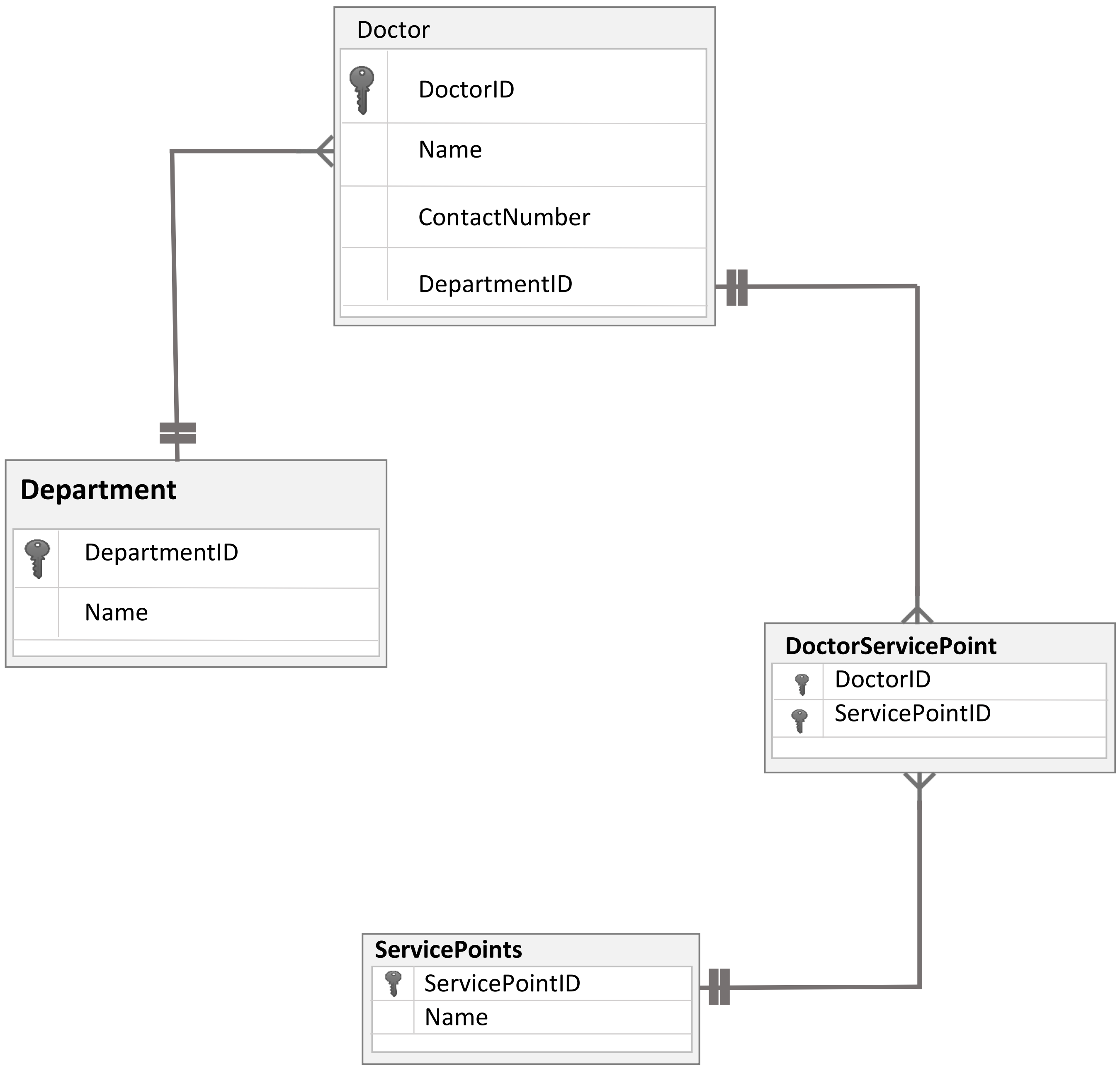


Figure: Entity Relationship Diagram using crow's foot notation

Answer to Question No: 2

2. Consider the following loop. Trace the value of "n" in every iteration of the loop.

```
int n = 30;

for (int i = 0; i <= 5; i++)
{
    n += i;
}

print(n);
```

Answer:

Iteration No	Value of 'I'	Increment	Value of 'n'
1	0	30+0	30
2	1	30+1	31
3	2	31+2	33
4	3	33+3	36
5	4	36+4	40
6	5	40+5	45

Answer to Question No: 4

4. **Explain method overloading and method overriding with example. Write your code in C# programming language.**

Answer:

❖ Both method overloading and method overriding are forms of polymorphism in C#, providing flexibility in handling different method implementations based on the context of usage.

