**Birla Institute of Technology & Science, Pilani**

**Work-Integrated Learning Programmes Division**

**First Semester 2023-2024**

**Comprehensive Examination**

**(EC-3 Regular)**

Course No. : SE ZG651

Course Title : SOFTWARE ARCHITECTURES

Pattern of Exam : TYPED ONLY

Nature of Exam : Open Book

Weightage : 40%

No. of Pages = 3

# No. of Questions = 8

Duration : 2 ½ Hours

Date of Exam : Saturday, 25/11/2023 (FN)

Note:

1. Please follow all the *Instructions to Candidates* given on the cover page of the answer book.
2. All parts of a question should be answered consecutively. Each answer should start from a fresh page.
3. Assumptions made if any, should be stated clearly at the beginning of your answer.

TekAlli’s primary concern was to develop a desktop application that would allow files to be transferred quickly and easily. After experimenting with various file transfer methods, such as byte transfer and steam transfer, TekAlli settled on the FTP file transfer method, which enables the transfer of files of up to 1 GB in size. The application that was developed by TekAlli employs different web services and transfers files seamlessly with strong and reliable firewall settings in place. They also developed a new user-friendly interface to help the client’s team quickly acclimate to the new system. In accordance with the client’s additional requirements, they also implemented SharePoint-based file transfer capabilities. This offers the ability to transfer files effortlessly from one SharePoint application to another.

As a result of working with TekAlli, the client now has a robust file transfer solution that allows the rapid transfer of large files to the selected county locations from their desktop and SharePoint application. Finally, the new system facilitates automated notifications upon transferring files, and even offers maintenance of file transfer history between the countries. The client has benefited tremendously with this dynamic solution, eliminating the hassles of manual file transfer while increasing speed and efficiency in their daily processes.

**a. What can happen on software integration strategy if the volume of backend data grows substantially after finishing the integration? Justify with proper explanation. [6 Marks]**

**b. What can happen on software integration strategy if the users ask for modification after finishing the integration? Justify with proper explanation. [6 Marks]**



A real-estate business house that owns and runs a real-estate listing website that caters to buyers, sellers and brokers wanted to launch a new real estate marketplace platform that enables borrowers to directly access affordable real estate loans. The real-estate business house had an idea about what they wanted their new platform to do but lacked the experience and resources to develop and implement it themselves.

TekGen, an IT organization, created a dynamic web platform for the real-estate business house that allows borrowers and investors to interact directly to find partners and process real estate loans. In addition to allowing borrowers to apply for loans and lenders to invest their money into the marketplace, the client’s real estate web platform includes a news and press release section that provides visitors with immediate real estate information.

TekGen’s agile methodology ensured the client was apprised and could provide feedback through every step of the project and saved on cost and time by allowing TekGen to address changing circumstances iteratively. TekGen performed component testing to make sure the delivered product worked as a cohesive whole and met the standards the client expected and offer on-going support and maintenance to keep the platform up to date and running at peak functionality.

The client received a product that met their business needs and performed the functions they required to provide their customers with a responsive, user-friendly real estate marketplace investment web platform.

a**. What can happen on software integration strategy if the volume of backend data grows substantially after finishing the integration? Justify with proper explanation. [6 Marks]**

**b. What can happen on software integration strategy if the users ask for modification after finishing the integration? Justify with proper explanation. [6 Marks]**



A garment house owns a large textile company with separate locations spread throughout their State. They need a system to manage and plan their resources from a single, easy-to-use location.

TekNet, an IT organization, worked directly with the client in addressing and solving the issues they were facing. The ERP system TekNet developed facilitates quick response times to inquiries and allows the complete tracking of material throughout the textile manufacturing process, including wastage and elongation.

The system includes dynamic modules such as dashboards, data analysis and reporting to obtain key information, including different reports, and an established approval chain that provides senior management with key information throughout the process. The new system makes it easy to manage multiple plants from a single location.

The system keeps a full, up-to-date record of inventory and sends out auto-alerts when stock needs to be re-ordered. Email alerts and SMS notifications keep users updated on new developments while material wastage management provides the ability to keep track of material once a work order is processed.  
  
TekNet provided the client with everything they were looking for and considered every possibility to implement the best solution for the client.

a**. What can happen on software integration strategy if the volume of backend data grows substantially after finishing the integration? Justify with proper explanation. [6 Marks]**

**b. What can happen on software integration strategy if the users ask for modification after finishing the integration? Justify with proper explanation. [6 Marks]**

2. Just assume we are receiving a data file which consists of,

Invoice information

Payment information related to the invoices already delivered.

Notes regarding already delivered invoices.

