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

Course Code: CS-4042	**Course Name:** Information Processing Techniques
Instructors: Mr. Murtaza Munawar Fazal, Mr. Syed Zain Ul Hassan, Mr. Basit Ali, Ms. Abeeha Sattar	
Student ID:	**Section:**
Date: November 26, 2021	**Time:** 10:30 am – 11:30 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. In a thin client model, what is responsible for the processing of data?

a) Middleware b) Client c) Server d) None of these

2. Which of the following statements are true about JSON?

a) JSON is a data interchange format
b) JSON can be used to transfer data between server and clients
c) JSON does not have any version
d) JSON is a markup language
e) JSON is not a document format

3.Which of the following statements are not true about threads?

a) A process can have more than one threads
b) A thread is a fundamental unit of execution
c) A thread can call the sleep method on itself
d) None of the above.

4. Which method is used to abort thread prior to its normal execution?

a) sleep() b) terminate() c) suspend() d) Abort()

5.Which of the following components of a program are shared across threads in a multithreaded process?

a) Heap Memory
b) Global Variables
c) Stack Memory
d) None of the above

6. If a class inheriting an abstract class does not define all of its functions then it is known as?

a) Abstract
b) A simple class
c) Static class
d) None of the above

7.How do you represent a Boolean with value "true" in JSON?

a) "true" b) 0 c) True d) 1

8. Select the two types of thread mentioned in the concept of multithreading:

a) foreground b) background c) only a d) Both a & b

9. Which keyword is used for using the synchronization features defined by the Monitorclass?

a) lock b) synchronized c) Monitor d) locked

10. Which of these method of Thread class is used to Suspend a thread for a period of time?

a) sleep() b) terminate() c) suspend() d) stop()

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

1. A SOAP message may be encoded using XML. (False) SOAP message must be encoded using XML
2. Azure Functions is an example of Software as a Service (SaaS) (False) - FaaS
3. Remote Proxies creates a local copy of the signature and function implementation. (False) – signature only
4. You can view the WSDL for a web service by appending &wsdl to its URL. (False) – by appending ?wsdl

5. When maintaining the reference count for proxies, the last proxy is responsible for deleting the object. (True)

Question 3: Explain the following questions. You may use diagrams where necessary.

1. What is Service Oriented Architecture? How it is beneficial over Distributed Object Computing? **(5 Points)**

Answer:

Service orientation allows you to build applications out of new services, services cleaved out of old applications, or application wrapped as services. SOA is important when application have to cross trust boundaries. They are interoperable which means that it can be used by cross platform application. Object technology can be used in implementing services. Web Services are the natural implementation technology for SOA.

Distributed Object Computing required a higher bandwidth usage which resulted in a network traffic. Objects on server were called from the client and the resultant was passed back to the client. During this process, the server object is active and the client has to dispose off the object whereas in SOA, the service would be called by the client, it will perform the desired operation and return back the data in a text based format. It is not calling an object but a Method which is available over some protocol.

2. What problems can the Proxy design pattern solve? Also, please suggest what solution does the Proxy design pattern describe. **(5 Points)**

Answer:

Problems:

- The access to an object should be controlled.
- Additional functionality should be provided when accessing an object.

When accessing sensitive objects, for example, it should be possible to check that clients have the needed access rights.

Solution:

Define a separate Proxy object that

- can be used as substitute for another object (Subject) and
- Implements additional functionality to control the access to this subject.

This makes it possible to work through a Proxy object to perform additional functionality when accessing a subject. For example, to check the access rights of clients accessing a sensitive object.

To act as substitute for a subject, a proxy must implement the Subject interface. Clients can't tell whether they work with a subject or its proxy.

3. Consider the JSON document below. Provide its corresponding C# code. **(3 Points)**

```
{
  "id": 1,
  "name": "John Doe",
  "email": "john.doe@example.com",
  "age": 32,
  "address": {
    "street": "155 Middleville Road",
    "city": "New York",
    "state": "New York",
    "zipCode": 10045
  },
  "paymentMethods": [
    "PayPal",
    "Stripe"
  ],
  "projects": [
    {
      "title": "Business Website",
      "budget": 45000
    },
    {
      "title": "Sales Dashboard",
      "budget": 85000
    }
  ]
}
```

Answer:

```
// Root myDeserializedClass = JsonConvert.DeserializeObject<Root>(myJsonResponse);
  public class Address
  {
    public string street { get; set; }
```

```
    public string city { get; set; }
    public string state { get; set; }
    public int zipCode { get; set; }
}

public class Project
{
    public string title { get; set; }
    public int budget { get; set; }
}

public class Root
{
    public int id { get; set; }
    public string name { get; set; }
    public string email { get; set; }
    public int age { get; set; }
    public Address address { get; set; }
    public List<string> paymentMethods { get; set; }
    public List<Project> projects { get; set; }
}
```

4. Explain the concept of threading? What types of issues can arise when developing a multi-threaded application and explain using a code snippet, how they can be resolved? **(6 Points)**

Answer:

Thread are light weight partitions of a process to improve the performance and execution of the process even on a single processor. The scheduling algorithm rapidly switches between multiple threads to execute the program. It helps the program to be executed without being unresponsive, complete higher priority threads first and perform large amount execution without stopping for the rest of the application.

When working with multi-threaded application, two of the most common issues are, deadlocks and race condition i.e., one thread waiting for a resource which is being used by another thread which is waiting for the prior thread's execution to complete its own execution and when two threads are accessing same memory location and the first one modifies the location such that the second procedures a result which is unexpected. To resolve both conditions, we can use locks, monitor or semaphores in the following manner.

```
lock (object) {
// critical section
}
```

5. There is a string, s, of lowercase English letters that is repeated infinitely many times. Given an integer, n, find and return the number of letter a's in the infinite string. **(6 Points)**

Example: s = 'abcac' , n = 10

The substring we consider is 'abcacabcac', the first 10 characters of the infinite string. There are 4 occurrences of 'a' in the substring.

Your task is to complete the following function and the solution should not take O(n) time:

public static long repeatedString(string s, long n)

Sample Input 1	Sample Input 2
aba, 10	a,1000000000000
Sample Output 1	Sample Output 2
7	1000000000000

Answer:

```
public static long repeatedString(string s, long n)
{
        int aCount = s.Length - (s.Replace("a", "")).Length;
```

```
        long cloneCount = n / s.Length;
        var cloneReminder = n % s.Length;
        var localCount = 0;
        for(int i = 0; i < cloneReminder;i++)
        {
               if (s[i] == 'a') localCount++;
        }
        return (aCount * cloneCount) + localCount;
}
```

BEST OF LUCK!