➢ **Method Overloading:**

- Allows a class to have multiple methods with the same name but different parameter lists.
- The compiler distinguishes between overloaded methods based on the number or types of parameters during compile time.

Here is the Example using C#:

```
public class MethodOverloading
{
    public int Add(int a, int b)
    {
        return a * b;
    }

    public int Add(int a, int b, int c)
    {
        return a + b + c;
    }

    public double Add(double a, double b, int c)
    {
        return a + b + c;
    }

    public double Add(double a, int c, double b)
    {
        return a * b + c;
    }
}
```

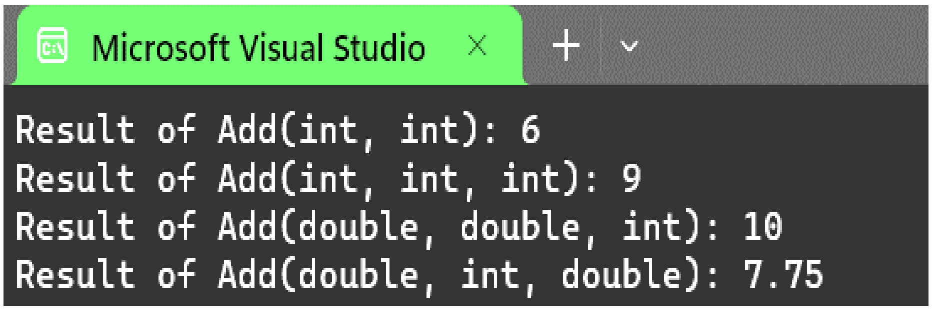
Number Of Parameters are different

Type Of Parameters are different

Order Of Parameters are different

Let's Run this Program!

```
using Answer_4;

class Program
{
    static void Main()
    {
        MethodOverloading calculator = new MethodOverloading();

        int result1 = calculator.Add(2, 3);
        Console.WriteLine("Result of Add(int, int): " + result1);

        int result2 = calculator.Add(2, 3, 4);
        Console.WriteLine("Result of Add(int, int, int): " + result2);

        double result3 = calculator.Add(2.5, 3.5, 4);
        Console.WriteLine("Result of Add(double, double, int): " + result3);

        double result4 = calculator.Add(2.5, 4, 1.5);
        Console.WriteLine("Result of Add(double, int, double): " + result4);
    }
```



```
Result of Add(int, int): 6
Result of Add(int, int, int): 9
Result of Add(double, double, int): 10
Result of Add(double, int, double): 7.75
```

➢ **<u>Method overriding:</u>**

- Method overriding is a form of type polymorphism, allowing multiple methods with the same name and signature in different classes.
- It relies on Inheritance.
- The compiler resolves overridden methods based on the actual type of the object <u>during run time</u>, considering the method in the derived class instead of the base class.

<u>Here is the Example using C#:</u>

```
using System;

namespace Answer_4
{
    public class BaseClass
    {
        public virtual void Greetings()
        {
            Console.WriteLine
                ("Muslim: As-Salamu-Alaikum");
        }
    }

    public class SubClass : BaseClass
    {
        public override void Greetings()
        {
            Console.WriteLine("Hindu: Namaskar");
        }
    }

}
```

Base/Parent class use virtual keyword

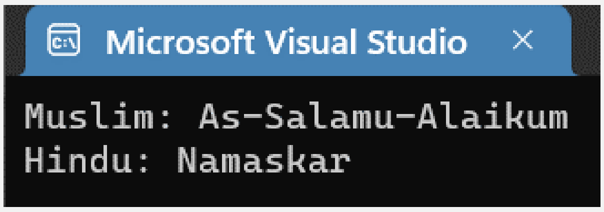
Method overriding Cannot be achieved without inheritance

