

**SVKM'S**  
**Mithibai College of Arts, Chauhan Institute of Science &**  
**Amrutben Jivanlal College of Commerce and Economics (Autonomous)**  
**Academic Year (2022-23)**  
**Year: 2 / Semester: IV**

**Program: B.Sc. Computer Science**

**Max. Marks: 75**

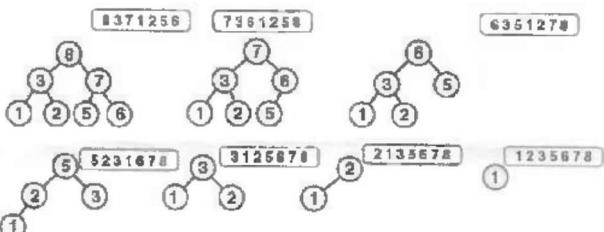
**Course: Fundamentals of Algorithms**

**Date:**

**Duration: 2 ½ hrs.**

**REGULAR EXAMINATION**

<b>Q.1</b>	<b>Attempt any three.</b>	<b>[21]</b>
A	<p>What is Algorithm? Discuss different types of algorithm analysis.          Which is most commonly used analysis? Why?          An <b>algorithm</b> is a step-by-step procedure for solving a problem in a finite amount of time.  <b>1 marks</b>          Best case, worst case, average case with notations— <b>5 marks</b>          Worst case is used most commonly – <b>1 mark</b></p>	
B	<p>Given following python code what is the complexity? Detail each step.</p> <pre>def func1(n):     i=1     while i&lt;=n:         i=i*2         print(i)     for j in range(0, n):         print(j)</pre> <p>first loop jumps by two 1 Marks          log n execution 2 marks          second loop executes n time 1 Marks  <math>f(n)=cn+c\log n+c</math> 2 Marks  <math>O(n)</math> 1 mark</p>	
C	<p>Given following python code find its complexity.</p> <pre>def func(n):     cnt=0     if n&lt;=0:         return     for i in range(0,n) :         for j in range(0,n):             cnt=cnt+1             func(n-3)             print(cnt)</pre> <p><math>f(n)=</math>loop executes <math>n^2</math> time  <math>f(n)=n^2</math> 1 Mark  <math>T(n)=T(n-3)+ n^2</math> 2 mark          Master theorem of subtract and conquer 1 Marl  <math>a=1</math>  <math>b=3</math>  <math>d=2</math></p>	

		O( $n^3$ ) 3 Mark	
	D	<p>Develop recursive python program to find <math>x^y</math>. Find its complexity.</p> <pre>def power(base,exp):     if(exp==1):         return(base)     if(exp!=1):         return(base*power(base,exp-1))</pre> <p>2 Marks</p> <p><math>T(n)=T(n-1)+1</math> 1 Mark  <b>Master theorem of subtract and conquer</b> 1 Mark  <math>a=1</math>  <math>b=1</math>  <math>O(n)</math></p> <p>3 Marks</p>	
	<b>Q.2</b>	<b>Attempt any three:</b>	[21]
	A	<p>What are heaps? Explain heapsort with following example:  <b>8,3,7,1,2,5,6</b></p> <p>A heap is a complete binary tree, and the binary tree is a tree in which the node can have the utmost two children. A complete binary tree is a binary tree in which all the levels except the last level, i.e., leaf node, should be completely filled, and all the nodes should be left-justified.</p> <p>2 Marks</p> <p><b>Heap sort</b> is a comparison-based sorting technique based on <b>Binary Heap</b> data structure. It is similar to the <b>selection sort</b> where we first find the minimum element and place the minimum element at the beginning. Repeat the same process for the remaining elements.</p> <p>2 Marks</p> 	
	B	<p>What is string matching? Describe naïve approach of the string matching with example.</p> <p>The problem of finding occurrence(s) of a pattern string within another string or body of text.</p> <p>The naïve approach tests all the possible placement of Pattern P [1.....m] relative to text T [1.....n]. We try shift s = 0, 1.....n-m, successively and for each shift s. Compare T [s+1.....s+m] to P [1.....m].</p>	

**2 Mark**

T = Text

P = Pattern

S=1

**So, S=2 is a Valid Shift**

S=3

S=4

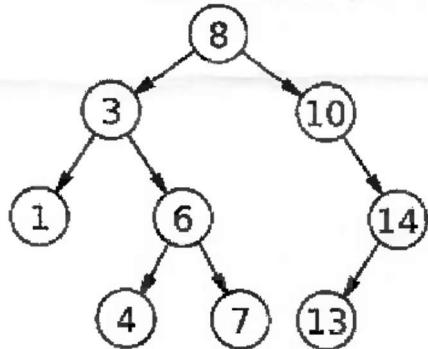
S=5

**So, S=6 is a Valid Shift**

S=7

**5 mark**

- C Explain the concept of threaded binary tree with its node structure. Given following binary tree generate threaded binary tree.



The idea of threaded binary trees is to make inorder traversal faster and do it without stack and without recursion.

A binary tree is made threaded by making all right child pointers that would normally be NULL point to the inorder successor of the node

2 Marks

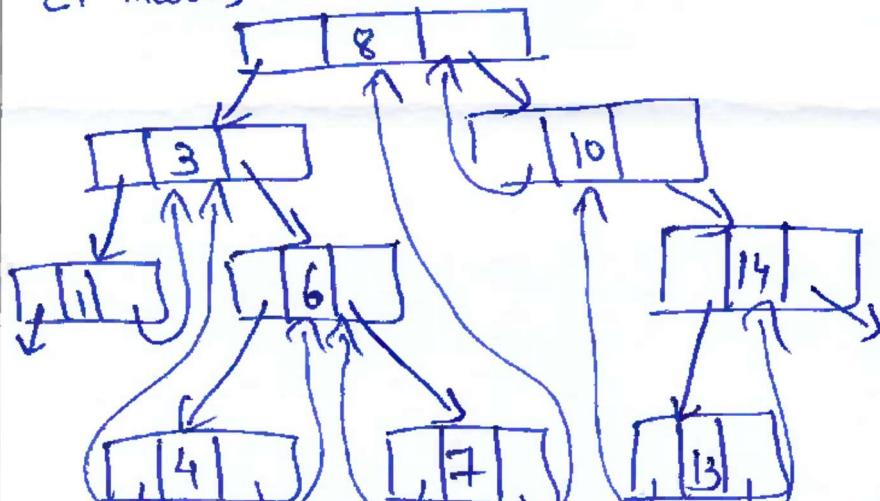
Node Structure:



*Threaded Binary Tree Node*

2 marks

Inorder traversal: 1, 3, 4, 6, 7, 8, 10, 13, 14  
[1 mark]



[2 Marks]

D Discuss median of median algorithm with suitable example.

- The Median of Medians is a fast recursive method for finding a value close to the median.

1. Divide the list into  $n/5$  sublists of length 5 and perhaps one group with the remaining elements and sort those sublists.

2. Select the median of each sublist. For the final sublist if it has two or four elements select the lower median.

3. Apply selectkth recursively on the smaller list of those values in order to find the median (or lower median) of that new list.

4 Marks +3 Marks example

Q.3 Attempt any three.

[21]

A Explain following methods of algorithm classification:

- Linear Programming

- A method to allocate scarce resources to competing activities in an optimal manner when the problem can be expressed using a linear objective function and linear inequality constraints.

2 Mark

- Reduction

	<p>Method to solve difficult problem by transforming it into a known problem for which we have asymptotically optimal algorithms. 1 mark</p> <ul style="list-style-type: none"> <li>• Deterministic or Non-Deterministic Deterministic algorithms solve the problem with a predefined process. 1 mark</li> <li>Non-deterministic algorithm guesses the best solution at each step 1 mark</li> <li>• Exact or Approximate Algorithms for which we are able to find optimal solution are exact algorithms 1 mark</li> <li>Approximate algorithms are associated with NP-hard problems where optimal solution may not be found only approximation may be possible. 1 mark</li> </ul>																																																									
B	<p>Find out longest common subsequence of longest and stone.</p> <table border="1" style="margin-left: auto; margin-right: auto;"> <tr> <td>-1</td><td>0</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td> </tr> <tr> <td>-1</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td> </tr> <tr> <td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>1</td><td>1</td> </tr> <tr> <td>1</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>1</td><td>2</td> </tr> <tr> <td>2</td><td>0</td><td>0</td><td>1</td><td>1</td><td>1</td><td>1</td><td>2</td> </tr> <tr> <td>3</td><td>0</td><td>0</td><td>1</td><td>2</td><td>2</td><td>2</td><td>2</td> </tr> <tr> <td>4</td><td>0</td><td>0</td><td>1</td><td>2</td><td>2</td><td>3</td><td>3</td> </tr> </table> <p><b>4 Marks</b>  <b>LCS= one</b>  <b>3 marks</b></p>	-1	0	1	2	3	4	5	6	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	0	0	0	0	0	1	2	2	0	0	1	1	1	1	2	3	0	0	1	2	2	2	2	4	0	0	1	2	2	3	3	
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C	<p>Write program of quick sort as an application of divide and conquer strategy.</p> <pre> def quickSort(alist,first,last):     if first&lt;last:         splitpoint = partition(alist,first,last)          quickSort(alist,first,splitpoint-1)         quickSort(alist,splitpoint+1,last)  def partition(alist,first,last):     pivotvalue = alist[first]     leftmark = first+1     rightmark = last     done = False      while not done:          while leftmark &lt;= rightmark and alist[leftmark] &lt;= pivotvalue:             leftmark = leftmark + 1         while leftmark &gt; rightmark and alist[rightmark] &gt; pivotvalue:             rightmark = rightmark - 1         if leftmark &gt; rightmark:             done = True         else:             temp = alist[leftmark]             alist[leftmark] = alist[rightmark]             alist[rightmark] = temp     return alist </pre>																																																									

```

leftmark = leftmark + 1

while alist[rightmark] >= pivotvalue and rightmark >= leftmark:
    rightmark = rightmark - 1

if rightmark < leftmark:
    done = True
else:
    temp = alist[leftmark]
    alist[leftmark] = alist[rightmark]
    alist[rightmark] = temp

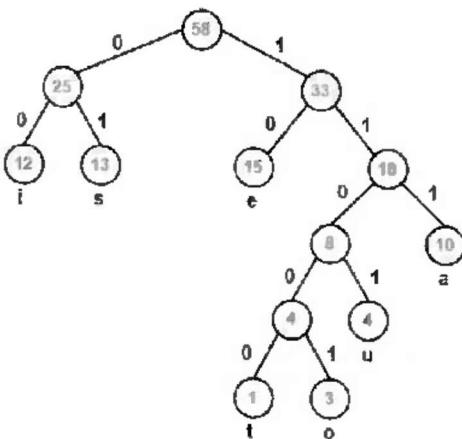
temp = alist[first]
alist[first] = alist[rightmark]
alist[rightmark] = temp
return rightmark

```

7 Marks

D	Given following character frequencies:																
	<table border="1"> <thead> <tr> <th>Character</th><th>a</th><th>e</th><th>i</th><th>o</th><th>u</th><th>s</th><th>t</th></tr> </thead> <tbody> <tr> <td>Frequency</td><td>10</td><td>15</td><td>12</td><td>3</td><td>4</td><td>13</td><td>1</td></tr> </tbody> </table>	Character	a	e	i	o	u	s	t	Frequency	10	15	12	3	4	13	1
Character	a	e	i	o	u	s	t										
Frequency	10	15	12	3	4	13	1										

Find its Huffman code.



Huffman Tree

5 Marks for construction of above tree

a = 111

e = 10

i = 00

o = 11001

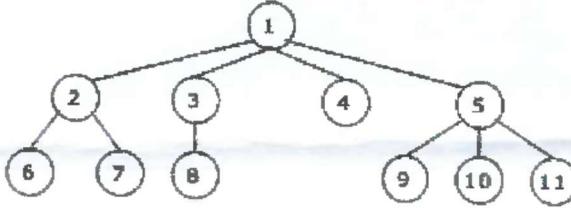
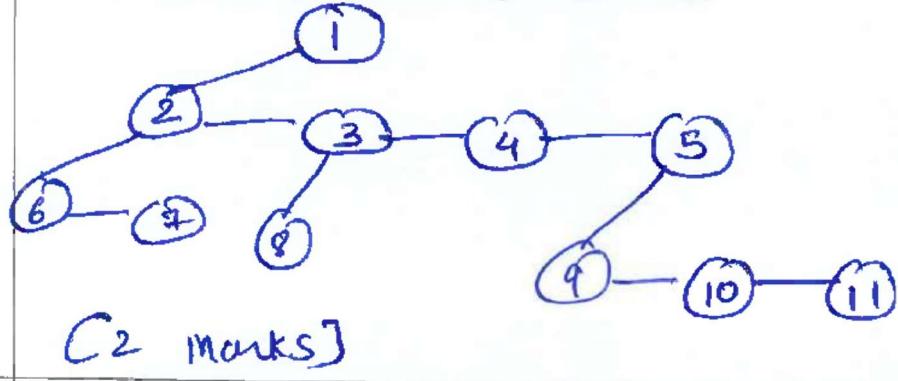
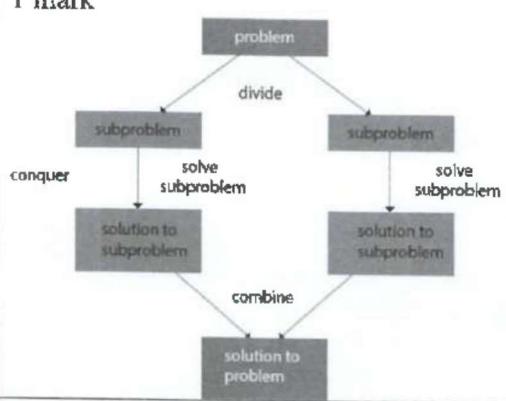
u = 1101

s = 01

t = 11000

2 Marks for above code

Q-4	Attempt any three:	[12]
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	A	<p>Given recurrence relation <math>T(n)=16T(n/4)+n</math> find its <math>\Theta</math>.  <math>a=16</math>, <math>b=4</math>, <math>k=1</math>, <math>p=0</math> 1 Mark  Master theorem of divide and conquer 1 Mark  <math>b^k=4</math>  <math>\Theta(n^2)</math>  2 Marks</p>
	B	<p>What are Generic tree? Given following generic tree convert it in corresponding binary tree.</p>  <ul style="list-style-type: none"> <li>• <b>Generic trees</b> are tree data structures that allow us to have up to <math>n</math> children nodes for each of the nodes 1 mark</li> <li>• For each node, we link the children of the common parent(siblings) from left to right order. 1 mark</li> </ul>  <p>[2 marks]</p>
	C	<p>Explain the programming terminology by which D &amp; C divides problems in sub-problems. Draw visualization of divide and conquer strategy.</p> <p>Recursion is used for divide and conquer technique.  1 mark</p> 

		3 mark	
D		<p>Explain components and approaches of dynamic programming</p> <p>Optimal substructure: optimal solution to a problem contains optimal solution to sub problems</p> <p>Overlapping sub problems: A recursive solution contains a small number of distinct sub problems</p> <p><b>2 marks</b></p> <p>Top-down (Memoization): problem is broken in sub problems and each sub problem is solved</p> <p>Bottom-up (Tabulation): evaluate sub problem starting with smallest possible input, store the values in table.</p> <p><b>2 Marks</b></p>	

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**Mithibai College of Arts, Chauhan Institute of Science &  
Amrutben Jivanlal College of Commerce and Economics (Autonomous)  
Academic Year (2022-23)**

**Class:S.Y.B.Sc. Semester: IV**

**Program: B.Sc. Computer Science**

**Max. Marks: 75**

**Course Name: .NET Technologies**

**Time:**

**Course Code: USMACS406**

**Duration: 2 hrs 30 minutes**

**Date:**

**REGULAR EXAMINATION**

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**Instructions:** Candidates should read carefully the instructions printed on the question paper and on the cover of the Answer Book, which is provided for their use.

