National University of Computer & Emerging Sciences, Karachi
Fall 2021 (School of Computing)
Midterm I Examination

Course Code: CS-4042	**Course Name:** Information Processing Techniques
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Student ID:	**Section:**
Date: October 15, 2021	**Time:** 9 am - 10 am (60 minutes)

Instructions:

- Attempt all questions
- The paper contains 4 questions on 3 pages.
- Return the paper after the exam.

Max Points: **40**

Question 1: Multiple Choice Questions **(10 Points)**

1. What is unboxing?

a) Encapsulating an object in a value type.
b) Encapsulating a copy of an object in a value type.
c) Encapsulating a value type in an object.
d) Encapsulating a copy of a value type in an object.

2. Different ways a method can be overloaded in C#.NET

a) Different parameter data types.
b) Different order of parameters.
c) Different number of parameters.
d) All of above.

3. Which of the following statements are correct about an interface used in C#.NET?

a) An interface can contain properties, methods and events.
b) The keyword must implement forces implementation of an interface.
c) Interfaces can be overloaded.
d) Interfaces can be implemented by a class or a struct.
e) Enhanced implementations of an interface can be developed without breaking existing code.

4. Which of these data type values is returned by equals() method of String class?

a) char b) int c) Boolean d) all of the mentioned

5. Which of the following statements are correct about a namespace used in C#.NET?

I. Classes must belong to a namespace, whereas structures need not.
II. Every class, struct, enum, delegate and interlace has to belong to some or the other namespace.
III. All elements of the namespace have to belong to one file.
IV. If not mentioned, a namespace takes the name of the current project.
V. The namespace should be imported to be able to use the elements in it.

a) I and III b) II, IV and V c) III and V d) IV only

6. Which of the following is not a function defined in the ServiceBase Class?

a) onStart() b) onResume() c) onPause() d) onContinue()

7. Which of the following statements are correct?

I. A struct can contain properties.
II. A struct can contain constructors.
III. A struct can contain protected data members.
IV. A struct cannot contain methods.
V. A struct cannot contain constants.

a) I and II b) III, and IV c) I, II and IV d) III and V

8. XML uses the features of

a) HTML b) XHTML c) VML d) SGML

9. If s1 and s2 are references to two strings, then which of the following is the correct way to compare the two references?

a) s1 is s2
b) s1 == s2
c) s1 === s2
d) s1.Equals(s2)
e) strcmp(s1, s2)

10. Which of the following forms of applying an attribute is correct?

a) < Serializable() > class sample
{ /* … */ }
b) (Serializable()) class sample
{ /* … */ }
c) [Serializable()] class sample
{ /* … */ }
d) Serializable() class sample
{ /* … */ }
e) None of the above.

Question 2: State the following as True or False and in case of false, justify your answer. **(5 Points)**

1. JIT compiler is a part of the common language runtime which compiles and converts all components to native code. False. It is a part of the CLR, which means it can only compile and convert managed components
2. Boolean in C# takes 1 byte. True
3. To install a windows service, following command can be executed: False – installutil <service.exe> installutil /u <service.exe>.
4. CTS describes how to represent entities in the .NET Metadata format. True
5. Currency is a reference type datatype in C#. False – it is value type

Question 3: Answer the following questions briefly.

1. Explain the following the following terminologies: **(3 Points)**

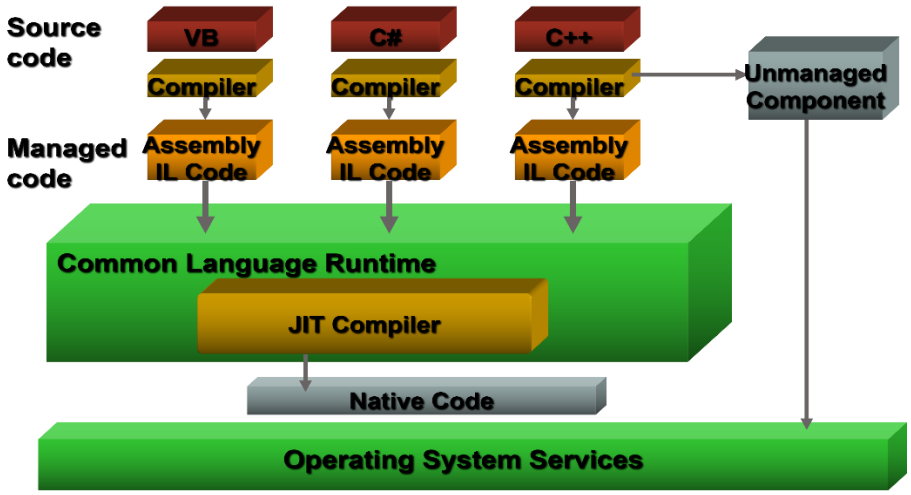
a) Abstraction in terms of a Mobile Phone
Answer: You can do multiple things like, make a call, take pictures, play games. It doesn't show you the inside process how it is doing the things. The implementation parts are hidden.

