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

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| **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:** December30, 2021 | | **Time:** 09:00am –12:00pm (180 minutes) |

**Instructions:**

* Attempt all questions
* The paper contains4 questions on 5 pages.
* Return the paper after the exam.

**Max Points**: **100**

**Question 1:Multiple Choice Questions (15Points)**

1. **What does the following declaration specify?**

**MethodsInfo[] GetMethods()**

1. Returns an array of MethodInfo objects
2. Returns a list of the public methods supported by the type by using GetMethods()
3. Both Return an array of MethodInfo objects & Return a list of the public methods supported by the type by using GetMethods()
4. None of the mentioned
5. **Can you overload a function with the same number and types of arguments (parameters) but with a different return type?**
6. Yes
7. No
8. Yes, but only if the function is static
9. Yes, but only if the function is virtual
10. **Which of these keywords are used for generating an exception manually?**
11. try
12. catch
13. throw
14. check

**4. Does C#.NET support partial implementation of interfaces?**

a) True.  
b) False.  
c) Can’t Say.  
d) None of the mentioned.

1. **Choose the correct statement about System.Type namespace.**
2. Core of the reflection subsystem as it encapsulates a type
3. Consists of many methods and properties that can be used to obtain information about a type at runtime
4. Both Core of the reflection subsystem as it encapsulates a type & Consists of many methods and properties that can be used to obtain information about a type at runtime
5. Only Consists of many methods and properties that can be used to obtain information about a type at runtime

**6. Select differences between reference type and value type:**

i. Memory allocated to ‘Value type’ is from heap and reference type is from ‘System. ValueType’

ii. Memory allocated to ‘Value type’ is from ‘System. ValueType’ and reference type is from ‘Heap’

iii. Structures, enumerated types derived from ‘System. ValueType’ are created on stack, hence known asValueType and all ‘classes’ are reference type because values are stored on heap.

a) i, iii

b) ii, iii

c) i, ii, iii

d) i

**7. Which among these are the consequences for the broker pattern?**a) Broker patterns simplify or decompose suppliers, or ease communication between them  
b) Broker patterns thus increase changeability, modifiability, and re-usability  
c) By interposing additional processing, they may degrade performance  
d) All of the mentioned

1. **\_\_\_\_\_\_\_\_\_\_ namespace is not defined in the .NET class library.**
2. System.CodeDom
3. System.IO
4. System.Thread
5. System.Text

**9.What will be the output of the following C# code snippet?**

1. class Program
2. {
3. static void Main(string[] args)
4. {
5. string[] strs = {"alpha", "beta", "gamma"};
6. var chrs = from str in strs
7. let chrArray = str.ToCharArray()
8. from ch in chrArray
9. orderby ch
10. select ch;
11. Console.WriteLine("The individual characters in sorted order:");
12. foreach (char c in chrs)
13. Console.Write(c + " ");
14. Console.WriteLine();
15. Console.ReadLine();
16. }
17. }

a) a a l h a b g m m a p e t a  
b) a a a a a b e g h l m m p t  
c) a g h l m m p t a a a a b e  
d) Run time error

**10. Assume 2 columns named as Product and Category how can be both sorted out based on first by category and then by product name?**  
a) var sortedProds = \_db.Products.Orderby(c => c.Category)  
b) var sortedProds = \_db.Products.Orderby(c => c.Category) + ThenBy(n => n.Name)  
c) var sortedProds = \_db.Products.Orderby(c => c.Category) . ThenBy(n => n.Name)  
d) all of the mentioned

**11. What will be the output of the following C# code?**

1. public class HelloWorld{
2. public static void Main(string[] args){
3. int i = 5;
4. int j =i;
5. method1(ref i);
6. method2(out j);
7. Console.WriteLine(i + " " + j);
8. }
9. public static void method1(ref int x){
10. x = x + x;
11. }
12. public static void method2(out int x){
13. x = x + 1;
14. x = x \* x;
15. }
16. }

a) 36, 10

b) 10, 36

c) Compilation Error

d) 36, 0

**12.** [**Which of the following are true about Extension Methods?**](http://www.read4learn.com/Question/64/which-of-the-following-are-true-about-extension-methods)

1. They can be declared either static or instance members.
2. Extension methods can be used to override existing instance methods
3. Extension methods with the same signature for the same class may be declared in multiple namespace without causing compilation errors.
4. They must be declared in the same assembly (but may be in different source files)

**13**.**Which among the following is a correct statement about namespace used in C#.NET?**

1. Classes must belong to a namespace, whereas structures need not
2. All elements of the namespace must to belong to one file
3. If not mentioned, a namespace takes the name of the current project
4. All of the mentioned.