- 1) This question paper contains 2 pages.
- 2) All Questions are compulsory.
- 3) Answer to each new question to be started on a fresh page.
- 4) Figures in brackets on the right hand side indicate full marks.
- 5) Assume Suitable data if necessary

<b>Q-1</b>	<b>Attempt any THREE Questions :</b>	<b>(21)</b>
a)	<p>How does Common Language Runtime impact .NET Framework ? (3 marks)</p> <p>The CLR is the engine that supports all the .NET languages. Many modern languages use runtimes. These runtimes may provide libraries used by the language, or they may have the additional responsibility of executing the code (as with Java). Not only does the CLR execute code, it also provides a whole set of related services such as code verification, optimization, and object management. All .NET code runs inside the CLR - running a Windows application or a web service. For example, when a client requests an ASP.NET web page, the ASP.NET service runs inside the CLR environment, executes your code, and creates a final HTML page to send to the client. (4 marks)</p> <p><b>Implications :</b></p> <p>Deep language integration: VB and C#, like all .NET languages, compile to IL. In other words, the CLR makes no distinction between different languages—in fact, it has no way of knowing what language was used to create an executable. This is far more than mere language compatibility; it's language integration.</p> <p>Side-by-side execution: The CLR also has the ability to load more than one version of a component at a time. In other words, you can update a component many times, and the correct version will be loaded and used for each application. As a side effect, multiple versions of the .NET Framework can be installed, meaning that you're able to upgrade to new versions of ASP.NET without replacing the current version or needing to rewrite your applications.</p>	(7)

	<p>Fewer errors: Whole categories of errors are impossible with the CLR. For example, the CLR prevents many memory mistakes that are possible with lower-level languages such as C++</p>	
b)	<p>Draw the diagram to depict when a page is requested and rendered and explain the steps. Also write about Page directive code.</p> <p>Diagram : 3 marks</p> <pre> graph TD     WebRequest[Web Request] --&gt; IIS{Is the file registered to ASP.NET?}     IIS -- NO --&gt; Handle[Handle the request internally, or pass it to another service.]     IIS -- YES --&gt; ASPNET[ASP.NET]     ASPNET{Has the application instance been created?} -- NO --&gt; InstantiateApp[Instantiate the application, create global variables, and fire global events.]     ASPNET -- YES --&gt; Compiled{Has the requested page been compiled?}     Compiled -- NO --&gt; CompileCache[Compile and cache the page.]     Compiled -- YES --&gt; InstantiatePage[Instantiate the page, fire events, and run the event handling code.]     InstantiatePage --&gt; Render[Render the page to HTML, one control at a time.]     Render --&gt; WebResponse[Web Response]   </pre> <p>Steps(3 marks) Code (1 mark)</p> <ol style="list-style-type: none"> <li>1. The request for the page is sent to the web server. The request is sent to the built-in test server.</li> <li>2. The web server determines that the .aspx file extension is registered with ASP.NET. If the file extension belonged to another service (as it would for .html files, for example), ASP.NET would never get involved.</li> <li>3. If this is the first time a page in this application has been requested, ASP.NET automatically creates the application domain. It also compiles all the web page code for optimum performance, and caches the compiled files. If this task has already been performed, ASP.NET will reuse the compiled version of the page.</li> <li>4. The compiled CurrencyConverter.aspx page acts like a miniature program. It starts firing events (most notably, the Page.Load event). However, you haven't created an event</li> </ol>	(7)

	<p>handler for that event, so no code runs. At this stage, everything is working together as a set of in-memory .NET objects.</p> <p>5. When the code is finished, ASP.NET asks every control in the web page to render itself into the corresponding HTML markup.</p> <p>6. The final page is sent to the user, and the application ends.</p>													
c)	<p>Discuss different class accessibility options available in C#. Create a class and a constructor for the class. Create an object for the class. Accessibility Options : 3 marks</p> <p><i>Table 3-1. Accessibility Keywords</i></p> <table border="1"> <thead> <tr> <th>Keyword</th> <th>Accessibility</th> </tr> </thead> <tbody> <tr> <td>public</td> <td>Can be accessed by any class</td> </tr> <tr> <td>private</td> <td>Can be accessed only by members inside the current class</td> </tr> <tr> <td>internal</td> <td>Can be accessed by members in any of the classes in the current assembly (the compiled code file)</td> </tr> <tr> <td>protected</td> <td>Can be accessed by members in the current class or in any class that inherits from this class</td> </tr> <tr> <td>protected internal</td> <td>Can be accessed by members in the current application (as with internal) and by the members in any class that inherits from this class</td> </tr> </tbody> </table> <pre> using System; using System.Collections.Generic; using System.Linq; using System.Text;  namespace ConsoleApplication1 {     class Program     {         static void Main(string[] args)         {             oop.student s1=new oop.student(12,"sap403","name1");             s1.display();              .....             .....             .....         }     } }  namespace oop {     public class student     {         public int rollno;         private string sapid;         internal string stuname;         internal protected int marks;         public student(int r, string s, string n)         {             rollno = r;             sapid = s;         }     } } </pre>	Keyword	Accessibility	public	Can be accessed by any class	private	Can be accessed only by members inside the current class	internal	Can be accessed by members in any of the classes in the current assembly (the compiled code file)	protected	Can be accessed by members in the current class or in any class that inherits from this class	protected internal	Can be accessed by members in the current application (as with internal) and by the members in any class that inherits from this class	(7)
Keyword	Accessibility													
public	Can be accessed by any class													
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```

        stuname = n;
    }
    public void display()
    {
        Console.WriteLine(this.ToString() + " with " + this.stuname + '-' +
this.rollno + '-' + this.sapid + " is created ");
        //Console.ReadKey();
    }
}

public class sy : student
{
    public string syfaculty;
    public override void display()
    {
        base.display();
        this.
        Console.WriteLine(this.syfaculty);
        Console.ReadKey();
    }
}

```

Or any equivalent example

d)	<p>Explain passing parameter by value and by reference with the help of a coding example. (7)</p> <p><b>Explanation (4 marks)</b></p> <p>Coding(3 marks)</p> <p>A variable for a simple data type contains the actual information you put in it (such as the number. Object variables store a reference that points to a location in memory where the full object is stored.</p> <p>The standard type is pass-by-value. When you use pass-by-value parameters, the method receives a copy of the parameter data. That means if the method modifies the parameter, this change won't affect the code that called the method. By default, all parameters are pass-by-value.</p> <p>The second type of parameter is pass-by-reference. With pass-by-reference, the method accesses the parameter value directly. If a method changes the value of a pass-by-reference parameter, the original object is also modified.</p>
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To get a better understanding of the difference, consider the following code, which shows a method that uses a parameter named number. This code uses the `ref` keyword to indicate that number should be passed by reference. When the method modifies this parameter (multiplying it by 2), the calling code is also affected:

```
private void ProcessNumber(ref int number)
{
    number *= 2;
}
```

The following code snippet shows the effect of calling the `ProcessNumber()` method. Note that you need

to specify the `ref` keyword when you define the parameter in the method and when you call the method. This

indicates that you are aware that the parameter value may change:

```
int num = 10;
ProcessNumber(ref num);
```

**Q-2** Attempt to solve any THREE Python programs. (Show the working of the program at each step / loop) (21)

a) How is information passed through query strings ? Explain with the help of a coding example. Also write about URL encoding. (7)  
Query String(5 marks)

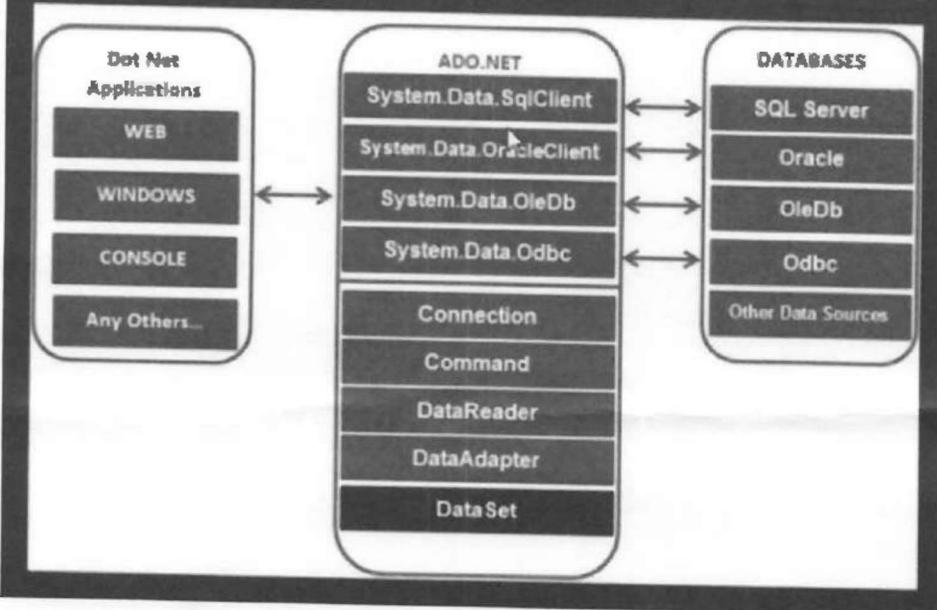
- Well suited in database applications in which you present the user with a list of items that correspond to records in a database, such as products. The user can then select an item and be forwarded to another page with detailed information about the selected item.
- Information is limited to simple strings, which must contain URL-legal characters.
- Information is clearly visible to the user and to anyone else who cares to eavesdrop on the Internet.
- The enterprising user might decide to modify the query string and supply new values, which your program won't expect and can't protect against.
- Many browsers impose a limit on the length of a URL (usually from 1 KB to 2 KB).

Default1.aspx :

`Response.Redirect("newpage.aspx?recordID=10&mode=full");`

	<p>(or)</p> <pre> string url = "newpage.aspx?"; url += "Item=" + lstItems.SelectedItem.Text + "&amp;"; url += "Mode=" + chkDetails.Checked.ToString(); </pre> <ul style="list-style-type: none"> <li>• newpage.aspx :</li> </ul> <p><b>string ID = Request.QueryString["recordID"];</b></p> <p>URL Encoding(2 marks)</p> <ul style="list-style-type: none"> <li>• One potential problem with the query string is that some characters aren't allowed in a URL. All characters must be alphanumeric or one of a small set of special characters (including \$-_.+!*()' ).</li> <li>• Furthermore, some characters have special meaning. For example, the ampersand (&amp;) is used to separate multiple query string parameters, the plus sign (+) is an alternate way to represent a space, and the number sign (#) is used to point to a specific bookmark in a web page. If you try to send query string values that include any of these characters, you'll lose some of your data.</li> </ul>	
b)	<p>Give at least 7 types of errors made by the user during data entry. Suggest ways to avoid them.</p> <ol style="list-style-type: none"> <li>1. A user might ignore an important field and leave it blank.</li> <li>2. If you disallow blank values, a user might type in semi-random input to circumvent the checks. For example, you might get stuck with an invalid e-mail address that causes problems for your automatic e-mailing program.</li> <li>3. A user might make an honest mistake, such as entering a typing error,</li> <li>4. entering a nonnumeric character in a number field, or submitting the wrong type of information.</li> <li>5. A user might even enter several pieces of information that are individually correct but when taken together are inconsistent (for example, entering a MasterCard number after choosing Visa as the payment type).</li> <li>6. A malicious user might try to exploit a weakness in your code by entering carefully structured wrong values. For example, an attacker might attempt to cause a specific error that will reveal sensitive information.</li> <li>7. SQL injection attack, whereby user-supplied values change the operation of a dynamically constructed database command.</li> </ol> <p>Each point carries 1 mark.</p>	(7)
c)	<p>What is AdRotator Control ? Write the XML file which is created for the AdRotator Control.</p> <p>(2 marks)</p> <p>The basic purpose of the AdRotator is to provide a graphic on a page that is chosen randomly from a group of possible images. In other words, every time the page is requested, an image is selected at random and displayed, which is the rotation indicated by the name AdRotator. One use of the AdRotator is to show banner-style advertisements on a page, but you can use it anytime you want to vary an image randomly.</p> <p>The Advertisement File (5 marks)</p>	(7)

	<p>The AdRotator stores its list of image files in an XML file. This file uses the format shown here:</p> <pre> &lt;Advertisements&gt;   &lt;Ad&gt;     &lt;ImageUrl&gt;prosetech.jpg&lt;/ImageUrl&gt;     &lt;NavigateUrl&gt;http://www.prosetech.com&lt;/NavigateUrl&gt;     &lt;AlternateText&gt;ProseTech Site&lt;/AlternateText&gt;     &lt;Impressions&gt;1&lt;/Impressions&gt;     &lt;Keyword&gt;Computer&lt;/Keyword&gt;   &lt;/Ad&gt; &lt;/Advertisements&gt;</pre>	
d)	<p>List at least 7 web control classes with their equivalent HTML elements. Also write the functionality of every control.</p> <p>Any 7 web control classes. Each class carries 1 mark.</p>	(7)
<b>Q-3</b>	<p><b>Attempt any THREE Questions :</b></p> <p>a) Draw the ADO.NET architecture diagram and explain about the two ways of accessing the data from back end. 4 marks</p>	(21)



Two ways : 3 marks

- When you query data with direct data access, you don't keep a copy of the information in memory. Instead, you work with it for a brief period of time while the database connection is open, and then close the connection as soon as possible.
- In disconnected data access, we keep a copy of the data in the DataSet object and work with it even after the database connection has been closed.

b)	<p>Write functions to insert a record and retrieve the contents of a SQL table using disconnected architecture</p> <p>Insert a record : 4 marks</p> <pre> protected void Button2_Click(object sender, EventArgs e) {     string connString;     SqlConnection cnn;     connString = " Data Source=MUM0219CPU0072\SQLEXPRESS;Initial Catalog=Student;Integrated Security=True";     cnn = new SqlConnection(connString);     cnn.Open();     SqlCommand command;     SqlDataAdapter adapter = new SqlDataAdapter();     String sql = "";     String newsap = TextBox1.Text;     String newname = TextBox2.Text;     String newstream = TextBox3.Text; </pre>	(7)
----	---	-----

```

sql = "Insert into Student values('" + newsap + "','" + newname + "','" +
newstream + "');";
command = new SqlCommand(sql, cnn);
adapter.InsertCommand = new SqlCommand(sql, cnn);
adapter.InsertCommand.ExecuteNonQuery();
command.Dispose();
cnn.Close();
}

Retrieve : 3 marks
public DataSet GetEmployeeData()
{
    SqlConnection conString = new SqlConnection("myconnection");
    conString.Open();
    SqlCommand cmdQuery = new SqlCommand("Select * from Employee", conString);
    SqlDataAdapter sda = new SqlDataAdapter(cmdQuery);
    DataSet dsData = new DataSet();
    sda.Fill(dsData);
    return dsData;
}

```

- c) What is Single-value Data binding ? Incorporate Single-value data binding and display different types of information on the web page. Also write the problems in single-value data binding (7)
- Single Value Data Binding (2 marks)**  
 You can use single-value data binding to add information anywhere on an ASP.NET page. You can even place information into a control property or as plain text inside an HTML tag. Single-value data binding doesn't necessarily have anything to do with ADO.NET. Instead, single-value data binding allows you to take a variable, a property, or an expression and insert it dynamically into a page. Single-value binding also helps you create templates for the rich data controls
- Usage(3 marks)**  
 Single-value data binding is really just a different approach to dynamic text. To use it, you add special data-binding expressions into your .aspx files. These expressions have the following format:
- ```
<%# expression_goes_here %>
```
- This may look like a script block, but it isn't. If you try to write any code inside this tag, you will receive an error. The only thing you can add is a valid data-binding expression. For example, if you have a public or protected variable named Country in your page, you could write the following:
- ```
<%# Country %>
```
- When you call the DataBind() method for the page, this text will be replaced with the value for Country (for example, Spain). Similarly, you could use a property or a built-in ASP.NET object as follows:
- ```
<%# Request.Browser.Browser %>
```
- This would substitute a string with the current browser name (for example, IE). In fact,

you can even call a function defined on your page, or execute a simple expression, provided it returns a result that can be converted to text and displayed on the page. Thus, the following data-binding expressions are all valid:

```
<%# GetUserName(ID) %>
<%# 1 + (2 * 20) %>
<%# "John " + "Smith" %>
```

#### Problems (2 marks)

**Putting code into a page's user interface:** One of ASP.NET's great advantages is that it allows developers to separate the user interface code (the HTML and control tags in the .aspx file) from the actual code used for data access and all other tasks (in the code-behind file). However, overenthusiastic use of single-value data binding can encourage you to disregard that distinction and start coding function calls and even operations into your page. If not carefully managed, this can lead to complete disorder.

**Fragmenting code:** When using data-binding expressions, it may not be obvious where the functionality resides for different operations. This is particularly a problem if you blend both approaches—for example, if you use data binding to fill a control and also modify that control directly in code.

- d) Assume an XML file which stores information about students. Create that file using XMLTextWriter and related classes. (XML Tree should have a depth of at least 4). (7)