b) Encapsulation in terms of a Multi-national Company
Answer: It can have several departments like Production Department, HR Dept and Marketing Dept. All these departments make up the company.

c) Boxing v/s Unboxing
Answer: Conversion of value type variables into reference type variables is known as boxing whereas unboxing is conversion of reference type variables into value type variables.

2. Considering a C# code, explain the CLR Execution Model. **(3 Points)**

Answer



3. Explain the process of serialization and deserialization and write the required C# class(es) and object which would represent the following XML: **(3 Points)**

```
<?xml version="1.0"?>
<ArrayOfEmployee xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xmlns:xsd="http://www.w3.org/2001/XMLSchema">
 <Employee>
  <Name>Ahmed</Name>
  <Age>21</Age>
  <isNewEmployee>false</isNewEmployee>
  <skillSet>
   <Skills>
    <skillTitle>Web Development</skillTitle>
    <experience>3</experience>
   </Skills>
   <Skills>
    <skillTitle>Mobile Development</skillTitle>
    <experience>2</experience>
   </Skills>
  </skillSet>
 </Employee>
 <Employee>
  <Name>Aslman</Name>
  <Age>22</Age>
  <isNewEmployee>false</isNewEmployee>
  <skillSet>
   <Skills>
    <skillTitle>Graphics Designing</skillTitle>
    <experience>5</experience>
   </Skills>
  </skillSet>
 </Employee>
</ArrayOfEmployee>
```

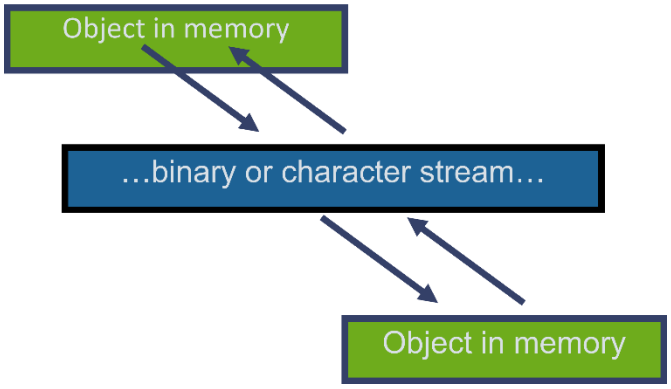
Answer:

Serialization:

Serialization is the process of converting an object, or a connected graph of objects, stored within computer memory, into a linear sequence of bytes

Deserialization:

Deserialization is the process of converting linear sequence of bytes into an object, or a connected graph of objects.



XML:

```
[Serializable]
public class Skills
{
    public string skillTitle;
    public int experience;
    public Skills()
    {
        skillTitle = "";
        experience = 0;
```

```
    }
    public Skills(string _skillTitle,int _Experience)
    {
        this.skillTitle = _skillTitle;
        this.experience = _Experience;
    }
}

[Serializable]
public class Employee
{
    public string Name;
    public int Age;
    public bool isNewEmployee;
    public List<Skills> skillSet;
    public Employee()
    {
        skillSet = new List<Skills>();
    }
    public Employee(string _Name, int _Age, bool _isNewEmployee,
        List<Skills> _skillList)
    {
        this.Name = _Name;
        this.Age = _Age;
        this.isNewEmployee = _isNewEmployee;
        this.skillSet = _skillList;
    }
}
    static void Main(string[] args)
    {
        List<Employee> employees = new List<Employee>();

        Employee std1 = new Employee();
        std1.Name = "Ahmed";
        std1.Age = 21;
        std1.isNewEmployee = false;
        List<Skills> skillSet = new List<Skills>();
        skillSet.Add(new Skills("Web Development",3));
        skillSet.Add(new Skills("Mobile Development",2));
        std1.skillSet = skillSet;
        employees.Add(std1);

        std1 = new Employee();
        std1.Name = "Aslman";
        std1.Age = 22;
        std1.isNewEmployee = false;
        skillSet = new List<Skills>();
        skillSet.Add(new Skills("Graphics Designing",5));
        std1.skillSet = skillSet;
        employees.Add(std1);

    }
```

4. Identify the Error(s) if any in given below scenarios. If there is any error, propose a solution **(3 Points)** to overcome the error(s).

a)

Assembly One	**Assembly Two**

Assume that we have created a Class Library in Assembly One.
 	
