

<b>Course Code: CS 423</b>	<b>Course Name: Information Processing Techniques</b>
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Instructions:

- Read each question completely before answering it. There are **3 questions and 4 pages**.
- In case of any ambiguity, you may make assumption. But your assumption should not contradict any statement in the question paper.
- All the answers must be solved according to the sequence given in the question paper.
- You should upload the solution PDF on Google Classroom and also send it on [murtaza.fazal@nu.edu.pk](mailto:murtaza.fazal@nu.edu.pk) (as a precaution)
- For any queries during the paper, you can ask questions on [meet.google.com/mea-ihdr-van](https://meet.google.com/mea-ihdr-van)
- This paper is subjective

**Time:** 180 minutes (+30 minutes to scan, upload and email)

**Max Marks:** 100 points

**Question 1: State the following as True or False and in case of false, justify your answer.** (5 Points)

1. The *mustUnderstand* attribute in the header element of SOAP messages indicates that a header entry is either required or optional for the recipient to process further.
2. Message Contract defines the parameters and return type of an operation.
3. ASP.Net WebServices and WCF uses DataContractSerializers for conversion into XML.
4. Reflection API can read meta data of all obfuscated assemblies.
5. DataReader object is used to fill a DataSet/DataTable with query results in ADO.net.

**Question 2: Answer the following questions briefly.**

1. Is the following statement valid in any scenario? Explain with an example. (4 Points)

*Interface iObj = new Class();*

2. Make changes to the following method so that it can only be accessed as POST request on a WebAPI Controller (version 1.0). (3 Points)

```
public string PostData(string str)
{
    return "Welcome: " + str;
}
```

3. What's the difference between abstract and virtual methods in C#? (4 Points)

4. The following code generates an xml which includes Name, Age and IsInWarning. Modify the code so that Age is not included in the xml generated. (3 Points)

```
[Serializable]
public class Student
{
    public string Name;
    public int Age;
    public bool IsInWarning;
    public Student()
    {}
    public Student(string _Name, int _Age, bool _IsInWarning)
    {
        this.Name = _Name;
        this.Age = _Age;
        this.IsInWarning = _IsInWarning;
    }
}
```

```

class Program
{
    static void Main(string[] args)
    {
        Student std1 = new Student();
        std1.Name = "Ahmed";
        std1.Age = 21;
        std1.IsInWarning = true;
        XmlSerializer serializer = new XmlSerializer(typeof(Student));
        StreamWriter streamWriter = new StreamWriter(@"D:\IPT\test.xml");
        serializer.Serialize(streamWriter, std1);
        Console.ReadLine();
    }
}

```

5. What are Extension Methods? Explain with an example. **(5 Points)**
6. What is an EndPoint in WCF. Briefly explain the pillars of WCF. **(5 Points)**
7. Briefly compare XML Web Services (ASMX) and WCF. **(5 Points)**
8. Compare any four of the following: **(8 Points)**
  - a. Explain different types of temporary variable/tables available in MS SQL.
  - b. What is difference between ref and out variables?
  - c. Clustered Index v/s Non-clustered Index
  - d. Tier versus Layer
  - e. Value type variables versus reference type variables

**Question 3: Explain the following questions. You may use diagram or code snippets where necessary**

1. Explain the advantages of using SQL File Stream over File system and Blob approaches. **(8 Points)**
2. Answer the following questions related to ADO.Net
  - a. What do you mean by ADO.Net? **(3 Points)**
  - b. Explain the steps to be performed for accessing data with ADO.Net using DataAdapter. **(5 Points)**
3. What is the purpose of using LINQ? Briefly explain LINQ to Object with an example. What is the difference between Select and SelectMany in LINQ? Consider the following string array, write a LINQ statement for finding common elements in both of the string arrays. **(8 Points)**

```

string[] strArray1 = new string[] { "apple", "mango", "orange" };
string[] strArray2 = new string[] { "mango", "banana", "apple" };

```
4. You have been hired to develop a WCF for an integration project between Slate and Flex. Create a SOAP based Web Service that will be used to store or perform the following operations: **(10 Points)**
  - Get Course List from Flex
    - Parameter: Semester ID will be provided
    - Output: Course (Course ID, Course Name, Course Code, Course Description)
  - Get Student List from Flex
    - Parameter: Semester ID, Course ID
    - Output: List of Students (Student ID, Student Name)
  - Add Students to Slate
    - Parameter: List of CourseStudent Object (Semester ID, Course ID, Student Number)
    - Output: Boolean
  - Delete a Student from Slate
    - Parameter: CourseStudent Object (Semester ID, Course ID, Student Number)
    - Output: Boolean

Note: As an integration developer, you have to provide the WCF implementation of contracts. You can safely assume that you have a Business Layer class which has all of the methods and queries which can be used by your code.

5. Write SQL queries for the following (should have valid MS SQL Server syntax)
  - a. You are given a table, #tmp, containing two columns: A and B. **(6 Points)**

Two pairs (A1, B1) and (A2, B2) are said to be symmetric pairs if A1 = B2 and A2 = B1. Write a query to output all such combinations in ascending order by the value of A.