```
string file = Path.Combine(Request.PhysicalApplicationPath,
    @"App_Data\SuperProProductList.xml");
FileStream fs = new FileStream(file, FileMode.Create);
XmlTextWriter w = new XmlTextWriter(fs, null);
w.WriteStartDocument();
w.WriteStartElement("SuperProProductList");
w.WriteComment("This file generated by the XmlTextWriter
class.");
// Write the first product.
w.WriteStartElement("Product");
w.WriteAttributeString("ID", "1");
w.WriteAttributeString("Name", "Chair");
w.WriteStartElement("Price");
w.WriteString("49.33");
w.WriteEndElement();
w.WriteEndElement();
// Write the second product.
w.WriteStartElement("Product");
w.WriteAttributeString("ID", "2");
w.WriteAttributeString("Name", "Car");
w.WriteStartElement("Price");
w.WriteString("43399.55");
w.WriteEndElement();
w.WriteEndElement();
// Write the third product.
w.WriteStartElement("Product");
w.WriteAttributeString("ID", "3");
```

|            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |      |
|------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|
|            | <pre>w.WriteAttributeString("Name", "Fresh Fruit Basket"); w.WriteStartElement("Price"); w.WriteString("49.99"); w.WriteEndElement(); w.WriteEndElement(); // Close the root element. w.WriteEndElement(); w.WriteEndDocument(); w.Close();</pre>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |      |
| <b>Q-4</b> | <b>Answer any THREE questions</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | (12) |
| a)         | <p>Write a note on .NET languages and Intermediate Language</p> <ol style="list-style-type: none"> <li>1. <b>Intermediate Language</b><br/>All the .NET languages are compiled into another lower-level language before the code is executed. This lower level language is the <i>Common Intermediate Language</i> (CIL, or just IL). The CLR, the engine of .NET, uses only IL code. Because all .NET languages are based on IL, they all have profound similarities. This is the reason that the VB and C# languages provide essentially the same features and performance. In fact, the languages are so compatible that a web page written with C# can use a VB component in the same way it uses a C# component, and vice versa</li> <li>2. <b>Common Language Specification</b><br/>The .NET Framework formalizes this compatibility with something called the <i>Common Language Specification</i> (CLS). Essentially, the CLS is a contract that, if respected, guarantees that a component written in one .NET language can be used in all the others. One part of the CLS is the <i>common type system</i> (CTS), which defines the rules for data types such as strings, numbers, and arrays that are shared in all .NET languages. The CLS also defines object-oriented ingredients such as classes, methods, events, and quite a bit more. For the most part, .NET developers don't need to think about how the CLS works, even though they rely on it every day.</li> </ol> | (4)  |
| b)         | <p>List any 4 derived classes of HtmlInputControl class.<br/>Any 4. Each derived class carries 1 mark.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | (4)  |

|    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |     |
|----|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|
|    | <pre> graph TD     HIC[HtmlInputControl] --&gt; HIB[HtmlInputButton]     HIC --&gt; HIS[HtmlInputSubmit]     HIC --&gt; HIR[HtmlInputReset]     HIC --&gt; HICB[HtmlInputCheckBox]     HIC --&gt; HIF[HtmlInputFile]     HIC --&gt; HH[HtmlInputHidden]     HIC --&gt; HI[HtmlInputImage]     HIC --&gt; HRB[HtmlInputRadioButton]     HIC --&gt; HIT[HtmlInputText]     HIC --&gt; HIP[HtmlInputPassword] </pre>                                                                                                                                  |     |
| c) | <p>Write down the steps to query information with simple data access.</p> <ol style="list-style-type: none"> <li>1. Create Connection, Command, and DataReader objects.</li> <li>2. Use the DataReader to retrieve information from the database, and display it in a control on a web form.</li> <li>3. Close your connection.</li> <li>4. Send the page to the user. At this point, the information your user sees and the information in the database no longer have any connection, and all the ADO.NET objects have been destroyed</li> </ol> | (4) |
| d) | <p>Write at least 4 generic properties of a web control<br/>Any 4 – Each property carries 1 mark.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                              | (4) |

**Table 6-2. WebControl Properties**

| Property                              | Description                                                                                                                                                                                                                                                                                                                                                                                                                     |
|---------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| AccessKey                             | Specifies the keyboard shortcut as one letter. For example, if you set this to Y, the Alt+Y keyboard combination will automatically change focus to this web control (assuming the browser supports this feature).                                                                                                                                                                                                              |
| BackColor, ForeColor, and BorderColor | Sets the colors used for the background, foreground, and border of the control. In most controls, the foreground color sets the text color.                                                                                                                                                                                                                                                                                     |
| BorderWidth                           | Specifies the size of the control border.                                                                                                                                                                                                                                                                                                                                                                                       |
| BorderStyle                           | One of the values from the BorderStyle enumeration, including Dashed, Dotted, Double, Groove, Ridge, Inset, Outset, Solid, and None.                                                                                                                                                                                                                                                                                            |
| Controls                              | Provides a collection of all the controls contained inside the current control. Each object is provided as a generic System.Web.UI.Control object, so you will need to cast the reference to access control-specific properties.                                                                                                                                                                                                |
| Enabled                               | When set to false, the control will be visible, but it will not be able to receive user input or focus.                                                                                                                                                                                                                                                                                                                         |
| EnableViewState                       | Set this to false to disable the automatic state management for this control. In this case, the control will be reset to the properties and formatting specified in the control tag (in the .aspx page) every time the page is posted back. If this is set to true (the default), the control uses the hidden input field to store information about its properties, ensuring that any changes you make in code are remembered. |

**SVKM'S**  
**Mithibai College of Arts, Chauhan Institute of Science &**  
**Amrutben Jivanlal College of Commerce and Economics (Autonomous)**  
**Academic Year (2022-23)**

**Class: SYBSC      Semester: IV**

**Program: B.Sc Computer Science**

**Course Name: Advanced Java**

**Course Code: USMACS402**

**Date:**

**Max. Marks: 75**

**Time:**

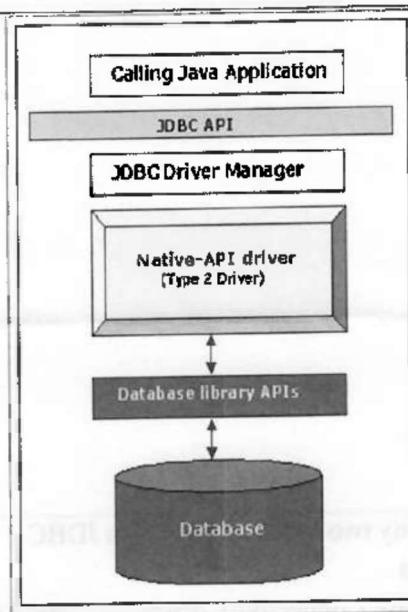
**Duration: 2 hrs 30 minutes**

**SOLUTION SET**

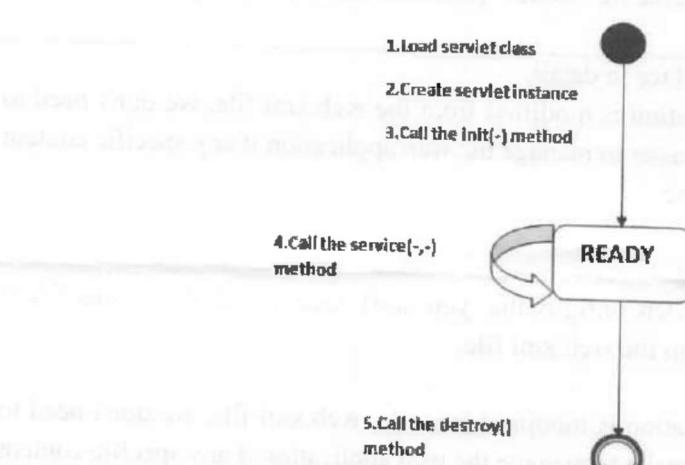
|           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |             |
|-----------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|
| <b>Q1</b> | <b>ATTEMPT ANY 3 FROM THE FOLLOWING:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | <b>[21]</b> |
| <b>A</b>  | <p>Write a swing snippet for generating the following.</p> <p style="text-align: center;"><b>Registration Form in Windows Form:</b></p>  <pre> Components texts, labels 5m + buttons 2m public class Registration extends JFrame {     JLabel l1, l2, l3, l4, l5, l6, l7, l8;     JTextField tf1, tf2, tf5, tf6, tf7;     JButton btn1, btn2;     JPasswordField p1, p2;     Registration()     {         setVisible(true);         setSize(700, 700);         setLayout(null);         setDefaultCloseOperation(JFrame.EXIT_ON_CLOSE);         setTitle("Registration Form in Java");         l1 = new JLabel("Registration Form in Windows Form:");     } } </pre> | 7           |