1. namespace AssemblyOne
2. {
3. public class Customer
4. {
5. internal int CNIC;
6. }
7. }
	Assume that we have created a console application in Assembly Two and taking the reference of the Class library created in Assembly One.
	
	1. namespace AssemblyTwo
	2. {
	3. public class Shop
	4. {
	5. public static void Main(string[] args)
	6. {
	7. AssemblyOne.Customer c1 = new Customer();
	8. c1.CNIC= 41245; //cannot access the attribute CNIC as it is internal. Internal members are available anywhere within the containing assembly. It

	is a compile-time error to access an internal member from outside the containing assembly.
	Solution: Define set and get function in AssemblyOne. (We can except any other appropriate solution)
	
	9. Console.WriteLine(c1.CNIC); //same }
	10. }
	11. }

b) No Error

Assembly One	**Assembly Two**

Assume that we have created a Class Library in AssemblyOne.
1. namespace AssemblyOne
2. {
3. public class Human
4. {
5. protected internal string name;
6. }
7. }
	Assume that we have created a console application in AssemblyTwo and taking the reference of the Class library created in AssemblyOne.
	1. namespace AssemblyTwo
	2. {
	3. public class Customer : Human
	4. {
	5. public void Set()
	6. {
	7. name = "Azeem";
	8. Console.WriteLine(name); }
	10. } }

Answer:

Question 4: Explain the following questions. You may use diagrams where necessary.

1. Explain with example how Windows Services are different from a Console Application? **(5 Points)**

Answer: Windows Service differs from console application in the following ways:

- A desktop / console application like cmd can have multiple instances, whereas windows service will always have one instance.
- A console application like cmd can run with both normal or administrative access whereas the windows service requires administrative access.
- A console application can be executed by running the exe file whereas a windows application needs to be installed before it can execute.
- A console app, either starts or stops whereas the lifecycle of windows service differs as it can be either started, paused, resumed or stopped.
- A console app has a user interface whereas windows service does not have a windows service.

2. A local virtual software house needs to implement ASCII based message level encryption within a windows service. The output would be list of sorted encrypted words with the count of each word against them. Your university has recommended you for this task. Write a C# code snippet which will encrypt a text based on the following assumption: **(8 Points)**

- Input can contain any alphabet or number
- You cannot use any third-party encryption functions.

Sample Input 1: Welcome to IPT
Output 1: KPV = 1, Vo = 1, YeNcQmG = 1
Sample Input 2: Pull up if I pull up
Output 2: K = 1, kf = 1, RuNl = 2, Wp = 2
Sample Input 3: Transforming Data
Output 3: FaVa =1, VrCnUfQrOiPg = 1

Answer:

Solution# 1:

```
static void Encrypt(string[] input)
{
	string[] encryptedWords = new string[10];

	string word;
	int index = 0;

	foreach (string s in input)
	{
		word = "";
		for (int i = 0; i < s.Length; i += 1)
		{
			if (i % 2 == 0)
			{
				int ascii = s[i] + 2;
				word += ((char)ascii).ToString().ToUpper();
			}
			else
				word += s[i];
		}

		if (!encryptedWords.Contains(word))
			encryptedWords[index] = word;

	  ++index;
}


     foreach (string s in encryptedWords)
     {
         Console.WriteLine(s + " ");
     }
  }
```

Solution# 2:

```
static void Encrypt(string text)
 {
	SortedDictionary<string, int> sd = new SortedDictionary<string, int>();
	var finalSentense = " ";
	foreach (string str in text.Split(finalSentense.ToCharArray(),
	StringSplitOptions.RemoveEmptyEntries))
	{
		string word = str;
		var finalWord = "";
		for (int i = 0; i < word.Length; i += 1)
		{
			if (i % 2 == 0)
			{
				int asciicode = (int)word[i] + 2;
				finalWord += ((char)asciicode).ToString().ToUpper();
			}
			else
				finalWord += word[i].ToString();
		}

		if (!sd.ContainsKey(finalWord))
			sd.Add(finalWord, 1);
		else
			sd[finalWord] = sd[finalWord] + 1;
	}
```

```
        foreach (KeyValuePair<string, int> keyValuePairs in sd)
        {
        Console.WriteLine($"Key: {keyValuePairs.Key} - Value: {keyValuePairs.Value}");
        }
}
```

BEST OF LUCK!