Column	Type
A	Integer
B	Integer

**Sample Input**

X	Y
20	20
20	20
20	21
23	22
22	23
21	20

**Sample Output**

20 20  
20 21  
22 23

- b. Write a query to display StudentID and StudentName of all students which are not registered in any course. (without using subqueries). Following is the table structure. **(4 Points)**

Student
StudentID
StudentName

Course
CourseID
CourseName

StudentCourse
StudentCourseID
StudentID
CourseID

6. Gotham City is going to have Mayor elections in the coming week. They are using a system that was donated by a Wayne Tech three years back. The System has these features:
- Mobility:** The voter is not restricted to cast his ballot at a single poll-site at his home precinct. He can vote from any poll-site within the nation or through mobile app
  - Convenience:** The system allows the voter to cast their votes quickly, in one session, and should not require many special skills or intimidate the voter (to ensure Equality of Access to Voters).
  - User-Interface:** The system shall provide an easy-to-use user-interface. Also, it shall not disadvantage any candidate while displaying the choices (e.g., by requiring the user to scroll down to see the last few choices).
  - Transparency:** Voters can possess a general knowledge and understanding of the voting process.
  - Flexibility:** The system is flexible such that it allows a variety of ballot question formats including open-ended questions (e.g. Write-in candidates and survey questions).
  - Support for Disabled Voters:** The system caters to the need of physically challenged voters (e.g. blind voters).
  - Accuracy:** The system records and count all the votes and shall do so correctly. It stores the vote locally but synchronizes with the centralized database on hourly basis.
  - Eligibility:** Only authorized voters, who are registered, can vote.
  - Uniqueness:** No voter can vote more than once.
  - Auditability:** It is possible to verify that all votes have been correctly accounted for in the final election tally, and it is reliable and demonstrably authentic election records, in terms of physical, permanent audit trail (does not reveal the user's identity in any manner).
  - Voter Confirmation:** The voter gets a confirmation SMS.
  - No Over-voting:** The voter shall be prevented from choosing more than one candidate / answer.
  - Under-voting:** underage citizens cannot vote.
  - Documentation and Assurance:** The design, implementation, and testing procedures are well documented so that the voter-confidence in the election process is ensured.

A gang named "Leviathans" which is lead a person name "Bruno" is taking over the city. His agenda has been simple and direct; he wants to take over Gotham City. He has invested his power into the system of the city of Gotham and hire some hackers to take over the election campaign. Exactly three years ago, on election day, there was a massive cyber-attack which tarnished the digital voting process completely and since then, Commissioner Gordon is trying to get the system back into action but each year before the election, either the system's database gets corrupted or somehow, they manage to change the election's result.

This year, which also happens to be Commissioner Gordon's last year has promised to the city of Gotham for a foolproof security and has made sure to provide security to every polling booth. Not only that, The CEO of the Wayne Tech, Mr. Bruce Wayne has promised a safe and better equipped voting system to the government. The multimillionaire has always been a generous man for the city by doing charity and putting our city on the world map of technology worldwide. He has promised to hire the best person for the Job. That person is You. Will you be able to do it? The only challenge you have is that, this is the last week before elections and the system needs to be secure and both mobile and web app should be functioning and storing data to their area's database.

- I. Which Web Service (ASMX, WCF or Web API) will you recommend and why? (2 Points)
- II. Irrespective of whatever you choose in the previous question, if you were given a choice to select between ASMX and WCF, which one you would choose and why? (2 Points)
- III. Which type of Partitioning (Vertical or Horizontal) would you recommended in this scenario and why? (2 Points)
- IV. Recommend all possible techniques which you think would be beneficial to cater the demand for so many users on the election day. (2 Points)
- V. Mr. Wayne wants you to build a Windows Service. Your requirement for the service is that the windows service will be running on each of the polling station which has the local database. Your task is to fetch the polling data every 30 minutes and send a consolidated email. Following is the input/output: (6 Points)

NIC	StationID	VotedForCandidate	VotingDateTime	Slot
12345-6789012-3	0071	1	2020-07-04 09:20:33	1
23451-6789012-1	0071	2	2020-07-04 09:21:41	1
34512-6789012-2	0071	1	2020-07-04 09:23:22	1
45123-6789012-5	0071	1	2020-07-04 09:29:13	1
51234-6789012-2	0071	3	2020-07-04 09:30:00	2
13452-6789012-5	0071	3	2020-07-04 09:35:13	2

**Output:**

**Email 1 at 09:30**

StationID	CandidateID	Votes
0071	1	2
0071	2	1

**Email 2 at 10:00**

StationID	CandidateID	Votes
0071	1	2
0071	2	1
0017	3	2

Note: You can assume that you already have an smtp class which all code written. You just need to send email by calling a static method Email.Send(params)

**Bonus:**

1. Discuss the terms Thin and Fat clients by providing an example of a working system. (5 Points)
2. ArrayList is a not thread-safe. Write a code to convert ArrayList to a thread safe version. (5 points)

**BEST OF LUCK!**