```
l1.setForeground(Color.blue);
l1.setFont(new Font("Serif", Font.BOLD, 20));
l2 = new JLabel("Name:");
l3 = new JLabel("Email-ID:");
l4 = new JLabel("Create Password:");
l5 = new JLabel("Confirm Password:");
l6 = new JLabel("Country:");
l7 = new JLabel("State:");
l8 = new JLabel("Phone No:");
tf1 = new JTextField();
tf2 = new JTextField();
p1 = new JPasswordField();
p2 = new JPasswordField();
tf5 = new JTextField();
tf6 = new JTextField();
tf7 = new JTextField();
btn1 = new JButton("Submit");
btn2 = new JButton("Clear");
btn1.addActionListener(this);
btn2.addActionListener(this);
l1.setBounds(100, 30, 400, 30);
l2.setBounds(80, 70, 200, 30);
l3.setBounds(80, 110, 200, 30);
l4.setBounds(80, 150, 200, 30);
l5.setBounds(80, 190, 200, 30);
l6.setBounds(80, 230, 200, 30);
l7.setBounds(80, 270, 200, 30);
l8.setBounds(80, 310, 200, 30);
tf1.setBounds(300, 70, 200, 30);
tf2.setBounds(300, 110, 200, 30);
p1.setBounds(300, 150, 200, 30);
p2.setBounds(300, 190, 200, 30);
tf5.setBounds(300, 230, 200, 30);
tf6.setBounds(300, 270, 200, 30);
tf7.setBounds(300, 310, 200, 30);
btn1.setBounds(50, 350, 100, 30);
btn2.setBounds(170, 350, 100, 30);
add(l1);
add(l2);
add(tf1);
add(l3);
add(tf2);
```

|   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |   |
|---|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|
|   | <pre> add(l4); add(p1); add(l5); add(p2); add(l6); add(tf5); add(l7); add(tf6); add(l8); add(tf7); add(btn1); add(btn2); } </pre>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |   |
| B | <p>What is a Driver? Explain any two types of drivers in JDBC.<br/>Driver 1m+ 6m for 2 drivers</p> <p>A JDBC driver (Java Database Connectivity driver) is a small piece of software that allows JDBC to connect to different databases. Essentially, a JDBC driver makes it possible to do three things: Establish a connection with a data source. Send queries and update statements to the data source. Process the results.</p> <ul style="list-style-type: none"> <li>• Type I: "Bridge" -</li> <li>• Type II: "Native" -</li> <li>• Type III: "Middleware" -</li> <li>• Type IV: "Pure"</li> </ul> <p>Type I Drivers</p> <pre> graph TD     A[Calling Java Application] --&gt; B[JDBC API]     B --&gt; C[JDBC Driver Manager]     C --&gt; D["JDBC – ODBC Bridge<br/>(Type 1 Driver)"]     D &lt;--&gt; E[ODBC driver]     E &lt;--&gt; F[Database library APIs]     F &lt;--&gt; G[Database] </pre> <p>Type II Drivers</p> | 7 |



| C    | <p>Differentiate between AWT and Swing.</p> <p>7 points 7m</p> <table border="1"> <thead> <tr> <th>S.NO</th> <th>AWT</th> <th>Swing</th> </tr> </thead> <tbody> <tr> <td>1.</td><td>Java AWT is an API to develop GUI applications in Java</td><td>Swing is a part of Java Foundation Classes and is used to create various applications.</td></tr> <tr> <td>2.</td><td>The components of Java AWT are heavy weighted.</td><td>The components of Java Swing are light weighted.</td></tr> <tr> <td>3.</td><td>Java AWT has comparatively less functionality as compared to Swing.</td><td>Java Swing has more functionality as compared to AWT.</td></tr> <tr> <td>4.</td><td>The execution time of AWT is more than Swing.</td><td>The execution time of Swing is less than AWT.</td></tr> <tr> <td>5.</td><td>The components of Java AWT are platform dependent.</td><td>The components of Java Swing are platform independent.</td></tr> <tr> <td>6.</td><td>MVC pattern is not supported by AWT.</td><td>MVC pattern is supported by Swing.</td></tr> <tr> <td>7.</td><td>AWT provides comparatively less powerful components.</td><td>Swing provides more powerful components.</td></tr> </tbody> </table> | S.NO                                                                                   | AWT | Swing | 1. | Java AWT is an API to develop GUI applications in Java | Swing is a part of Java Foundation Classes and is used to create various applications. | 2. | The components of Java AWT are heavy weighted. | The components of Java Swing are light weighted. | 3. | Java AWT has comparatively less functionality as compared to Swing. | Java Swing has more functionality as compared to AWT. | 4. | The execution time of AWT is more than Swing. | The execution time of Swing is less than AWT. | 5. | The components of Java AWT are platform dependent. | The components of Java Swing are platform independent. | 6. | MVC pattern is not supported by AWT. | MVC pattern is supported by Swing. | 7. | AWT provides comparatively less powerful components. | Swing provides more powerful components. | 7 |
|------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------|-----|-------|----|--------------------------------------------------------|----------------------------------------------------------------------------------------|----|------------------------------------------------|--------------------------------------------------|----|---------------------------------------------------------------------|-------------------------------------------------------|----|-----------------------------------------------|-----------------------------------------------|----|----------------------------------------------------|--------------------------------------------------------|----|--------------------------------------|------------------------------------|----|------------------------------------------------------|------------------------------------------|---|
| S.NO | AWT                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Swing                                                                                  |     |       |    |                                                        |                                                                                        |    |                                                |                                                  |    |                                                                     |                                                       |    |                                               |                                               |    |                                                    |                                                        |    |                                      |                                    |    |                                                      |                                          |   |
| 1.   | Java AWT is an API to develop GUI applications in Java                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Swing is a part of Java Foundation Classes and is used to create various applications. |     |       |    |                                                        |                                                                                        |    |                                                |                                                  |    |                                                                     |                                                       |    |                                               |                                               |    |                                                    |                                                        |    |                                      |                                    |    |                                                      |                                          |   |
| 2.   | The components of Java AWT are heavy weighted.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | The components of Java Swing are light weighted.                                       |     |       |    |                                                        |                                                                                        |    |                                                |                                                  |    |                                                                     |                                                       |    |                                               |                                               |    |                                                    |                                                        |    |                                      |                                    |    |                                                      |                                          |   |
| 3.   | Java AWT has comparatively less functionality as compared to Swing.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Java Swing has more functionality as compared to AWT.                                  |     |       |    |                                                        |                                                                                        |    |                                                |                                                  |    |                                                                     |                                                       |    |                                               |                                               |    |                                                    |                                                        |    |                                      |                                    |    |                                                      |                                          |   |
| 4.   | The execution time of AWT is more than Swing.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | The execution time of Swing is less than AWT.                                          |     |       |    |                                                        |                                                                                        |    |                                                |                                                  |    |                                                                     |                                                       |    |                                               |                                               |    |                                                    |                                                        |    |                                      |                                    |    |                                                      |                                          |   |
| 5.   | The components of Java AWT are platform dependent.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | The components of Java Swing are platform independent.                                 |     |       |    |                                                        |                                                                                        |    |                                                |                                                  |    |                                                                     |                                                       |    |                                               |                                               |    |                                                    |                                                        |    |                                      |                                    |    |                                                      |                                          |   |
| 6.   | MVC pattern is not supported by AWT.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | MVC pattern is supported by Swing.                                                     |     |       |    |                                                        |                                                                                        |    |                                                |                                                  |    |                                                                     |                                                       |    |                                               |                                               |    |                                                    |                                                        |    |                                      |                                    |    |                                                      |                                          |   |
| 7.   | AWT provides comparatively less powerful components.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | Swing provides more powerful components.                                               |     |       |    |                                                        |                                                                                        |    |                                                |                                                  |    |                                                                     |                                                       |    |                                               |                                               |    |                                                    |                                                        |    |                                      |                                    |    |                                                      |                                          |   |
| D    | <p>Describe any 4 methods and any 3 fields used for navigation through database records using a ResultSet object.</p> <p>4 methods 4m+ 3 fields 3m</p> <ol style="list-style-type: none"> <li>1. boolean first()</li> <li>2. boolean isFirst()</li> <li>3. boolean beforeFirst()</li> <li>4. boolean isbeforeFirst()</li> </ol> <ol style="list-style-type: none"> <li>1. TYPE_FORWARD_ONLY</li> </ol>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 7                                                                                      |     |       |    |                                                        |                                                                                        |    |                                                |                                                  |    |                                                                     |                                                       |    |                                               |                                               |    |                                                    |                                                        |    |                                      |                                    |    |                                                      |                                          |   |

|    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |      |
|----|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|
|    | <p>2. TYPE_SCROLL_SENSITIVE<br/>3. TYPE_SCROLL_INSENSITIVE</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |      |
| Q2 | ATTEMPT ANY 3 FROM THE FOLLOWING:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | [21] |
| A  | <p>Define a servlet? Explain its life cycle methods.<br/>Servlet 2m +5m for life cycle</p> <p>Servlet technology is used to create a web application (resides at server side and generates a dynamic web page).</p> <p>Servlet technology is robust and scalable because of java language. Before Servlet, CGI (Common Gateway Interface) scripting language was common as a server-side programming language.</p>  <pre> graph TD     Start(( )) --&gt; Step1[1. Load servlet class]     Step1 --&gt; Step2[2. Create servlet instance]     Step2 --&gt; Step3[3. Call the init() method]     Step3 --&gt; Ready[READY]     Ready --&gt; Step4[4. Call the service(-,-) method]     Step4 --&gt; Step5[5. Call the destroy() method]     Step5 --&gt; End(( ))   </pre> | 7    |
| B  | <p>Explain forward and include actions in JSP with an example.<br/>Forward 3.5m + Include 3.5m</p> <p><b>jsp:forward action tag</b></p> <p>The jsp:forward action tag is used to forward the request to another resource it may be jsp, html or another resource.</p> <p>Syntax of jsp:forward action tag without parameter</p> <pre>&lt;jsp:forward page="relativeURL   &lt;%= expression %&gt;" /&gt;</pre> <p>Syntax of jsp:forward action tag with parameter</p> <pre>&lt;jsp:forward page="relativeURL   &lt;%= expression %&gt;"&gt; &lt;jsp:param name="parametername" value="parametervalue &lt;%=expression%&gt;" /&gt; &lt;/jsp:forward&gt;</pre>                                                                                                                                                                                                 | 7    |

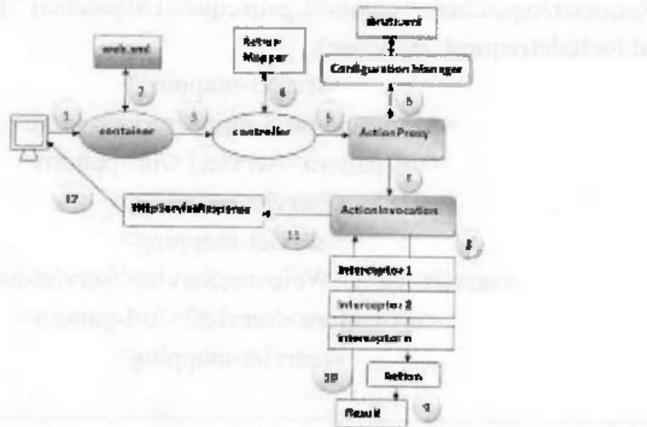
|   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |   |
|---|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|
|   | <p>The jsp:include action tag is used to include the content of another resource it may be jsp, html or servlet.</p> <p>The jsp include action tag includes the resource at request time so it is better for dynamic pages because there might be changes in future.</p> <p>The jsp:include tag can be used to include static as well as dynamic pages.</p> <p><b>Advantage of jsp:include action tag</b></p> <p><b>Code reusability :</b> We can use a page many times such as including header and footer pages in all pages. So it saves a lot of time.</p> <p><b>Syntax of jsp:include action tag without parameter</b></p> <pre>&lt;jsp:include page="relativeURL   &lt;%= expression %&gt;" /&gt;</pre> <p><b>Syntax of jsp:include action tag with parameter</b></p> <pre>&lt;jsp:include page="relativeURL   &lt;%= expression %&gt;"&gt; &lt;jsp:param name="parametername" value="parametervalue   &lt;%=expression%&gt;" /&gt; &lt;/jsp:include&gt;</pre>                                                                                                                                                                                                                                                                                                                                                               |   |
| C | <p><b>Describe servletconfig interface in detail.</b></p> <p>If the configuration information is modified from the web.xml file, we don't need to change the servlet. So it is easier to manage the web application if any specific content is modified from time to time.</p> <p><b>Advantage of ServletConfig</b></p> <p>The core advantage of ServletConfig is that you don't need to edit the servlet file if information is modified from the web.xml file.</p> <p>If the configuration information is modified from the web.xml file, we don't need to change the servlet. So it is easier to manage the web application if any specific content is modified from time to time.</p> <p><b>Advantage of ServletConfig</b></p> <p>The core advantage of ServletConfig is that you don't need to edit the servlet file if information is modified from the web.xml file.</p> <p><b>Methods of ServletConfig interface</b></p> <p>public String getInitParameter(String name):Returns the parameter value for the specified parameter name.</p> <p>public Enumeration getInitParameterNames():Returns an enumeration of all the initialization parameter names.</p> <p>public String getServletName():Returns the name of the servlet.</p> <p>public ServletContext getServletContext():Returns an object of ServletContext.</p> | 7 |
| D | <p>Write a servlet code to show the use of request dispatcher, also write web.xml.</p> <pre>String n=request.getParameter("userName");</pre>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 7 |

|                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                  |                                  |                                     |                          |                                      |                                                                         |                                                 |                         |                     |                            |                                                     |                                                                  |                         |                            |   |
|-----------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------|----------------------------------|-------------------------------------|--------------------------|--------------------------------------|-------------------------------------------------------------------------|-------------------------------------------------|-------------------------|---------------------|----------------------------|-----------------------------------------------------|------------------------------------------------------------------|-------------------------|----------------------------|---|
|                                                     | <pre> String p=request.getParameter("userPass");  if(p.equals("servlet")){     RequestDispatcher rd=request.getRequestDispatcher("servlet2");     rd.forward(request, response); } else{     out.print("Sorry UserName or Password Error!");     RequestDispatcher rd=request.getRequestDispatcher("/index.html");     rd.include(request, response); }  &lt;servlet-mapping&gt; &lt;servlet-name&gt;Login&lt;/servlet-name&gt; &lt;url-pattern&gt;/servlet1&lt;/url-pattern&gt; &lt;/servlet-mapping&gt; &lt;servlet-mapping&gt; &lt;servlet-name&gt;WelcomeServlet&lt;/servlet-name&gt; &lt;url-pattern&gt;/servlet2&lt;/url-pattern&gt; &lt;/servlet-mapping&gt; </pre>                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                  |                                  |                                     |                          |                                      |                                                                         |                                                 |                         |                     |                            |                                                     |                                                                  |                         |                            |   |
| <b>Q3</b>                                           | <b>ATTEMPT ANY 3 FROM THE FOLLOWING:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | [21]                             |                                  |                                     |                          |                                      |                                                                         |                                                 |                         |                     |                            |                                                     |                                                                  |                         |                            |   |
| <b>A</b>                                            | <p>What is JSON? Differentiate between JSON and XML.</p> <p>JSON 2m+ json vs xml 5m</p> <p>JSON stands for JavaScript Object Notation. JSON is a lightweight data-interchange format. JSON is plain text written in JavaScript object notation. JSON is used to send data between computers. JSON is language independent</p> <table> <tbody> <tr> <td>It is JavaScript Object Notation</td> <td>It is Extensible markup language</td> </tr> <tr> <td>It is based on JavaScript language.</td> <td>It is derived from SGML.</td> </tr> <tr> <td>It is a way of representing objects.</td> <td>It is a markup language and uses tag structure to represent data items.</td> </tr> <tr> <td>It does not provide any support for namespaces.</td> <td>It supports namespaces.</td> </tr> <tr> <td>It supports arrays.</td> <td>It doesn't support arrays.</td> </tr> <tr> <td>Its files are very easy to read as compared to XML.</td> <td>Its documents are comparatively difficult to read and interpret.</td> </tr> <tr> <td>It doesn't use end tag.</td> <td>It has start and end tags.</td> </tr> </tbody> </table> | It is JavaScript Object Notation | It is Extensible markup language | It is based on JavaScript language. | It is derived from SGML. | It is a way of representing objects. | It is a markup language and uses tag structure to represent data items. | It does not provide any support for namespaces. | It supports namespaces. | It supports arrays. | It doesn't support arrays. | Its files are very easy to read as compared to XML. | Its documents are comparatively difficult to read and interpret. | It doesn't use end tag. | It has start and end tags. | 7 |
| It is JavaScript Object Notation                    | It is Extensible markup language                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                  |                                  |                                     |                          |                                      |                                                                         |                                                 |                         |                     |                            |                                                     |                                                                  |                         |                            |   |
| It is based on JavaScript language.                 | It is derived from SGML.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                  |                                  |                                     |                          |                                      |                                                                         |                                                 |                         |                     |                            |                                                     |                                                                  |                         |                            |   |
| It is a way of representing objects.                | It is a markup language and uses tag structure to represent data items.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                  |                                  |                                     |                          |                                      |                                                                         |                                                 |                         |                     |                            |                                                     |                                                                  |                         |                            |   |
| It does not provide any support for namespaces.     | It supports namespaces.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                  |                                  |                                     |                          |                                      |                                                                         |                                                 |                         |                     |                            |                                                     |                                                                  |                         |                            |   |