Derived/Child class use override keyword

Let's Run This Program!

```
using Answer_4;

class Program
{
    static void Main()
    {
        BaseClass baseObj = new BaseClass()
;
        SubClass subObj = new SubClass();

        baseObj.Greetings();
        subObj.Greetings();
    }
}
```

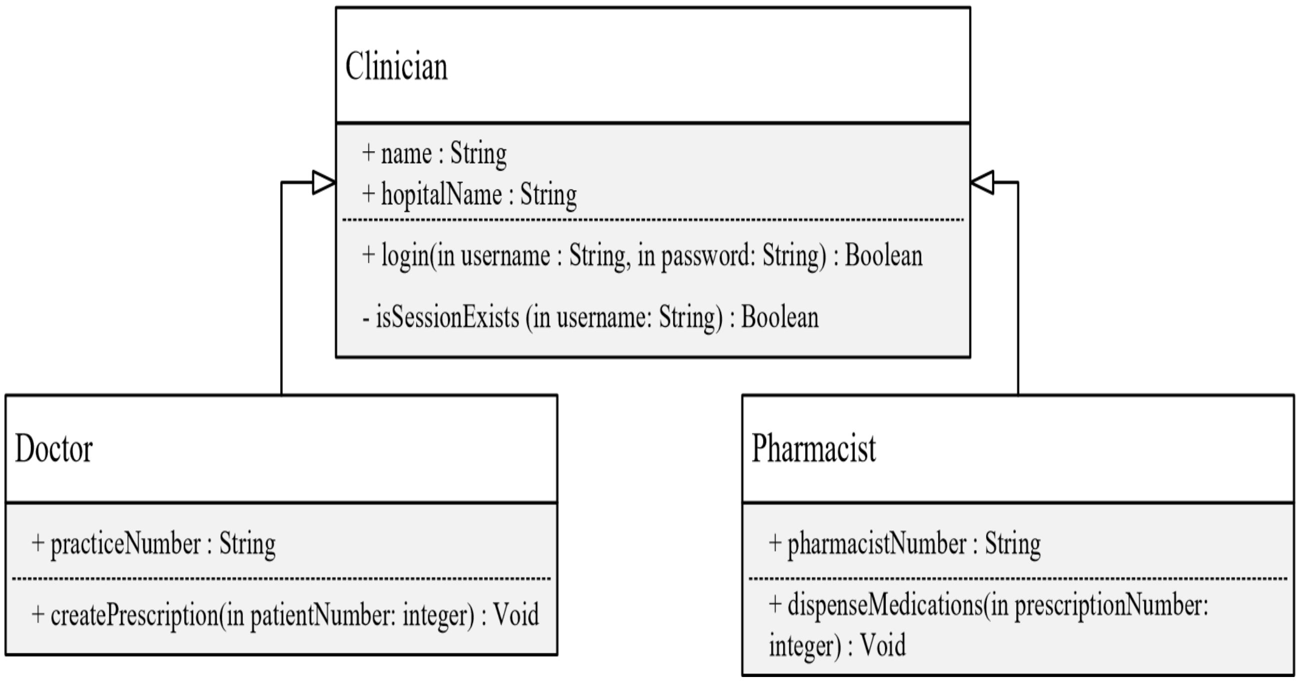
<u>Output:</u>



```
Muslim: As-Salamu-Alaikum
Hindu: Namaskar
```

Answer to Question No: 5

5. **Translate the following UML Class Diagram into program code. Write your code in C# programming language.**



Clinician
+ name : String
+ hopitalName : String
+ login(in username : String, in password: String) : Boolean
- isSessionExists (in username: String) : Boolean
Doctor
+ practiceNumber : String
+ createPrescription(in patientNumber: integer) : Void
Pharmacist
+ pharmacistNumber : String
+ dispenseMedications(in prescriptionNumber: integer) : Void

Answer:

- **Clinician Class:**

```
public class Clinician
    {
        public string Name { get; set; }
        public string HospitalName { get; set; }

        public bool Login(string username, string password)
        {
            return true;
        }

        private bool IsSessionExists(string username)
        {
            return true;
        }
    }
```

➢ <u>Doctor Class:</u>

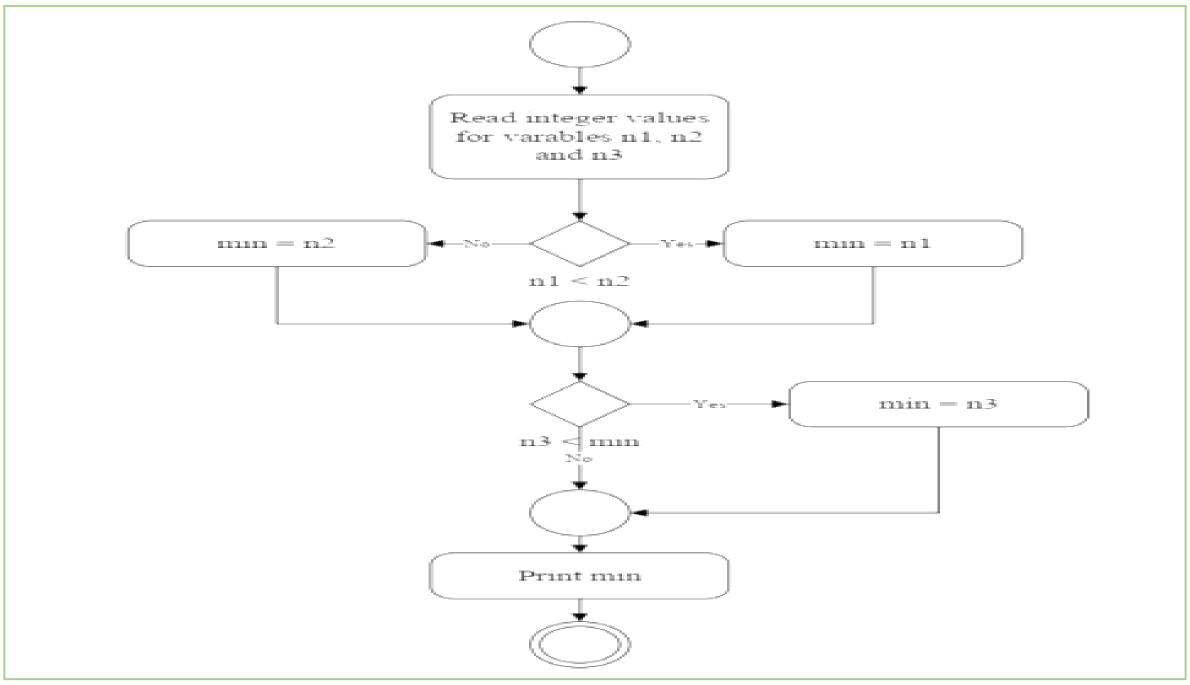
```
public class Doctor : Clinician
    {
        public string PracticeNumber { get; set; }

        public void CreatePrescription(int patientNumber)
        {
            Console.WriteLine($"Prescription created for patient
 {patientNumber} by Doctor {Name}");
        }
    }
```

➢ <u>Pharmacist Class:</u>

```
public class Pharmacist : Clinician
    {
        public string PharmacistNumber { get; set; }

        public void DispenseMedications(int prescriptionNumber)
        {
            Console.WriteLine($"Medications dispensed for prescr
iption {prescriptionNumber} by Pharmacist {Name}");
        }
    }
```

Answer to Question No: 6

6. Translate the UML Activity diagram into program code. Write your code either in C#



Answer:

```
public class Flowchart
    {
        public void PrintMinNum(int n1, int n2, int n3)
        {
            int min = 0;
            if (n1 < n2)
            {
                min = n1;
            }
            else
            {
                min = n2;
            }

            if (n3 < min)
            {
                min = n3;
            }

            Console.WriteLine($"Minimum Number : {min}");
        }
    }
```