**14. Which of the following statements is correct about a delegate?**

a) inheritance is a prerequisite for using delegates  
b) delegates are not type safe  
c) delegates provide wrappers for function pointers  
d) none of the mentioned

**15. Which of the following statements are correct with regards to Polymorphism?**

1. Polymorphism is a process by which a class can exist in multiple forms
2. Polymorphism is a process by which a class can exist in only two forms
3. Polymorphism is a process by which objects of a reference type can display different behavior
4. Polymorphism is a process by which different instances of the same class display different behavior.
5. Polymorphism allows old code in a class library to call new code written by a programmer that derives a class from a class in the class library.

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

1. System.ServiceProcess is the elementary namespace, which must be imported to develop code of a Web service.(False)
2. MethodImplAttribute is used to prevent a method of a class from being executed by more than one thread at a time.(True)
3. DataReader object is used to fill a DataSet/DataTable with query results in ADO.net.(False)
4. ***IComparer***interface provides a way to customize the sort order of a collection.(True)
5. Semantic invariant conversion of data into a machine independent format is called Marshaling.(True)

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

1. In which scenario would you prefer to use Object, Var or Dynamic (you may pick multiple if you can justify them). Give a justification for your answer. **(6 Points)**
   1. You are programming in an environment where you want to make sure that you do not encounter any runtime errors.

**Answer:** Var. You will not get any runtime errors with these, because the compiler does not let you compile the code until there are no errors.

* 1. You want to be able to reassign values to a variable without having to create multiple variables for multiple values.

Answer: Object or Dynamic. Both can store different types of values unlike in var, where you can only store a value of one type.

* 1. You are using reflecting to create objects are runtime.

Answer: Dynamic. As it allows you to use methods that may not be predefined in your program. When you are using reflection, you will be fetching the objects and methods at runtime.

* 1. You do not want to perform any type casting when writing the code.

Answer: Var or Dynamic. Only Object requires you to type cast.

1. Explain four different HTTP Verbs and their usage. **(4 Points)**
2. What are some of the architectural principles that a REST API must follow? Briefly explain the principles. **(6 Points)**

**Answer:**

* Should have a client-server architecture (separation of concerns)
* Resource oriented, and each resource must be addressable via a URI
* Uses a small set of well-defined methods to manipulate your resources
* Server must be stateless. Client needs to provide all necessary information to process a request
* Responses can be cached for later use

1. What is connection pooling? How this technique is useful? **(6 Points)**

Connection pooling is the ability to re-use your connection to the Database. This means if you enable Connection pooling in the connection object, actually you enable the re-use of the connection to more than one user.The connection pooling is enabled by default in the connection object. If you disable the connection pooling, this means the connection object which you create will not be re-used to any other user than who creates that object. This technique is useful as it maximizes the use of physical connection with the Database and your application.

1. Compare any four of the following: **(2 Points each)**
2. View Models versus Data Models

A Data model is usually more closely related to how your data is stored (database, services, etc.) and the model will closely resemble those. The ViewModel on the other hand is closely related to how your data is presented to the user. It is usually a flatten version of your model, denormalized, etc

1. Data Reader versus Data Adapter

Data Reader is read only format, we can't update records. It is connection oriented, whenever data bind from database that need connection and then connection is disconnected. Whereas Dataadapter is a disconnected oriented architecture. DataAdapter is like a mediator between DataSet (or) DataTable and database. This dataadapter is used to read the data from database and bind to dataset.