| It supports arrays.                                 | It doesn't support arrays.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                  |                                  |                                     |                          |                                      |                                                                         |                                                 |                         |                     |                            |                                                     |                                                                  |                         |                            |   |
| Its files are very easy to read as compared to XML. | Its documents are comparatively difficult to read and interpret.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                  |                                  |                                     |                          |                                      |                                                                         |                                                 |                         |                     |                            |                                                     |                                                                  |                         |                            |   |
| It doesn't use end tag.                             | It has start and end tags.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                  |                                  |                                     |                          |                                      |                                                                         |                                                 |                         |                     |                            |                                                     |                                                                  |                         |                            |   |
| <b>B</b>                                            | <p>What are interceptors in Struts2? What is the execution flow with respect to interceptor?</p> <p>Interceptors 2m+ the execution flow 5m</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 7                                |                                  |                                     |                          |                                      |                                                                         |                                                 |                         |                     |                            |                                                     |                                                                  |                         |                            |   |

Interceptor is an object that is invoked at the preprocessing and postprocessing of a request. In Struts 2, interceptor is used to perform operations such as validation, exception handling, internationalization, displaying intermediate result etc.

#### Advantage of interceptors

Pluggable If we need to remove any concern such as validation, exception handling, logging etc. from the application, we don't need to redeploy the application. We only need to remove the entry from the struts.xml file.



C Explain the components of struts framework.

7

Any 5 for 7m

- Filter Dispatcher.
- Action.
- Result.
- Configuration file.
- Interceptors.
- Deployment descriptor.
- Tag Library.

D Write a program to depict MVC using struts2.

7

Main snippet with other assumptions 7m

1. `<?xml version="1.0" encoding="UTF-8" ?>`
2. `<!DOCTYPE struts PUBLIC "-//Apache Software Foundation//DTD Struts Configuration 2.1//EN" "http://struts.apache.org/dtds/struts-2.1.dtd">`
3. `<struts>`
4. `<package name="default" extends="struts-default">`
5. `<action name="product" class="com.Product">`
6. `<result name="success">welcome.jsp</result>`
7. `</action>`

|           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |             |
|-----------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|
|           | <p>10.<br/>11. &lt;/package&gt;<br/>12. &lt;/struts&gt;</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |             |
|           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |             |
| <b>Q4</b> | <b>ATTEMPT ANY 3 FROM THE FOLLOWING:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | <b>[12]</b> |
| <b>A</b>  | <p><b>What is the use of BLOB and CLOB?</b><br/>2m each one</p> <p>A BLOB is binary large object that can hold a variable amount of data with a maximum length of 65535 characters. These are used to store large amounts of binary data, such as images or other types of files. Fields defined as TEXT also hold large amounts of data.</p> <p>CLOB stands for Character Large Object in general, an SQL Blob is a built-in datatype and is used to store large amount of textual data. Using this datatype, you can store data up to 2,147,483,647 characters.</p> <p>The java.sql.Clob interface of the JDBC API represents the CLOB datatype. Since the Clob object in JDBC is implemented using an SQL locator, it holds a logical pointer to the SQL CLOB (not the data).</p> <p>MYSQL database provides support for this datatype using four variables.</p> <ul style="list-style-type: none"> <li>• TINYTEXT: A CLOB type with a maximum of 28-1 (255) characters.</li> <li>• TEXT: A CLOB type with a maximum of 216-1 (65535) characters.</li> <li>• MEDIUMTEXT: A CLOB type with a maximum of 224-1 (16777215) characters.</li> <li>• LONGTEXT: A CLOB type with a maximum of 232-1 (4294967295 ) characters.</li> </ul> | <b>4</b>    |
| <b>B</b>  | <p><b>State the three directive elements available in JSP.</b><br/>3 elements for 4m</p> <p>Page<br/>Include<br/>Taglib</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | <b>4</b>    |
| <b>C</b>  | <p><b>What is action entity in Struts2 framework?</b><br/>Struts 2 Action<br/>Struts 2 Action<br/>Action Interface<br/>ActionSupport class<br/>In struts 2, action class is POJO (Plain Old Java Object).</p> <p>POJO means you are not forced to implement any interface or extend any class.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | <b>4</b>    |

|   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |   |
|---|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|
|   | Generally, execute method should be specified that represents the business logic. The simple action class may look like:                                                                                                                                                                                                                                                                                                                                                                                                                                     |   |
| D | <p>Welcome.java</p> <pre>package com.mithi; public class Welcome {     public String execute(){         return "success";     } }</pre> <p>Write a code snippet to implement JSON.</p> <p>4m for program to encode or decode</p> <pre>import org.json.simple.JSONObject; public class JsonExample1{     public static void main(String args[]){         JSONObject obj=new JSONObject();         obj.put("name","sonuj");         obj.put("age",new Integer(27));         obj.put("salary",new Double(600000));         System.out.print(obj);     } }</pre> | 4 |

**SVKM'S**

**Mithibai College of Arts, Chauhan Institute of Science &  
Amrutben Jivanlal College of Commerce and Economics (Autonomous)**

**Academic Year: 2022-23**

**Batch: 2022-23**

**Class: SYBSc**

**Semester: IV**

**Programme: B.Sc. Computer Science**

**Max. Marks: 75**

**Course Name: Linear Algebra with Python**

**Course Code: USMACS405**

**Date:** Time:

**Duration: 2 hours 30 minutes**

**MODEL ANSWER PAPER**

---

**Q1 ATTEMPT ANY THREE**

21

**A** Given  $\mathbf{u} = (2, -1, 2, 1, 4)$ ,  $\mathbf{v} = (-1, -3, 2, 2, -3)$  find

7

i. distance between the vectors  $\mathbf{u}$  and  $\mathbf{v}$ :  $2*(-1)+(-1)(-3)+2*2+1*2+4(-3)=-5$  (1 mark)

ii. angle between the vectors  $\mathbf{u}$  and  $\mathbf{v}$ :

$$\frac{\mathbf{u} \cdot \mathbf{v}}{\|\mathbf{u}\| \|\mathbf{v}\|} = \frac{-5}{(\sqrt{26}) \cdot (3\sqrt{3})} = -\frac{5\sqrt{78}}{234} \quad (2 \text{ marks})$$

iii. projection between the vectors  $\mathbf{u}$  and  $\mathbf{v}$ :

$$\frac{-5}{(3\sqrt{3})^2} \cdot (-1, -3, 2, 2, -3) \quad (2 \text{ marks})$$

iv. norm of the vector  $\mathbf{v}$ :  $|-1|^2 + |-3|^2 + |2|^2 + |2|^2 + |-3|^2 = 27$ . (2 marks)

**B** Given  $z$  and  $w$  are complex numbers where  $z = 3 - 2i$  and  $w = -1 - 4i$  then find

7

i.  $z + w$ :  $2 - 6i$  (1 mark)

ii.  $zw$ :  $(3(-1) - (-2)(-4)) + (3(-4) - 2(-1))i = -11 - 10i$  (2 mark)

iii. conjugate of  $z$ :  $3 + 2i$  (1 mark)

iv.  $w/z$ :  $\{( -1 - 4i)(3 + 2i)\} / \{(3 - 2i)(3 + 2i)\} = \{5\} / \{13\} - \{14\} / \{13\}i$  (2 mark)

v.  $|z|$ :  $\sqrt{9 + (-2)^2} = \sqrt{13}$  (1 mark)

**C** Given that

7

$$A = \begin{bmatrix} -2 & 1 & 4 \\ 2 & 1 & -2 \\ 0 & 1 & 1 \end{bmatrix} \quad B = \begin{bmatrix} 2 & 1 & 1 \\ 1 & -2 & 3 \\ 1 & -3 & 2 \end{bmatrix}$$

i. Find the difference  $A - B$  (2 mark)

$$\begin{bmatrix} -2 & 1 & 4 \\ 2 & 1 & -2 \\ 0 & 1 & 1 \end{bmatrix} - \begin{bmatrix} 2 & 1 & 1 \\ 1 & -2 & 3 \\ 1 & -3 & 2 \end{bmatrix} =$$

$$\begin{bmatrix} (-2) - (2) & (1) - (1) & (4) - (1) \\ (2) - (1) & (1) - (-2) & (-2) - (3) \\ (0) - (1) & (1) - (-3) & (1) - (2) \end{bmatrix} = \begin{bmatrix} -4 & 0 & 3 \\ 1 & 3 & -5 \\ -1 & 4 & -1 \end{bmatrix}$$

ii. Find the transpose of matrix A (1 mark)

$$\begin{bmatrix} -2 & 2 & 0 \\ 1 & 1 & 1 \\ 4 & -2 & 1 \end{bmatrix}$$

iii. Find the product of matrices (4 mark)

$$\begin{bmatrix} -2 & 1 & 4 \\ 2 & 1 & -2 \\ 0 & 1 & 1 \end{bmatrix} \cdot \begin{bmatrix} 2 & 1 & 1 \\ 1 & -2 & 3 \\ 1 & -3 & 2 \end{bmatrix} =$$

$$\begin{bmatrix} (-2) \cdot (2) + (1) \cdot (1) + (4) \cdot (1) & (-2) \cdot (1) + (1) \cdot (-2) + (4) \cdot (-3) & (-2) \cdot (1) + (1) \cdot (1) \\ (2) \cdot (2) + (1) \cdot (1) + (-2) \cdot (1) & (2) \cdot (1) + (1) \cdot (-2) + (-2) \cdot (-3) & (2) \cdot (1) + (1) \cdot (1) \\ (0) \cdot (2) + (1) \cdot (1) + (1) \cdot (1) & (0) \cdot (1) + (1) \cdot (-2) + (1) \cdot (-3) & (0) \cdot (1) + (1) \cdot (1) \end{bmatrix} =$$

$$\begin{bmatrix} 1 & -16 & 9 \\ 3 & 6 & 1 \\ 2 & -5 & 5 \end{bmatrix}$$

D Given that

7

$$A = \begin{bmatrix} -2 & -3 & 2 \\ -4 & 1 & 4 \\ -1 & -1 & -1 \end{bmatrix} \quad B = \begin{bmatrix} -1 & 2 & -1 \\ -1 & 1 & -2 \\ 1 & 2 & 1 \end{bmatrix}$$

i. Find the sum of the matrices (2 marks)

$$\begin{bmatrix} -2 & -3 & 2 \\ -4 & 1 & 4 \\ -1 & -1 & -1 \end{bmatrix} + \begin{bmatrix} -1 & 2 & -1 \\ -1 & 1 & -2 \\ 1 & 2 & 1 \end{bmatrix} =$$

$$\begin{bmatrix} (-2) + (-1) & (-3) + (2) & (2) + (-1) \\ (-4) + (-1) & (1) + (1) & (4) + (-2) \\ (-1) + (1) & (-1) + (2) & (-1) + (1) \end{bmatrix} = \begin{bmatrix} -3 & -1 & 1 \\ -5 & 2 & 2 \\ 0 & 1 & 0 \end{bmatrix}$$

ii. Find the inverse of matrix B from its adjugate matrix only (5 mark)

Calculate the determinant of the matrix: it equals  $-4$

$$\text{Calculate the adjugate of the matrix: it is } \begin{bmatrix} 5 & -4 & -3 \\ -1 & 0 & -1 \\ -3 & 4 & 1 \end{bmatrix}$$

The inverse matrix is the adjugate matrix divided by the determinant.

$$\text{Thus, the inverse matrix is } \begin{bmatrix} -\frac{5}{4} & 1 & \frac{3}{4} \\ \frac{1}{4} & 0 & \frac{1}{4} \\ \frac{3}{4} & -1 & -\frac{1}{4} \end{bmatrix}$$

**Q2 ATTEMPT ANY THREE**

21

- A Solve the following system of linear equations using Gaussian Elimination

7

$$x + 2y - 3z = 1 \quad (1)$$

$$2x + 5y - 3z = 4 \quad (2)$$

$$3x + 8y + 3z = 7 \quad (3)$$

Subtract (2) from (1)

$$\begin{array}{r} x + 2y - 3z = 1 \\ - 2x - 5y + 3z = -4 \\ \hline -x - 3y = -3 \quad (4) \end{array}$$

2 marks

Adding (2) & (3)

$$\begin{array}{r} 2x + 5y - 3z = 4 \\ 3x + 8y + 3z = 7 \\ \hline 5x + 13y = 11 \quad (5) \end{array}$$

2 marks

Mul. (4) by 5 & add with (5)

$$\begin{array}{r} -5x - 15y = -15 \\ 5x + 13y = 11 \\ \hline y = 2. \end{array}$$

2 marks

Substituting y in (4).

$$\begin{aligned} -x - 3(2) &= -3 \\ x &= -3 \end{aligned}$$

Substituting x, y in (1)

$$\begin{aligned} -3 + 2(2) - 3(2) &= 1 \\ z &= 0 \end{aligned}$$

The soln is  $(-3, 2, 0)$

1 mark.

- B Reduced the following matrix to its echelon form and then to its row-canonical form

7

$$\begin{bmatrix} 1 & 2 & 3 \\ 2 & 1 & -1 \\ 1 & 2 & -2 \end{bmatrix}$$

(1 mark for each step)

Subtract row 1 multiplied by 2 from row 2:  $R_2 - R_2 - 2R_1$ .

$$\begin{bmatrix} 1 & 2 & 3 \\ 0 & -3 & -7 \\ 1 & 2 & -2 \end{bmatrix}$$

Subtract row 1 from row 3:  $R_3 - R_3 - R_1$ .

$$\begin{bmatrix} 1 & 2 & 3 \\ 0 & -3 & -7 \\ 0 & 0 & -5 \end{bmatrix}$$

Divide row 2 by -3:  $R_2 = -\frac{R_2}{3}$ .

$$\begin{bmatrix} 1 & 2 & 3 \\ 0 & 1 & \frac{1}{3} \\ 0 & 0 & -5 \end{bmatrix}$$

Subtract row 2 multiplied by 2 from row 1:  $R_1 - R_1 - 2R_2$ .

$$\begin{bmatrix} 1 & 0 & -\frac{5}{3} \\ 0 & 1 & \frac{1}{3} \\ 0 & 0 & -5 \end{bmatrix}$$

Divide row 3 by -5:  $R_3 = -\frac{R_3}{5}$ .

$$\begin{bmatrix} 1 & 0 & -\frac{5}{3} \\ 0 & 1 & \frac{1}{3} \\ 0 & 0 & 1 \end{bmatrix}$$

Add row 3 multiplied by  $\frac{5}{3}$  to row 1:  $R_1 = R_1 + \frac{5R_3}{3}$ .

$$\begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & \frac{1}{3} \\ 0 & 0 & 1 \end{bmatrix}$$

Subtract row 3 multiplied by  $\frac{1}{3}$  from row 2:  $R_2 = R_2 - \frac{R_3}{3}$ .

$$\begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$$

- C Find the basis and the rank of following matrix using row space of the matrix:

7

$$\begin{bmatrix} 1 & 1 & 2 & 1 \\ 2 & 2 & 2 & 2 \\ -2 & -1 & 3 & -2 \\ -1 & 3 & 3 & -2 \end{bmatrix}$$

(1 mark for each step)

The row echelon form of the matrix is

$$\left[ \begin{array}{cccc} 1 & 2 & -2 & -1 \\ 0 & -2 & 7 & 5 \\ 0 & 0 & 1 & 4 \\ 0 & 0 & 0 & -17 \end{array} \right]$$

The row space is a space spanned by the nonzero rows of the reduced matrix.

Thus, the row space is

$$\left\{ \left[ \begin{array}{c} 1 \\ 2 \\ -2 \\ -1 \end{array} \right], \left[ \begin{array}{c} 0 \\ -2 \\ 7 \\ 5 \end{array} \right], \left[ \begin{array}{c} 0 \\ 0 \\ 1 \\ 4 \end{array} \right], \left[ \begin{array}{c} 0 \\ 0 \\ 0 \\ -17 \end{array} \right] \right\}.$$

**The rank is 4**

- D i. Consider the basis  $S = \{(1,2), (4,7)\}$  of  $\mathbb{R}^2$  and let  $v = (5,8)$  presented in the standard basis. Find the coordinates of  $v$  in the basis  $S$ , that is find  $[v]_S$ . (3 Marks) 7

We set  $(5,8) = c_1(1,2) + c_2(4,7)$  or

$$\begin{aligned} c_1 + 4c_2 &= 5 \\ 2c_1 + 7c_2 &= 8 \end{aligned}$$

We get the matrix equation

$$\begin{pmatrix} 1 & 4 \\ 2 & 7 \end{pmatrix} \begin{pmatrix} c_1 \\ c_2 \end{pmatrix} = \begin{pmatrix} 5 \\ 8 \end{pmatrix}$$

The matrix is just the matrix whose columns are the basis vectors of  $S$ . The solution to this is

$$\begin{pmatrix} c_1 \\ c_2 \end{pmatrix} = \begin{pmatrix} 1 & 4 \\ 2 & 7 \end{pmatrix}^{-1} \begin{pmatrix} 5 \\ 8 \end{pmatrix} = \begin{pmatrix} -3 \\ 2 \end{pmatrix}$$

$$c_1 = -3 \quad c_2 = 2$$

- ii. Let  $S = \{(2,3), (1,4)\}$  and  $T = \{(0,2), (-1,5)\}$  be two bases for  $\mathbb{R}^2$ , and let

$$[v]_S = (-2,6)$$

Find  $[v]_T$  (4 Marks)

We can first find  $v$  in the standard basis. We have  $v = A_S [v]_S$  where  $A_S$  is the matrix whose columns are the vectors in  $S$ . Now convert to the  $T$  basis.

$$[\mathbf{v}]_T = (\mathbf{A}_T)^{-1}\mathbf{v} = (\mathbf{A}_T)^{-1}\mathbf{A}_S[\mathbf{v}]_S \text{ or}$$

$$[\mathbf{v}_T] = \begin{pmatrix} 0 & -1 \\ 2 & 5 \end{pmatrix}^{-1} \begin{pmatrix} 2 & 1 \\ 3 & 4 \end{pmatrix} \begin{pmatrix} -2 \\ 6 \end{pmatrix} = \begin{pmatrix} 14 \\ -2 \end{pmatrix}$$

**Q3 ATTEMPT ANY THREE**

**21**

**A For the following matrix A**

**7**

- i. Find all eigenvalues and corresponding eigenvectors. (6 marks)
- ii. Find matrices P and D such that P is nonsingular and  $D = P^{-1}AP$  is diagonal. (1 marks)

$$\mathbf{A} = \begin{bmatrix} 3 & 2 \\ 3 & -2 \end{bmatrix}$$

Start from forming a new matrix by subtracting  $\lambda$  from the diagonal entries of the given matrix:

$$\begin{bmatrix} 3 - \lambda & 2 \\ 3 & -\lambda - 2 \end{bmatrix}$$

The determinant of the obtained matrix is  $(\lambda - 4)(\lambda + 3)$

Solve the equation  $(\lambda - 4)(\lambda + 3) = 0$ .

The roots are  $\lambda_1 = 4, \lambda_2 = -3$

These are the eigenvalues.

Next, find the eigenvectors.

- $\lambda = 4$

$$\begin{bmatrix} 3 - \lambda & 2 \\ 3 & -\lambda - 2 \end{bmatrix} = \begin{bmatrix} -1 & 2 \\ 3 & -6 \end{bmatrix}$$

The null space of this matrix is  $\left\{ \begin{bmatrix} 2 \\ 1 \end{bmatrix} \right\}$

This is the eigenvector.

- $\lambda = -3$

$$\begin{bmatrix} 3 - \lambda & 2 \\ 3 & -\lambda - 2 \end{bmatrix} = \begin{bmatrix} 6 & 2 \\ 3 & 1 \end{bmatrix}$$

The null space of this matrix is  $\left\{ \begin{bmatrix} -\frac{1}{3} \\ 1 \end{bmatrix} \right\}$

This is the eigenvector.

Form the matrix  $P$ , whose column  $i$  is eigenvector no.  $i$ :  $P = \begin{bmatrix} 2 & -\frac{1}{3} \\ 1 & 1 \end{bmatrix}$ .

Form the diagonal matrix  $D$  whose element at row  $i$ , column  $i$  is eigenvalue no.  $i$ :  $D = \begin{bmatrix} 4 & 0 \\ 0 & -3 \end{bmatrix}$ .

The matrices  $P$  and  $D$  are such that the initial matrix  $\begin{bmatrix} 3 & 2 \\ 3 & -2 \end{bmatrix} = PDP^{-1}$ .

- B** Let  $u = (1, 3, -4, 2)$ ,  $v = (4, -2, 2, 1)$ ,  $w = (5, -1, -2, 6)$  in  $\mathbb{R}^4$ . 7

- (i) Show  $\langle 3u - 2v, w \rangle = 3\langle u, w \rangle - 2\langle v, w \rangle$  (3 marks)  
By definition,

$$\langle u, w \rangle = 5 - 3 + 8 + 12 = 22 \quad \text{and} \quad \langle v, w \rangle = 20 + 2 - 4 + 6 = 24$$

Note that  $3u - 2v = (-5, 13, -16, 4)$ . Thus,

$$\langle 3u - 2v, w \rangle = -25 - 13 + 32 + 24 = 18$$

- (ii) Normalize  $u$  and  $v$  (2 marks)  
By definition,

$$\|u\| = \sqrt{1 + 9 + 16 + 4} = \sqrt{30} \quad \text{and} \quad \|v\| = \sqrt{16 + 4 + 4 + 1} = 5$$

We normalize  $u$  and  $v$  to obtain the following unit vectors in the directions of  $u$  and  $v$ , respectively:

$$\hat{u} = \frac{1}{\|u\|} u = \left( \frac{1}{\sqrt{30}}, \frac{3}{\sqrt{30}}, \frac{-4}{\sqrt{30}}, \frac{2}{\sqrt{30}} \right) \quad \text{and} \quad \hat{v} = \frac{1}{\|v\|} v = \left( \frac{4}{5}, \frac{-2}{5}, \frac{2}{5}, \frac{1}{5} \right)$$

- (iii) Does this vector space has positive definite property? (2 marks)  
 $\langle 1, 3, -4, 2 \rangle \cdot \langle 1, 3, -4, 2 \rangle = (1) \cdot (1) + (3) \cdot (3) + (-4) \cdot (-4) + (2) \cdot (2) = 30$ .  
 $\langle u, u \rangle$  is greater than zero so this vector space has positive definite property.

- C** Explain the Gram-Schmidt orthogonalization process. (Each step 1 mark) 7

Suppose  $\{v_1, v_2, \dots, v_n\}$  is a basis of an inner product space  $V$ . One can use this basis to construct an orthogonal basis  $\{w_1, w_2, \dots, w_n\}$  of  $V$  as follows. Set

$$w_1 = v_1$$

$$w_2 = v_2 - \frac{\langle v_2, w_1 \rangle}{\langle w_1, w_1 \rangle} w_1$$

$$w_3 = v_3 - \frac{\langle v_3, w_1 \rangle}{\langle w_1, w_1 \rangle} w_1 - \frac{\langle v_3, w_2 \rangle}{\langle w_2, w_2 \rangle} w_2$$

$$\dots$$

$$w_n = v_n - \frac{\langle v_n, w_1 \rangle}{\langle w_1, w_1 \rangle} w_1 - \frac{\langle v_n, w_2 \rangle}{\langle w_2, w_2 \rangle} w_2 - \dots - \frac{\langle v_n, w_{n-1} \rangle}{\langle w_{n-1}, w_{n-1} \rangle} w_{n-1}$$

In other words, for  $k = 2, 3, \dots, n$ , we define

$$w_k = v_k - c_{k1}w_1 - c_{k2}w_2 - \dots - c_{kk-1}w_{k-1}$$

where  $c_{ki} = \langle v_k, w_i \rangle / \langle w_i, w_i \rangle$  is the component of  $v_k$  along  $w_i$ . By Theorem 7.8, each  $w_k$  is orthogonal to the preceding  $w$ 's. Thus,  $w_1, w_2, \dots, w_n$  form an orthogonal basis for  $V$  as claimed. Normalizing each will then yield an orthonormal basis for  $V$ .

- D Apply the Gram-Schmidt orthogonalization process to find an orthogonal basis and then an orthonormal basis for the subspace U of R4 spanned by  $v_1 = (1, -2, 2, 1)$ ,  $v_2 = (1, 3, 1, -1)$ ,  $v_3 = (1, 1, 4, 2)$

Step 1

$$\tilde{u}_1 = \tilde{v}_1 = \begin{bmatrix} 1 \\ -2 \\ 2 \\ 1 \end{bmatrix}$$

$$\tilde{e}_1 = \frac{\tilde{u}_1}{\|\tilde{u}_1\|} = \begin{bmatrix} \frac{\sqrt{10}}{10} \\ -\frac{\sqrt{10}}{10} \\ \frac{\sqrt{10}}{10} \\ \frac{\sqrt{10}}{10} \end{bmatrix}$$

Step 2

$$\tilde{u}_2 = \tilde{v}_2 - \text{proj}_{\tilde{u}_1}(\tilde{v}_2) = \begin{bmatrix} \frac{7}{10} \\ \frac{11\sqrt{65}}{130} \\ \frac{13}{10} \\ -\frac{9\sqrt{65}}{130} \end{bmatrix}$$

$$\tilde{e}_2 = \frac{\tilde{u}_2}{\|\tilde{u}_2\|} = \begin{bmatrix} \frac{7\sqrt{65}}{130} \\ \frac{11\sqrt{65}}{130} \\ \frac{13}{10} \\ -\frac{9\sqrt{65}}{130} \end{bmatrix}$$

Step 3

$$\tilde{u}_3 = \tilde{v}_3 - \text{proj}_{\tilde{u}_1}(\tilde{v}_3) - \text{proj}_{\tilde{u}_2}(\tilde{v}_3) = \begin{bmatrix} -\frac{41}{130} \\ \frac{15}{130} \\ \frac{13}{130} \\ \frac{21}{130} \end{bmatrix}$$

$$\tilde{e}_3 = \frac{\tilde{u}_3}{\|\tilde{u}_3\|} = \begin{bmatrix} -\frac{31\sqrt{3406}}{3406} \\ \frac{10\sqrt{3406}}{3406} \\ \frac{1703}{3406} \\ \frac{43\sqrt{3406}}{3406} \end{bmatrix}$$

ANSWER

The set of the orthonormal vectors is  $\left\{ \begin{bmatrix} \frac{\sqrt{10}}{10} \\ -\frac{\sqrt{10}}{10} \\ \frac{\sqrt{10}}{10} \\ \frac{\sqrt{10}}{10} \end{bmatrix}, \begin{bmatrix} \frac{7\sqrt{65}}{130} \\ \frac{11\sqrt{65}}{130} \\ \frac{13}{10} \\ -\frac{9\sqrt{65}}{130} \end{bmatrix}, \begin{bmatrix} -\frac{31\sqrt{3406}}{3406} \\ \frac{10\sqrt{3406}}{3406} \\ \frac{1703}{3406} \\ \frac{43\sqrt{3406}}{3406} \end{bmatrix} \right\} \approx$

**Q4 ATTEMPT ANY THREE** 12

**A i. Explain linear combination of vectors. (2 marks)**

Now suppose we are given vectors  $u_1, u_2, \dots, u_m$  in  $\mathbb{R}^n$  and scalars  $k_1, k_2, \dots, k_m$  in  $\mathbb{R}$ . We can multiply the vectors by the corresponding scalars and then add the resultant scalar products to form the vector

$$v = k_1 u_1 + k_2 u_2 + k_3 u_3 + \cdots + k_m u_m$$

Such a vector  $v$  is called a *linear combination* of the vectors  $u_1, u_2, \dots, u_m$ .

**ii. Explain degenerate linear equations and its solutions.(2 marks)**

A linear equation is said to be *degenerate* if all the coefficients are zero—that is, if it has the form

$$0x_1 + 0x_2 + \cdots + 0x_n = b \quad (3.3)$$

The solution of such an equation depends only on the value of the constant  $b$ . Specifically,

(i) If  $b \neq 0$ , then the equation has no solution.

(ii) If  $b = 0$ , then every vector  $u = (k_1, k_2, \dots, k_n)$  in  $\mathbb{K}^n$  is a solution.

**B i. What is a system of linear equations and its solutions? (2 marks)** 4

A system of linear equations is a list of linear equations with the same unknowns. In particular, a system of  $m$  linear equations  $L_1, L_2, \dots, L_m$  in  $n$  unknowns  $x_1, x_2, \dots, x_n$  can be put in the *standard form*

$$\begin{aligned} a_{11}x_1 + a_{12}x_2 + \cdots + a_{1n}x_n &= b_1 \\ a_{21}x_1 + a_{22}x_2 + \cdots + a_{2n}x_n &= b_2 \\ \dots \\ a_{m1}x_1 + a_{m2}x_2 + \cdots + a_{mn}x_n &= b_m \end{aligned} \quad (3.2)$$

where the  $a_{ij}$  and  $b_i$  are constants. The number  $a_{ij}$  is the *coefficient* of the unknown  $x_j$  in the equation  $L_i$ , and the number  $b_i$  is the *constant* of the equation  $L_i$ .

**ii. What is row canonical form of a matrix? (2 marks)**

A matrix  $A$  is said to be in *row canonical form* (or *row-reduced echelon form*) if it is an echelon matrix—that is, if it satisfies the above properties (1) and (2), and if it satisfies the following additional two properties:

(3) Each pivot (leading nonzero entry) is equal to 1.

(4) Each pivot is the only nonzero entry in its column.

**C i. Define inner product spaces (2 marks)** 4

Let  $V$  be a real vector space. Suppose to each pair of vectors  $u, v \in V$  there is assigned a real number, denoted by  $\langle u, v \rangle$ . This function is called a (*real*) *inner product* on  $V$  if it satisfies the following axioms:

[I<sub>1</sub>] (*Linear Property*):  $\langle au_1 + bu_2, v \rangle = a\langle u_1, v \rangle + b\langle u_2, v \rangle$ .

[I<sub>2</sub>] (*Symmetric Property*):  $\langle u, v \rangle = \langle v, u \rangle$ .

[I<sub>3</sub>] (*Positive Definite Property*):  $\langle u, u \rangle \geq 0$ ; and  $\langle u, u \rangle = 0$  if and only if  $u = 0$ .

The vector space  $V$  with an inner product is called a (*real*) *inner product space*.

**ii. What are orthogonal complements? (2 marks)**

Let  $S$  be a subset of an inner product space  $V$ . The orthogonal complement of  $S$ , denoted by  $S^\perp$  (read " $S$  perp") consists of those vectors in  $V$  that are orthogonal to every vector  $u \in S$ ; that is,

$$S^\perp = \{v \in V : (v, u) = 0 \text{ for every } u \in S\}$$

**D i. Describe diagonalization (2 marks)**

4

Let  $A$  be any  $n$ -square matrix. Then  $A$  can be represented by (or is similar to) a diagonal matrix  $D = \text{diag}(k_1, k_2, \dots, k_n)$  if and only if there exists a basis  $S$  consisting of (column) vectors  $u_1, u_2, \dots, u_n$  such that

$$\begin{aligned} Au_1 &= k_1 u_1 \\ Au_2 &= k_2 u_2 \\ \dots \\ Au_n &= k_n u_n \end{aligned}$$

In such a case,  $A$  is said to be *diagonalizable*. Furthermore,  $D = P^{-1}AP$ , where  $P$  is the nonsingular matrix whose columns are, respectively, the basis vectors  $u_1, u_2, \dots, u_n$ .

**ii. Define eigenvalue and eigenvector. (2 marks)**

Let  $A$  be any square matrix. A scalar  $\lambda$  is called an *eigenvalue* of  $A$  if there exists a nonzero (column) vector  $v$  such that

$$Av = \lambda v$$

Any vector satisfying this relation is called an *eigenvector* of  $A$  belonging to the eigenvalue  $\lambda$ .

\*\*\*\*\*

**SVKM'S**  
**Mithibai College of Arts, Chauhan Institute of Science &**  
**Amrutben Jivanlal College of Commerce and Economics (Autonomous)**  
**Academic Year (2022-23)**

**Class: SYBSC Semester: IV**

**Program: B.Sc Computer Science**

**Max. Marks: 75**

**Course Name: Software Engineering**

**Time:**

**Course Code: USMACS407**

**Duration: 2 hrs 30 minutes**

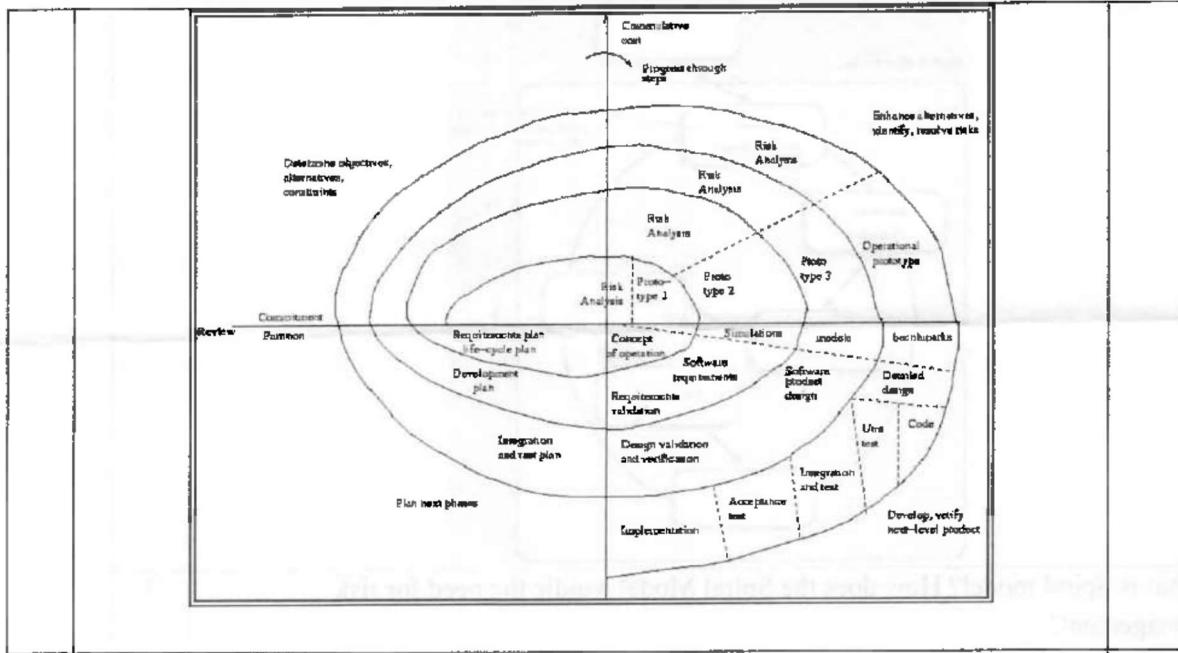
**Date:**

**SOLUTION SET**

|    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |      |
|----|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|
| Q1 | <b>ATTEMPT ANY 3 FROM THE FOLLOWING:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | [21] |
| A  | <p>Define Software process. Explain software process framework with the help of a diagram.</p> <p>Software process 1M+diagram 2M+4M software process framework</p> <p>Step must be executed as per project plan that gives duration, effort, resources, constraints, etc. It must produce information for management so that corrective actions can be taken E.g., adding more resources</p> <div style="border: 1px solid black; padding: 10px; width: fit-content;"> <p><u>Common process framework</u></p> <ul style="list-style-type: none"> <li>Framework activities</li> <li>work tasks</li> <li>work products</li> <li>milestones &amp; deliverables</li> <li>QA checkpoints</li> <li><u>Umbrella Activities</u></li> </ul> </div> <ul style="list-style-type: none"> <li>• Software project management</li> <li>• Formal technical reviews</li> <li>• Software quality assurance</li> <li>• Software configuration management</li> <li>• Document preparation and production</li> <li>• Reusability management</li> <li>• Measurement</li> <li>• Risk management</li> </ul> | 7    |
| B  | Explain Cultural, Economic and Organizational Feasibility in detail.<br>6M for a explanation 1 for example                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 7    |

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|---|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|
|   | <p><b>Cultural Feasibility Study</b></p> <p>The compatibility of the proposed project with the cultural environment of the project is included in the cultural feasibility. Planned operations should be integrated with the local cultural beliefs and practices in labor-intensive projects. For example, what a person is willing to perform or not perform is influenced by his religious beliefs.</p> <p><b>Economic Feasibility –</b></p> <p>In Economic Feasibility study cost and benefit of the project is analyzed. Means under this feasibility study a detail analysis is carried out what will be cost of the project for development which includes all required cost for final development like hardware and software resource required, design and development cost and operational cost and so on. After that it is analyzed whether project will be beneficial in terms of finance for organization or not.</p> <p><b>Organizational Feasibility</b></p> <p>Though the software project is feasible from the technical aspect what if you need to make major organizational changes. It will make things more complex. To check if the software is organizationally or operationally feasible or not we must consider the following key points:</p> <ol style="list-style-type: none"> <li>1. Identify whether the organizational staff is ready to accept the new software or not</li> <li>2. Is the organizational staff technical sound to cope up with new technologies?</li> <li>3. Does the organization hardware infrastructure capable to support the new software?</li> </ol> |   |
| C | <p>What are the problems with waterfall model? Describe the concurrent model in detail.</p> <p>problems with waterfall model 3M+ concurrent model 4M</p> <ul style="list-style-type: none"> <li>– Customer may not be aware of what getting (for non manual systems)</li> <li>– Costly when discrepancy found in later stages</li> <li>– Sometimes freezes part of development (requirements change)</li> <li>– May lead to badly structured systems</li> </ul> <p>- To much documentation (not necessary for all)</p> <p>Concurrent model</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 7 |

|   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |   |
|---|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|
|   | <p>The diagram illustrates the Spiral Model's progression through various software engineering states. It starts at the top with a box labeled "none". Below it is a large rounded rectangle containing several boxes arranged in a spiral pattern:</p> <ul style="list-style-type: none"> <li><b>Under development</b>: The initial state.</li> <li><b>Awaiting changes</b>: Reached from Under development.</li> <li><b>Under review</b>: Reached from Awaiting changes.</li> <li><b>Under revision</b>: Reached from Under review.</li> <li><b>Baselined</b>: Reached from Under revision.</li> <li><b>Done</b>: Reached from Baseline.</li> </ul> <p>Arrows indicate a clockwise flow between these states, forming a spiral. A note on the right side of the spiral states: "represents the state of a software engineering activity or task".</p>                                                                                                                                                                                                                                                                                                               |   |
| D | <p>What is Spiral model? How does the Spiral Model handle the need for risk management?</p> <p>Spiral model 1M+ diagram 2M+Spiral Model handle the need for risk 4M</p> <p><b>Spiral model</b></p> <ul style="list-style-type: none"> <li>Activities are organized in a spiral having many cycles</li> <li>Four quadrants in each cycle</li> <li>Risk driven</li> <li>Anchor point milestones</li> </ul> <p><b>Spiral Model handle the need for risk</b></p> <p>The Spiral Model addresses the need for risk management by performing risk analysis and risk resolution during each spiral of the life cycle.</p> <ul style="list-style-type: none"> <li>Prototyping, simulations, benchmarking may be done to resolve uncertainties/risks</li> <li>Development step depends on remaining risks; e.g., <ul style="list-style-type: none"> <li>Do prototype for user interface risks</li> <li>Use basic waterfall model when user interface and performance issues are understood but only development risk remains</li> </ul> </li> <li>Risk driven : allows us mix of specification-oriented, prototype-oriented, simulation based or any other approach.</li> </ul> | 7 |



**Q2 ATTEMPT ANY 3 FROM THE FOLLOWING:** [21]

- A What is Software Requirement Specification? State and explain the characteristics of SRS.

Software Requirement Specification 2M+5M characteristics

Description of a software system to be developed.

Lays out functional and non-functional requirements

May include a set of use cases that describe user interactions that the software must provide.

Correct: If every requirement included in the SRS represents something required in the final system.

Complete: If everything the software is supposed to do and the responses of the software to all classes of input data are specified in the SRS

Unambiguous: If and only if every requirement stated has one and only one interpretation

Verifiable: If there exists some cost-effective process that can check whether the final software meets that requirement.

Consistent: If there is no requirement that conflicts with another.

Ranked for importance and/or stability: If for each requirement the importance and the stability of the requirement are indicated. Stability of a requirement is the chances of it changing in future.

Modifiable: If its structure and style are such that any necessary change can be made easily while preserving completeness and consistency.

7

|   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |   |
|---|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|
|   | <p>Traceable: An SRS is traceable if the origin of each of its requirements is clear and if it allows the referencing of each requirement in future development.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |   |
| B | <p>Draw a State diagram for depicting a telephone call.<br/>Any 7 states 7M</p> <pre> graph TD     Idle((idle)) -- "disconnect line" --&gt; DialTone((Dial Tone<br/>do / soundDialTone))     DialTone -- "onReline" --&gt; DialTone     DialTone -- "digit(n)" --&gt; Dialing((Dialing))     Dialing -- "validnumber" --&gt; Connecting((Connecting<br/>do / findConnection))     Dialing -- "invalidnumber" --&gt; InvalidNumber((Recorded Message<br/>do / Play Message))     Connecting -- "numberBusy" --&gt; Busy((busy<br/>do / Sound_Busy_Tone))     Connecting -- "routed" --&gt; Ringing((Ringing<br/>do / ringBell))     Ringing -- "calledPhoneAnswer" --&gt; Connected((Connected))     Connected -- "calledPhoneHangup" --&gt; Disconnected((Disconnected))     Disconnected -- "disconnect line" --&gt; DialTone     </pre> | 7 |
| C | <p>Explain usecase diagram with its components.<br/>Usecase diagram 2M +components 5M</p> <ul style="list-style-type: none"> <li>• Use Case Analysis</li> </ul> <p>A software is judged ‘successful’ by its users and not by developers.<br/>Developers can deliver a successful software only if they understand user requirements.<br/>User requirements consists of detailed description of how they want to use the system.</p>                                                                                                                                                                                                                                                                                                                                                                                                       | 7 |

|   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |   |
|---|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|
|   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |   |
| D | <p>What is Cohesion? Explain any 3 types of cohesion.</p> <p>Cohesion 1M+ any 3 types of cohesion 6M</p> <p>Cohesion of a module represents how tightly bound the internal elements of the module are to one another. Cohesion of a module gives the designer an idea about whether the different elements of a module belong together in the same module. Cohesion and coupling are clearly related. Usually, the greater the cohesion of each module in the system, the lower the coupling between modules is. With cohesion, we are interested in determining how closely the elements of a module are related to each other.</p> <p>types</p> <p>Coincidental</p> <ul style="list-style-type: none"> <li>◦ It is the lowest level and weakest in terms of cohesion.</li> <li>◦ It occurs when there is no meaningful relationship among the elements of a module.</li> <li>◦ It can occur if an existing program is "modularized" by chopping it into pieces and making different pieces modules.</li> <li>◦ If a module is created to save duplicate</li> </ul> <p>Temporal:</p> <ul style="list-style-type: none"> <li>◦ Temporal cohesion is the same as logical cohesion, except that, the elements are also related in time and are executed together.</li> <li>◦ Modules that perform activities like "initialization," "clean-up," and "termination" are usually temporally bound.</li> <li>◦ Even though the elements in a temporally bound module are logically related, temporal cohesion is higher than logical cohesion, because the elements are all executed together. This avoids the problem of passing the flag, and the code is usually simpler.</li> </ul> <p>Logical</p> | 7 |

|    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |      |
|----|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|
|    | <ul style="list-style-type: none"> <li>◦ A module has logical cohesion if there is some logical relationship between the elements of a module, and the elements perform functions that fall in the same logical class.</li> <li>◦ A typical example of this kind of cohesion is a module that performs all the inputs or all the outputs.</li> <li>◦ Logically cohesive modules should be avoided, if possible.</li> </ul>                                                                                                                                                  |      |
| Q3 | ATTEMPT ANY 3 FROM THE FOLLOWING:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | [21] |
| A  | <p>Write a short note on Effort Distribution and Timeline charts.</p> <p>Effort Distribution 3M+ Timeline charts 3M</p> <ul style="list-style-type: none"> <li>■ Split project into tasks and estimate time and resources required to complete each task.</li> <li>■ Organize tasks concurrently to make optimal use of workforce.</li> <li>■ Minimize task dependencies to avoid delays caused by one task waiting for another to complete.</li> <li>■ Dependent on project managers intuition and experience.</li> </ul>                                                  | 7    |
| B  | <p>Explain Function point analysis in detail with an example.</p> <p>Function point analysis 5M+example 2M</p> <ul style="list-style-type: none"> <li>■ Based on a combination of program characteristics <ul style="list-style-type: none"> <li>◦ external inputs and outputs;</li> <li>◦ user interactions;</li> <li>◦ external interfaces;</li> <li>◦ files used by the system.</li> </ul> </li> <li>■ A weight is associated with each of these and the function point count is computed by multiplying each raw count by the weight and summing all values.</li> </ul> | 7    |

- The function point count is modified by complexity of the project
- FPs can be used to estimate LOC depending on the average number of LOC per FP for a given language
  - $LOC = AVC * \text{number of function points};$
  - AVC is a language-dependent factor varying from 200-300 for assemble language to 2-40 for a 4GL;
- FPs are very subjective. They depend on the estimator

**Weighting factor**

| Measurement parameter         | Count                | Simple | Average | Complex | = | Count total          |
|-------------------------------|----------------------|--------|---------|---------|---|----------------------|
| Number of user inputs         | <input type="text"/> | x 3    | 4       | 6       | = | <input type="text"/> |
| Number of user outputs        | <input type="text"/> | x 4    | 5       | 7       | = | <input type="text"/> |
| Number of user inquiries      | <input type="text"/> | x 3    | 4       | 6       | = | <input type="text"/> |
| Number of files               | <input type="text"/> | x 7    | 10      | 15      | = | <input type="text"/> |
| Number of external interfaces | <input type="text"/> | x 5    | 7       | 10      | = | <input type="text"/> |
| Count total                   |                      |        |         |         |   | <input type="text"/> |

$$FP = \text{count total} * (0.65 + 0.01 * \text{sum of } (Fi))$$

where count total is the sum of all FP entries

- C What is testing? Discuss any 3 types of testing in detail.

7

Testing 1M+ any 3 types 6M

Testing is the process of executing a program to find errors. To make our software perform well it should be error-free.

Unit tests

Unit tests are very low level and close to the source of an application. They consist in testing individual methods and functions of the classes, components, or modules used by your software. Unit tests are generally quite cheap to automate and can run very quickly by a continuous integration server.

## 2. Integration tests

Integration tests verify that different modules or services used by your application work well together. For example, it can be testing the interaction with the database or making sure that microservices work together as expected. These types of tests are more expensive to run as they require multiple parts of the application to be up and running.

## 3. Functional tests

Functional tests focus on the business requirements of an application. They only verify the output of an action and do not check the intermediate states of the system when performing that action.

There is sometimes a confusion between integration tests and functional tests as they both require multiple components to interact with each other. The difference is that an integration test may simply verify that you can query the database while a functional test would expect to get a specific value from the database as defined by the product requirements.

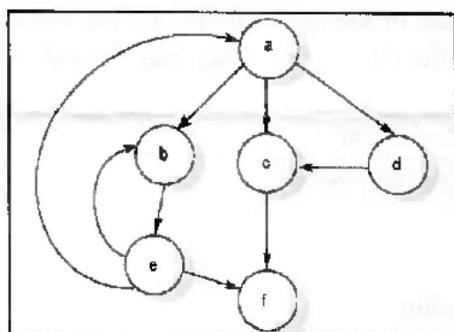
- D Explain: Cyclomatic complexity. Find the Cyclomatic Complexity of the following figures using at least 2 ways. 7

Any 2 ways:

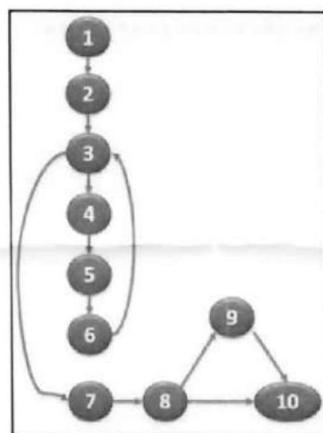
Cyclomatic complexity

- 1)  $V(G) = \text{Total number of region} = 3$
- 2) Cyclomatic complexity  $V(G) = E - N + 2$
- 3) Cyclomatic complexity  $V(G) = P + 1$

a)



b)



| Q4 ATTEMPT ANY 3 FROM THE FOLLOWING: |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | [12] |
|--------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|
| A                                    | <p>State the reasons for failure of a software.</p> <p>4 reasons 4M</p> <ul style="list-style-type: none"> <li>• Lack of user participation.</li> <li>• Changing requirements.</li> <li>• Unrealistic or unarticulated project goals.</li> <li>• Inaccurate estimates of needed resources.</li> <li>• Badly defined system requirements.</li> </ul>                                                                                                                            | 4    |
| B                                    | <p>Who are the users of the SRS document?</p> <p>4 users 4M</p> <p>Customers and users for understanding what they are expected to get,<br/>     Project managers to estimate and plan the project to deliver the system,<br/>     Designers and programmers to know what to build,<br/>     Testers to prepare for testing activities,</p>                                                                                                                                    | 4    |
| C                                    | <p>Write a note on stakeholders in Software engineering.</p> <p>Stakeholders are people who have interest in successful implementation of the system.</p> <p>We categorize stakeholders into one of the three groups: (1) the users, who actually use the system on daily basis, (2) the clients, those who pay for and own the system, and (3) the technical staff, the people who must ensure that the system operates in the computing environment of the organization.</p> | 4    |
| D                                    | <p>What are the two fundamental testing activities?</p> <ul style="list-style-type: none"> <li>• Planning and Control.</li> <li>• Analysis and Design.</li> <li>• Implementation and Execution.</li> <li>• Evaluating exit criteria and Reporting.</li> <li>• Test Closure activities.</li> </ul>                                                                                                                                                                              | 4    |

\*\*\*\*\*

**SVKM'S**  
**Mithibai College of Arts, Chauhan Institute of Science &**  
**Amrutben Jivanlal College of Commerce and Economics (Autonomous)**  
**Academic Year (2022-23)**

**Class: S. Y. B.Sc.(Computer Science) Semester: IV**

**Program: Bachelor of Science**

**Max. Marks: 75**

**Course Name: Android Developer Fundamentals**

**Time: 10:30 am to 1:00 pm**

**Course Code: USMACS404**

**Duration: 2hrs 30 minutes**

**Date:**

**MODEL ANSWER KEY SET 3**

---

**Q.1. Attempt any Three**

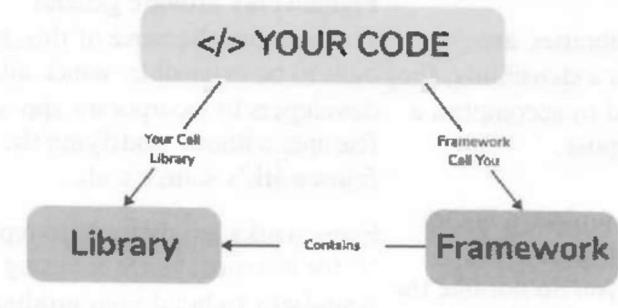
**(21)**

- a. With the example differentiate framework and library

**(7)**

By using a library, you control the flow of the program. The library can be invoked whenever and wherever you like. Contrary to this, when you use a framework, the flow is controlled by the framework. The framework instructs you where to put your code, but it will call your code as required. Simply put, our code calls the library's code, but in a framework, it's the framework's code that calls our code as shown in the below diagram.

Developers can invoke libraries to perform specific tasks by using components, classes, and methods. A framework, however, already provides code to perform common tasks and uses code provided by a developer for custom functionality.



| Parameters           | Library                                                                                                                              | Framework                                                                                                                  |
|----------------------|--------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------|
| Definition           | Libraries provide developers with predefined functions and classes to make their work easier and boost the development process.      | Framework, on the other hand, is like the foundation upon which developers build applications for specific platforms.      |
| Inversion of Control | By using a library, you can control the flow of the application and call the library.                                                | In contrast, when you use a framework, the control is inverted, i.e., the framework controls the flow and calls your code. |
| Collection           | Generally, libraries are a collection of helper modules, objects, classes, functions, message templates, pre-written libraries, etc. | Frameworks consist of a lot of APIs, compilers, toolsets, support programs, message templates, pre-written libraries, etc. |

|                   |                                                                                                                                                                                                   |                                                                                                                                                                                                                                                                     |
|-------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Code Modification | Codes in libraries are geared toward a particular program or to solve a specific development problem. Therefore, developers must modify library code to meet their needs.                         | Despite the fact that frameworks generate new codes for developers. These codes cannot be altered or modified later. Unlike libraries, frameworks do not allow users to modify their pre-written codes, so you don't have to worry about deleting or changing them. |
| Scope             | It is possible to call a library out of context. You may use the library wherever you see fit in your code.                                                                                       | On the other hand, you can only call and use what belongs to a Framework within the same Framework.                                                                                                                                                                 |
| Function          | In the program linking and binding process, they play an important role.                                                                                                                          | Using them, you can build and deploy applications in a standard way as the framework already provides code to perform common tasks and uses code provided by a developer for custom functionality.                                                                  |
| Complexity        | Having a library means understanding the functionality of each method, and it isn't easy to create complex interactions since you need to call many methods to get the desired results.           | Frameworks, on the other hand, embody the basic flow, and since plugins need to be added to code, it is easier to do the right modification.                                                                                                                        |
| Extensibility     | Generally, libraries aren't designed for extensibility; they are designed to accomplish a specific purpose.                                                                                       | Frameworks provide general functionality. Because of this, they are built to be extensible, which allows developers to incorporate app-specific features without modifying the framework's source code.                                                             |
| Replaceable       | It is easy to replace a library with another library. For instance, if you do not like the jQuery date picker library, you can use another date picker like a bootstrap date picker or pick date. | Frameworks are difficult to replace. If, for instance, you were using AngularJS to build your product, you cannot simply swap it out for another framework. It requires rewriting the entire codebase.                                                              |
| Performance       | Less code is required to build libraries, which leads to faster loading times and better performance.                                                                                             | Developing a framework requires a lot of coding, which increases loading times and decreases performance.                                                                                                                                                           |
| Usage             | The purpose of libraries is to perform a defined and specific task. Eg: Image manipulation, network protocols, math operations, etc.                                                              | Frameworks can be used for performing a wide range of tasks. Among these are Web application systems, plug-in managers, GUI systems, and so on.                                                                                                                     |
| Existing Projects | You can integrate libraries seamlessly into existing projects to add functionality.                                                                                                               | Incorporating frameworks seamlessly into an existing project is impossible.                                                                                                                                                                                         |

|          |                                                                                                  |                                                                                                             |
|----------|--------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------|
|          |                                                                                                  | Instead, frameworks should be used when starting a new project.                                             |
| Benefits | Good code quality, reusability, and control, enhanced speed and performance of the program, etc. | Faster programming, support from the community, great support for MVC (Model View Controller) pattern, etc. |
| Examples | JQuery, React JS, etc.                                                                           | Spring, NodeJS, AngularJS, Vue JS, etc.                                                                     |

### Explanation and difference 7 marks

- b. Explain Scroll View and write a code snipped for the same (7)

In Android, a ScrollView is a view group that is used to make vertically scrollable views. A scroll view contains a single direct child only. In order to place multiple views in the scroll view, one needs to make a view group(like LinearLayout) as a direct child and then we can define many views inside it. A ScrollView supports Vertical scrolling only, so in order to create a horizontally scrollable view, HorizontalScrollView is used. Android using Kotlin.

Step 1: Create a new project

Click on File, then New => New Project.

Choose “Empty Activity” for the project template.

Select language as Kotlin.

Select the minimum SDK as per your need.

Step 2: Modify strings.xml

Add some strings inside the strings.xml file to display those strings in the app.

strings.xml