1. Tier versus Layer
2. Value type variables versus reference type variables
3. Clustered v/s Non-Clustered Index

**Question 4: Explain the following questions. You may use diagram or code snippets where necessary**

1. What is Reflection? Discuss its advantage using a real-world, practical application. **(8 Points)**

Reflection allows us to fetch Type (Assembly) information at runtime or programmatically. It enables us to use code that was not available at compile time and also effectively to find all the types in an assembly and/or dynamically invoke methods in an assembly. With reflection, we can dynamically create an instance of a type, bind the type to an existing object, or get the type from an existing object and invoke its methods or access its fields and properties.

Real-world Example: You have developed an e-commerce application. You have it on the production and it’s working fine. But changes are happening regularly (i.e. target clients changing or sells policies).

Instead of hard-coding your functionalities for all sorts of computations inside the core app and rebuilding your software and then publishing it. We can have a separate DLL which you would load into system and then use reflection to access its props or methods and use them dynamically.

1. For the following data, write a code snippet that uses LINQ with extension methods to retrieve and print all workers with a salary between 50,000 and 75,000 and residing in Karachi. **(8 Points)**

IList<Worker> workers = new List<Worker>( ) {

new Worker() { city = "Lahore", salary = 35000 },

new Worker() { city = "Karachi", salary = 49000 },

new Worker() { city = "Karachi", salary = 51000 },

new Worker() { city = "Hyderabad", salary = 70000}

};  
var selectedWorkers = workers.Where(

w =>

{

if (w.city.Equals("Karachi") && w.salary >= 50000 && w.salary <= 75000)

Select w; });

foreach (var work in selectedWorkers)

Console.WriteLine(work.city + " " + work.salary);  
 var selectedWorkers = from w in workers where ( w.salary > 50000 && w.salary < 75000 && w.city.Equals("Karachi") Select w;

1. Briefly explain the concept of an Endpoint in WCF. Also discuss how does it make the WCF services more advantageous in terms of interoperability? **(8 Points)**WCF offers its services to its client using an endpoint. An endpoint comprises of three key elements, the address, binding and contract. WCF endpoints provide the necessary resources and directions, which help clients to communicate with the various services WCF offers.  
   An endpoint in WCF allows us to use a single service to serve more than one different clients. Unlike ASMX, where an altogether different service was required, in WCF for each different client we can define a new endpoint hence supporting interoperability.
2. What are extension methods? Write an extension method “CharacterCount” in C# which returns every English character with the number of times it was used in the input string in the alphabetic order. Following is a sample input / output. **(8 Points)**

**Input:**  
*string str = "Hello World. Welcome to the Final Examination of IPT. Will you pass the course?"   
 var Dictionary = str.CharacterCount();*  
**Output:**

a:4 b:0 c:2 d:1 e:7 f:2 g:0 h:3 i:5

j:0 k:0 l:7 m:2 n:3 o:8 p:2 q:0 r:2

s:3 t:5 u:2 v:0 w:3 x:1 y:1 z:0

1. 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: **(18 Points)**
2. 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
3. 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).
4. 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).
5. Transparency: Voters can possess a general knowledge and understanding of the voting process.
6. 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).
7. Support for Disabled Voters: The system caters to the need of physically challenged voters (e.g. blind voters).
8. 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.
9. Eligibility: Only authorized voters, who are registered, can vote.
10. Uniqueness: No voter can vote more than once.
11. 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).
12. Voter Confirmation: The voter gets a confirmation SMS.
13. No Over-voting: The voter shall be prevented from choosing more than one candidate / answer.
14. Under-voting: underage citizens cannot vote.
15. 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 month before elections and the system needs to be secure and needs to have a desktop interface, a web interface and a mobile interface.

1. **What architectural design would you recommend?**
2. **If you are limited to SOAP based Web Services, which one would you suggest among ASMX and WCF and why?**
3. **If you are limited to RESTful Web Services, which one would you suggest among WCF Restful Serviceor Web API and why?**
4. **Can Windows Service be incorporated in the project to resolve any of the feature?**
5. **If the system was deployed on the Cloud, what features do you think can be implemented using Azure Functions?**
6. **Suggest ways to improve the application security.**

**Bonus:**

* + - 1. Write a function which accepts an object and converts it into JSON String using Reflection **(5 Points)**

***BEST OF LUCK!***