```
<resources>
    <string name="app_name">gfgapp_scrollview</string>
    <string name="scrolltext">Kotlin is a statically typed,
```

Explanation:

Here, we have initialized the constructor parameters with some

default values emp\_id = 100 and emp\_name = “abc”.

When the object emp is created we passed the values for both the parameters so it prints those values.

But, at the time of object emp2 creation, we have not passed

the emp\_name so initializer block uses the default values and print to the standard output.</string>

</resources>

Step 3: Modify activity\_main.xml

Add the ScrollView and inside the ScrollView add a TextView to display the strings that are taken in the strings.xml file.

activity\_main.xml

```

<?xml version="1.0" encoding="utf-8"?>
<androidx.constraintlayout.widget.ConstraintLayout
    xmlns:android="http://schemas.android.com/apk/res/android"
    xmlns:app="http://schemas.android.com/apk/res-auto"
    xmlns:tools="http://schemas.android.com/tools"
    android:layout_width="match_parent"
    android:layout_height="match_parent"
    tools:context=".MainActivity">

    <ScrollView
        android:layout_width="match_parent"
        android:layout_height="match_parent"
        tools:layout_editor_absoluteX="0dp"
        tools:layout_editor_absoluteY="-127dp">

        <TextView
            android:id="@+id/scrolltext"
            style="@style/AppTheme"
            android:layout_width="match_parent"
            android:layout_height="wrap_content"
            android:text="@string/scrolltext"
            android:textColor="@color/green"/>
    </ScrollView>
</androidx.constraintlayout.widget.ConstraintLayout>

```

Steps with code 7 marks

c. Differentiate List View and Recycle View

(7)

In Android View is a basic building block of UI (User Interface). A view is a small rectangular box that responds to user inputs. RecyclerView and ListView are the two major Views in Android. So in this article, we are going to see the major differences between these two views.

#### RecyclerView

RecyclerView is a ViewGroup added to the android studio as a successor of the GridView and ListView. It is an improvement on both of them and can be found in the latest v-7 support packages. It has been created to make possible the construction of any lists with XML layouts as an item that can be customized vastly while improving on the efficiency of ListViews and GridViews. This improvement is achieved by recycling the views which are out of the visibility of the user. For example, if a user scrolled down to a position where items 4 and 5 are visible; items 1, 2, and 3 would be cleared from the memory to reduce memory consumption.

To read more on RecyclerView refer to this article: [RecyclerView in Android with Example](#)

#### ListView

A ListView is a type of AdapterView that displays a vertical list of scroll-able views and each view is placed one below the other. Using the Adapter, items are inserted into the list from an array or database. For displaying the items in the list method setAdaptor() is used. setAdaptor() method conjoins an adapter with the list. Android ListView is a ViewGroup that is used to display the list of items in multiple rows and contains an adapter that automatically inserts the items into the list.

RecyclerView	ListView
The RecyclerView's adaptor forces us to use the ViewHolder pattern. The views are split into onCreateViewHolder() and onBindViewHolder() methods.	The ListView doesn't give that kind of protection by default, so without implementing the ViewHolder pattern inside the getView().
Efficient Scrolling, we can choose the way of scroll-like vertically or horizontally and grids.	Inefficient scrolling, we can only create vertical scrolling.
Use of less memory.	More memory is used for a long list. Sometimes devices get hanged.
Animations using ItemAnimator are easy and smooth. Animations like list appearance and disappearance, adding or removing particular views, and so on.	It's complex to use Animation and hard to handle it.
Dividers between items are not shown by default.	Dividers between items are shown by default.
Use ItemDecorations to add margins and draw on or under an item View.	ItemDecorations require customization.
Explanation 2 marks difference 5 marks	

- d. Write a code to add toggle button and display the toggle value

(7)

```
import 'package:flutter/material.dart';

const List<Widget> fruits = <Widget>[
  Text('Apple'),
  Text('Banana'),
  Text('Orange')
];

const List<Widget> vegetables = <Widget>[
  Text('Tomatoes'),
  Text('Potatoes'),
  Text('Carrots')
];

const List<Widget> icons = <Widget>[
```

```

Icon(Icons.sunny),
Icon(Icons.cloud),
Icon(Icons.ac_unit),
];

void main() => runApp(const MyApp());

class MyApp extends StatelessWidget {
const MyApp({super.key});

static const String _title = 'ToggleButtons Sample';

@Override
Widget build(BuildContext context) {
return const MaterialApp(
title: _title,
home: ToggleButtonsSample(title: _title),
);
}
}

class ToggleButtonsSample extends StatefulWidget {
const ToggleButtonsSample({super.key, required this.title});

final String title;

@Override
State<ToggleButtonsSample> createState() => _ToggleButtonsSampleState();
}

class _ToggleButtonsSampleState extends State<ToggleButtonsSample> {
final List<bool> _selectedFruits = <bool>[true, false, false];
final List<bool> _selectedVegetables = <bool>[false, true, false];
final List<bool> _selectedWeather = <bool>[false, false, true];
bool vertical = false;

@Override
Widget build(BuildContext context) {
final ThemeData theme = Theme.of(context);

return Scaffold(
appBar: AppBar(title: Text(widget.title)),
body: Center(
child: SingleChildScrollView(
child: Column(

```

```
mainAxisSize: MainAxisSize.min,
mainAxisAlignment: MainAxisAlignment.center,
children: <Widget>[
    // ToggleButtons with a single selection.
    Text('Single-select', style: theme.textTheme.titleSmall),
    const SizedBox(height: 5),
    ToggleButtons(
        direction: vertical ? Axis.vertical : Axis.horizontal,
        onPressed: (int index) {
            setState(() {
                // The button that is tapped is set to true, and the others to false.
                for (int i = 0; i < _selectedFruits.length; i++) {
                    _selectedFruits[i] = i == index;
                }
            });
        },
        borderRadius: const BorderRadius.all(Radius.circular(8)),
        selectedBorderColor: Colors.red[700],
        selectedColor: Colors.white,
        fillColor: Colors.red[200],
        color: Colors.red[400],
        constraints: const BoxConstraints(
            minHeight: 40.0,
            minWidth: 80.0,
        ),
        isSelected: _selectedFruits,
        children: fruits,
    ),
    const SizedBox(height: 20),
    // ToggleButtons with a multiple selection.
    Text('Multi-select', style: theme.textTheme.titleSmall),
    const SizedBox(height: 5),
    ToggleButtons(
        direction: vertical ? Axis.vertical : Axis.horizontal,
        onPressed: (int index) {
            // All buttons are selectable.
            setState(() {
                _selectedVegetables[index] = !_selectedVegetables[index];
            });
        },
        borderRadius: const BorderRadius.all(Radius.circular(8)),
        selectedBorderColor: Colors.green[700],
        selectedColor: Colors.white,
        fillColor: Colors.green[200],
        color: Colors.green[400],
```

```

constraints: const BoxConstraints(
    minHeight: 40.0,
    minWidth: 80.0,
),
isSelected: _selectedVegetables,
children: vegetables,
),
const SizedBox(height: 20),
// ToggleButtons with icons only.
Text('Icon-only', style: theme.textTheme.titleSmall),
const SizedBox(height: 5),
ToggleButtons(
    direction: vertical ? Axis.vertical : Axis.horizontal,
    onPressed: (int index) {
        setState(() {
            // The button that is tapped is set to true, and the others to false.
            for (int i = 0; i < _selectedWeather.length; i++) {
                _selectedWeather[i] = i == index;
            }
        });
    },
    borderRadius: const BorderRadius.all(Radius.circular(8)),
    selectedBorderColor: Colors.blue[700],
    selectedColor: Colors.white,
    fillColor: Colors.blue[200],
    color: Colors.blue[400],
    isSelected: _selectedWeather,
    children: icons,
),
],
),
),
),
),
floatingActionButton: FloatingActionButton.extended(
    onPressed: () {
        setState(() {
            // When the button is pressed, ToggleButtons direction is changed.
            vertical = !vertical;
        });
    },
    icon: const Icon(Icons.screen_rotation_outlined),
    label: Text(vertical ? 'Horizontal' : 'Vertical'),
),
);
}

```

}

**Code 7 marks**

**Q.2. Attempt any Three**

(21)

- a. Write a code and process to add image in a page  
import 'package:flutter/material.dart';

(7)

```
// function to start app building
void main() => runApp(const MyApp());

class MyApp extends StatelessWidget {
  const MyApp({Key? key}) : super(key: key);

  // This widget is the root
  // of your application

  @override
  Widget build(BuildContext context) {
    return MaterialApp(
      home: Scaffold(
        appBar: AppBar(
          title: const Text(
            'Insert Image Demo',
          ),
        ),
        body: Center(
          child: Column(
            children: <Widget>[
              Image.asset('assets/images/output.gif',
                height: 200,
                scale: 2.5,
                // color: Color.fromARGB(255, 15, 147, 59),
                opacity:
                  const AlwaysStoppedAnimation<double>(0.5)), //Image.asset
              Image.asset(
                'assets/images/geeksforgeeks.jpg',
                height: 400,
                width: 400,
              ), // Image.asset
            ], //<Widget>[]
        ), //Column
      ), //Center
    );
  }
}
```

7 marks

- b. Write a code to increase counter on tap of button  
import 'package:flutter/material.dart';

```
void main() {
  runApp(const MyApp());
}

class MyApp extends StatelessWidget {
  const MyApp({Key? key}) : super(key: key);

  // This widget is the root of your application.
  @override
  Widget build(BuildContext context) {
    return MaterialApp(
      title: 'Flutter Demo',
      theme: ThemeData(
        primarySwatch: Colors.blue,
      ),
      home: const MyHomePage(title: 'Flutter Demo Home Page'),
    );
  }
}

class MyHomePage extends StatefulWidget {
  const MyHomePage({Key? key, required this.title}) : super(key: key);

  final String title;

  @override
  State<MyHomePage> createState() => _MyHomePageState();
}

class _MyHomePageState extends State<MyHomePage> {
  int _counter = 0;

  void _incrementCounter() {
    setState(() {
      _counter++;
    });
  }

  @override
  Widget build(BuildContext context) {
    return Scaffold(
      appBar: AppBar(
```

```

        title: Text(widget.title),
    ),
    body: Center(
        child: Column(
            mainAxisSize: MainAxisSize.center,
            children: <Widget>[
                const Text(
                    'You have pushed the button this many times:',
                ),
                Text(
                    '$_counter',
                    style: Theme.of(context).textTheme.headline4,
                ),
            ],
        ),
    ),
    floatingActionButton: FloatingActionButton(
        onPressed: _incrementCounter,
        tooltip: 'Increment',
        child: const Icon(Icons.add),
    ), // This trailing comma makes auto-formatting nicer for build methods.
);
}
}

```

#### 7 Marks

- c. Write UI code to add image in background and to add two text feild and one toggle button and at the end one button (7)

```

<?xml version="1.0" encoding="utf-8"?>
<RelativeLayout xmlns:android="http://schemas.android.com/apk/res/android"
    android:layout_width="match_parent"
    android:layout_height="match_parent"
    android:background="@drawable/background_image">

    <EditText
        android:id="@+id/text_field_1"
        android:layout_width="match_parent"
        android:layout_height="wrap_content"
        android:hint="Enter text 1 here"
        android:padding="16dp"
        android:layout_marginTop="100dp"/>

    <EditText
        android:id="@+id/text_field_2"
        android:layout_width="match_parent"
        android:layout_height="wrap_content"
        android:hint="Enter text 2 here"
        android:padding="16dp"/>

```

```

        android:layout_below="@+id/text_field_1"/>

<ToggleButton
    android:id="@+id/toggle_button"
    android:layout_width="wrap_content"
    android:layout_height="wrap_content"
    android:text="Toggle button"
    android:layout_below="@+id/text_field_2"
    android:layout_marginTop="16dp"
    android:layout_marginStart="16dp"/>

<Button
    android:id="@+id/submit_button"
    android:layout_width="wrap_content"
    android:layout_height="wrap_content"
    android:text="Submit"
    android:layout_alignParentBottom="true"
    android:layout_centerHorizontal="true"
    android:layout_marginBottom="32dp"/>

</RelativeLayout>

```

#### Code 7 Marks

- d. Elaborate the light mode and Dark mode with the example and write down the precautions measures. (7)

**Readability and Legibility** – Let me explain the point scientifically. I am sure you will agree that the sun, planets, and other bodies emit electromagnetic energy of different wavelengths? A portion of that spectrum is visible to the human eye; of course, depending on the wavelength or the color of that light. For example, a clear sky is blue because clean air scatters blue light wavelengths more than red ones.

In addition to this, wavelengths can boost our levels of attention, mood, and reaction time during the day. It's a different story at night, though. And that's the reason why e-book services, such as Google Play Books, introduce features such as "Night Light" for reading.

**Accessibility** – While creating a theme, keeping the contrast between the background, text colors, font size, and other accessibility factors is extremely important. After all, you are creating a project for people who aren't YOU, but for a broad range of users. To be precise, something that might have worked for one user might not work for another; a younger audience has different needs and preferences than an older audience. Apart from age, special needs, or disabilities, all of these can also determine the choice of color for the background and layout elements. Here the keyword is to research well to get closer to the target audience.

**Clarity** – in a general sense it is defined as the ability to see and distinguish all the core details on the screen or page. Let's take simplicity and intuitiveness of navigation for starters; if your end-user can easily find zones of information and elements of interaction just by scanning the layout, he or she doesn't need to put much effort in getting what they are looking for. In case the aspect is not tested properly; it might lead to weak visual hierarchy ending up in a complete mess.

**Responsiveness** – In layman's word, the responsiveness of the interface means that what users get is usable and functional irrespective of the device they prefer using.

For example, if something which looked stylish and appealing in Sketch on a high-res professional monitor may turn into a dirty stain on the small resolution screen. I am sure you must have encountered a situation where some color schemes looking nice at the design stage may lose their beauty in a variety of everyday conditions they are applied in. Provided the fact that a color scheme can have a significant impact on color, shape, and copy perceptions, one should test project on diverse devices and screens before making the final decision.

Environment – Last but certainly not least, is a question in which environments these web and mobile interfaces will be used. For example, for constant use under natural light, a dark background can literally create the effect of reflection, especially on glossy screens typical for tablets and smartphones. In a bad environment, a dark background can take the light away from the screen leading to bad influence on navigation and readability. In a nutshell, color combinations, contrast, and shades draw big attention here.

When to use dark UI?

When there is little text to read and more images/videos to watch

When there are very few elements in the design and are spaced well

When you want to give your users the feel of a dark environment like in a movie

When you want the core element of the page to stand out and gain prominence

When you want to reduce eye strain and make it comfortable for users to stay long in your website

When to use light UI?

When your website or app will be used mostly in the daytime

When your readers will be reading a lot of text

When there are a lot of elements on the screens

When you are using different color elements

Explanation 7 marks

**Q.3. Attempt any Three**

(21)

- a. Write a code to accept Name age address from the user, store the details in one JSON structure and save the data in JSON. (7)

```
class Person {  
    String name;  
    int age;  
    String address;
```

```
Person({required this.name, required this.age, required this.address});
```

```
Map<String, dynamic> toJson() =>  
    {'name': name, 'age': age, 'address': address};  
}
```

```
class PersonForm extends StatefulWidget {  
    @override  
    _PersonFormState createState() => _PersonFormState();  
}
```

```
class _PersonFormState extends State<PersonForm> {
```

```

final _formKey = GlobalKey<FormState>();
final _nameController = TextEditingController();
final _ageController = TextEditingController();
final _addressController = TextEditingController();

@Override
void dispose() {
    _nameController.dispose();
    _ageController.dispose();
    _addressController.dispose();
    super.dispose();
}

@Override
Widget build(BuildContext context) {
    return Form(
        key: _formKey,
        child: Column(
            mainAxisAlignment: MainAxisAlignment.start,
            children: <Widget>[
                TextFormField(
                    controller: _nameController,
                    decoration: InputDecoration(
                        labelText: 'Name',
                    ),
                    validator: (value) {
                        if (value == null || value.isEmpty) {
                            return 'Please enter your name';
                        }
                        return null;
                    },
                ),
                TextFormField(
                    controller: _ageController,
                    decoration: InputDecoration(
                        labelText: 'Age',
                    ),
                    keyboardType: TextInputType.number,
                    validator: (value) {
                        if (value == null || value.isEmpty) {
                            return 'Please enter your age';
                        }
                        if (int.tryParse(value) == null) {
                            return 'Please enter a valid age';
                        }
                    }
                )
            ],
        )
    );
}

```

```

        return null;
    },
),
TextField(
    controller: _addressController,
    decoration: InputDecoration(
        labelText: 'Address',
    ),
    validator: (value) {
        if (value == null || value.isEmpty) {
            return 'Please enter your address';
        }
        return null;
    },
),
Padding(
    padding: const EdgeInsets.symmetric(vertical: 16.0),
    child: ElevatedButton(
        onPressed: () {
            if (_formKey.currentState!.validate()) {
                final person = Person(
                    name: _nameController.text,
                    age: int.parse(_ageController.text),
                    address: _addressController.text,
                );
                saveData(person);
                ScaffoldMessenger.of(context).showSnackBar(
                    SnackBar(content: Text('Data saved')),
                );
            }
        },
        child: Text('Save'),
    ),
),
],
),
),
);
}

void saveData(Person person) async {
    final prefs = await SharedPreferences.getInstance();
    final personJson = jsonEncode(person.toJson());
    await prefs.setString('person', personJson);
}
}

```

Code 7 marks

- b. Elaborate following firebase authentication method

(7)

Firebase Authentication is a service offered by Google's Firebase platform that provides developers with the ability to easily add user authentication and authorization to their mobile and web applications. Firebase Authentication supports several different authentication methods, including mobile, email, and custom authentication. Let's take a closer look at each of these methods:

**Mobile Authentication:** Mobile authentication is a method of authentication that allows users to sign in to an application using their phone number. This method is convenient for users who do not want to create and remember a separate username and password. Firebase Authentication uses SMS messages to verify the user's phone number, and once verified, the user can access the app. Mobile authentication is supported on both Android and iOS platforms.

**Email Authentication:** Email authentication is a widely used method that allows users to sign in to an application using their email address and a password. This method is secure and easy to use, as users can use their existing email accounts to authenticate themselves. Firebase Authentication provides email authentication out-of-the-box and allows developers to customize the sign-in flow. The service also supports passwordless authentication, which allows users to sign in to an app without a password by sending them a sign-in link via email.

**Custom Authentication:** Custom authentication is a method that enables developers to implement their own authentication system, which can be useful if the app requires specific user data or if the app has an existing user database. With custom authentication, developers can authenticate users using their own backend servers or other identity providers such as Facebook or Google. Firebase Authentication provides a way to authenticate users with custom tokens, which developers can generate and verify using Firebase Admin SDK.

In summary, Firebase Authentication provides several authentication methods, including mobile, email, and custom authentication, making it easy for developers to add user authentication and authorization to their apps. The service also provides a secure and scalable authentication infrastructure, allowing developers to focus on developing the core features of their apps.

- c. Explain loader write code for loader.

(7)

a loader is a widget that is commonly used to indicate to the user that a process or action is ongoing or in progress. The loader is often displayed as a spinning circular icon or progress bar, and it can be implemented using the CircularProgressIndicator widget

```
import 'package:flutter/material.dart';
Center(
  child: CircularProgressIndicator(),
),
Center(
  child: CircularProgressIndicator(
    valueColor: AlwaysStoppedAnimation<Color>(Colors.red),
),
),
```

Center(

    child: CircularProgressIndicator(  
        valueColor: AlwaysStoppedAnimation<Color>(Colors.red),  
        semanticsLabel: 'Loading...',  
    ),  
,

### **Explanation 2 Makrs 5 marks code**

- d. Elaborate how mobile and server can interact with each other and list the required permission. (7)

Mobile and server interaction is a fundamental component of many modern applications. The mobile app acts as the client, while the server provides the backend services and data storage required by the app. In order for the mobile app and server to communicate with each other, there are several mechanisms that can be used, such as APIs, HTTP requests, and socket connections.

Here's a high-level overview of how mobile and server interact with each other: The mobile app sends a request to the server, such as a data query or a user action. This request is typically sent over a network connection, such as Wi-Fi or cellular data.

The server receives the request and processes it. This may involve retrieving data from a database, executing business logic, or performing other operations.

The server generates a response to the request, such as data to be displayed in the app or a status code indicating success or failure.

The server sends the response back to the mobile app over the network connection. The mobile app receives the response and updates its UI or performs other actions based on the data or status code.

In order for the mobile app to communicate with the server, the app must have the necessary permissions and configurations. The required permissions depend on the type of communication protocol used and the security requirements of the application. Here are some examples of the required permissions:

Network access permission: The app must have permission to access the network, such as Wi-Fi or cellular data.

Internet permission: The app must have permission to use the internet to communicate with the server.

API key or authentication token: The app must have a valid API key or authentication token to access the server's services or data.

User permission: If the app requires access to the user's location, contacts, or other sensitive information, the user must grant permission to the app.

Firewall and security configurations: The server must have appropriate firewall and security configurations to prevent unauthorized access and protect the data and services provided by the server.

In summary, mobile and server interaction involves sending requests and responses over a network connection using APIs, HTTP requests, or socket connections. The mobile app must have the necessary permissions and configurations to communicate with the server, such as network access permission, API key or authentication token, and user permission. The server must have appropriate firewall and security configurations to protect its services and data.

### **Explanation 7 Marks**

**Q.4. Attempt any Three** (12)

- a. Explain pubspec.yaml file.

In Flutter, the pubspec.yaml file is a configuration file that defines the dependencies, assets, and metadata for a Flutter app or package. This file is located in the root directory of the project and is used by the Flutter tool to manage dependencies, generate code, and build the app.

Here's a breakdown of the different sections and properties of the pubspec.yaml file:

- name - This property specifies the name of the Flutter app or package. It should be a valid Dart package name and should not contain any spaces or special characters.
- description - This property provides a brief description of the app or package.
- version - This property specifies the version number of the app or package. It should follow the semantic versioning format (major.minor.patch) and should be updated whenever a new version is released.

environment - This section specifies the minimum version of the Flutter SDK required to run the app or package.

dependencies - This section specifies the external packages or libraries required by the app or package. Each dependency should be listed with its name and version number.

dev\_dependencies - This section specifies the development dependencies required by the app or package, such as testing frameworks or code generators. These dependencies are not included in the final app or package.

flutter - This section specifies the Flutter-specific configurations for the app or package, such as the Flutter SDK version, assets, and plugins.

assets - This property specifies the list of asset files that should be included in the app or package. These can be images, fonts, or other files that are required by the app.

plugins - This property specifies the list of Flutter plugins that should be included in the app or package. These plugins provide additional functionality to the app, such as accessing device sensors or interacting with native APIs.

The pubspec.yaml file is an important configuration file in Flutter that defines the dependencies, assets, and metadata for a Flutter app or package. By managing the dependencies and configurations in this file, the Flutter tool can generate code, build the app, and package it for distribution.

**Explanation 4 Marks**

- b. With the help of an example explain following

(4)

1. Assets

In Flutter, assets are any files that are bundled and deployed with the app, such as images, fonts, audio or video files, and configuration files. These assets can be accessed by the app at runtime and used to provide content, style, or configuration to the app.

For example, let's say you have an image file named 'my\_image.png' that you want to use in your Flutter app. To include this file as an asset, you would first add it to the 'assets' section of your pubspec.yaml file

2. build.gradle Android, the build.gradle file is a configuration file that controls the build process for the app. It specifies the dependencies, build settings, and other configurations required to compile the app and package it for distribution.

For example, let's say you want to add a new library to your Android app. To do this, you would first add the library as a dependency in your app's build.gradle file:

**Explanation 4 marks**

- c. Differentiate Firebase cloud firestore and Firebase RTDB (4)

Firebase Cloud Firestore and Firebase Realtime Database (RTDB) are both NoSQL databases offered by Firebase. While both databases are suitable for real-time data syncing and work well with Firebase's other services, there are some differences between them:

**Data Structure:**

Firebase RTDB stores data as a large JSON tree, where each key maps to a value. Firestore, on the other hand, stores data in a more structured format called collections and documents. In Firestore, each document contains fields, which are key-value pairs.

**Querying:**

Firestore supports more complex queries, such as range queries, sorting, and filtering by multiple fields. Firebase RTDB, in contrast, only supports simple queries, such as ordering and filtering by a single field.

**Scalability:**

Firestore is designed to handle larger and more complex datasets, while Firebase RTDB is better suited for smaller, simpler data models. Firestore also has better scalability features, such as sharding, which allows the database to be split across multiple servers.

**Cost:**

The cost of using Firestore is based on the number of reads, writes, and storage used, while Firebase RTDB is charged based on the amount of data transferred over the network.

**Real-time updates:**

Both Firestore and RTDB support real-time updates, but the way they handle these updates is different. Firebase RTDB pushes updates to clients as soon as they occur, while Firestore uses a more efficient mechanism called real-time listeners that only updates clients when the relevant data changes

#### **Explanation 4 Marks**

- d. Differentiate Hybrid application development and native application development (4)

Hybrid application development and native application development are two approaches to developing mobile apps. Here are some of the key differences between the two:

**Technology:**

Native apps are developed using platform-specific technologies and languages such as Swift or Objective-C for iOS and Java or Kotlin for Android. Hybrid apps, on the other hand, are built using web technologies such as HTML, CSS, and JavaScript and are wrapped in a native container using frameworks such as React Native or Ionic.

**Performance:**

Native apps generally offer better performance and faster response times compared to hybrid apps. This is because native apps are optimized for the specific platform and can take advantage of the platform's hardware and software features, while hybrid apps are essentially web apps running in a container and can be slower and less responsive.

**User experience:**

Native apps can provide a better user experience by taking advantage of the platform's native features and user interface guidelines. Hybrid apps may have some limitations in this regard, as they may not be able to fully utilize all the native features of the platform.

Development speed:

Hybrid apps can be developed faster compared to native apps, as they can be built using web technologies and the same codebase can be used across multiple platforms. Native app development, on the other hand, requires separate development for each platform.

Cost:

Hybrid app development can be less expensive compared to native app development, as the same codebase can be used across multiple platforms, reducing the amount of development effort required. Native app development can be more expensive as it requires separate development for each platform.

#### **Explanation 4 Marks**

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Native and hybrid mobile applications follow the same steps in MDTA, involving the following phases: initial analysis, requirements gathering, design, implementation, testing, deployment, and maintenance.

Native app development typically follows a linear process of analysis, design, implementation, and testing. In contrast, hybrid app development follows a more iterative process, where frequent back-and-forth communication between developers and stakeholders is common.

Native app development involves writing platform-specific code for each platform, such as Java for Android or Swift for iOS. This can lead to code duplication and increased complexity. Hybrid app development, on the other hand, uses a single codebase that runs on both platforms, making it easier to maintain and update the application.

Native app development often requires extensive testing to ensure compatibility across different devices and operating systems. Hybrid app development, however, can benefit from cross-platform testing tools like Appium, which allows for automated UI testing across multiple platforms.

Native app development can be slower than hybrid development due to the need for separate codebases and the lack of reuse. Hybrid app development, on the other hand, can be faster due to the shared codebase and the ability to reuse existing components.

Native app development can provide a better user experience by taking advantage of the platform's native features and user interface guidelines. Hybrid apps may have some limitations in this regard, as they may not be able to fully utilize all the native features of the platform.