And Credit Notes (Invoice Cancellations)

Just forget about what information we need to deal with for the moment and just think about what type of data we need to import into the system, which are mentioned below

* Invoices
* Payments
* Notes
* Credit Notes

Those are the four types of data that come with the data files. All we need to do is transform the data file content into a data object with the above-mentioned properties. So, we have to make sure we read the data properly and have them stored in the data objects in the end.

Explain in detail how you will implement Architectural Pattern Solution using Pipes and Filters without diagram? Mention the challenges involved for the above solution? What are the advantages of the above pattern with respect to above mentioned scenario?

**4+3+2 = 9 Marks**

1. You must develop a gaming software. How will you implement Service Oriented Architecture for developing the software? What is the benefit of using it?

**2+2 =4 Marks**



1. A window management system is a type of interactive user interface that enables users to work with multiple separate applications at the same time. This is achieved using a desktop metaphor in which each process is associated with a graphical window. A window management system provides the functionality to create and manipulate the display of multiple processes. A window management system includes different important components such as

* Input manager for I/O controlling,
* Process manager for managing application processes,
* Screen manager for maintaining the integrity of the screen and
* Window manager for managing the windows that are related to the application processes.

Identify the three architectural patterns suitable for the above scenario. Justify your selection in detail for each of the architectural pattern. Also mention the challenges for implementing the selected architectural pattern. **2+6+2 = 10 Marks**

Multiple business processes in an organization require the user authentication functionality.

1. How will you implement Service Oriented Architecture to implement the above mentioned scenario? What is the benefit of using it? **2+1 =3 Marks**
2. A weather forecasting system needs to process a large volume of data very quickly. The data to be processed include wind speed and direction, temperature, humidity. These data are collected from 10 million locations every 2 minutes. The processing of these data to predict the weather consists of 2 steps: Step 1: Calculate the trend of each parameter during the last 72 hours. Step 2: Correlate the trends to predict the weather for the next 3 days.

Which patterns can be best suited for the above-mentioned scenario? Justify your answer for selection of the pattern with detail explanation. What are the challenges that may be faced for your selected pattern. **2+3+2 = 7 Marks**

1. Develop 3 different architectures using Layered, MVC and Broker for Gaming software and compare them regarding fulfilment of quality attributes.

The game must support following User operations:

* Game can be played on any device.
* Any number of users are possible to play.
* User interface must be good.
* All payers should score marks and highest score to be conveyed to other players.
* Winner of the game will be informed and will be rewarded.

**6 Marks**

a)

A Fleet Management Application has a reliability/availability of 99.95%. A proposal to improve the system by having a parallel system was envisaged. A legacy system is available with the company which will have no additional cost but has a reliability of only 80%. Compute the overall reliability of the system if this system is introduced. 3

After introducing this system, the company was informed that all location updates need to be updated to individual fleet operators on a real-time basis. This system has a reliability/availability of 99%. What would be the impact on system reliability/availability? 3

b) 3+3+3

Use the Cost-Benefit Analysis Method (CBAM) to assess which alternative solution to use to implement a middleware system upgrade for a fleet management application that tracks the real-time locations of delivery trucks. CBAM considers existing utility and expected utility in the decision-making process.

• The current middleware system processes 1,000 location updates per minute with an average response time of 200 milliseconds. The theoretical minimum possible is 50 milliseconds with up to 5000 location updates per minute. The current utility is computed as 5000 utility points.

The cost for each improvement is presented below:

|  |  |  |  |
| --- | --- | --- | --- |
| 2000 updates/min | 3000 updates/min | 4000 updates/min | 5000 updates/min |
| 3 Lakhs | 7 Lakhs | 10 Lakhs | 20 Lakhs |

|  |  |  |
| --- | --- | --- |
| 150 milliseconds | 100 milliseco | 50 milliseco |
| 3 Lakhs | 7 Lakhs | 10 Lakhs |

• Three alternative approaches to upgrading infrastructure have been presented. Alternative 1 requires provides 4000 location updates per minute at with 150 seconds response time; Alternative 2 requires provides 2000 location updates per minute at with 150 seconds response time; Alternative 2 requires provides 4000 location updates per minute at with 50 seconds response time;

• Every 1000 location update per minute gives a utility of 100 points and every 50 miliseconds improvement gives a utility of 300 points.

• By implementing each alternative, you anticipate that the middleware can dynamically allocate resources based on the network conditions in abetter way.



a)

A Fleet Management Application has a reliability/availability of 99.95%. A proposal to improve the system by having a parallel system was envisaged. A legacy system is available with the company which will have no additional cost but has a reliability of only 50%. Compute the overall reliability of the system if this system is introduced. 3

After introducing this system, the company was informed that all location updates need to be updated to individual fleet operators on a real-time basis. This system has a reliability/availability of 97%. What would be the impact on system reliability/availability? 3

b) 3+3+3

Use the Cost-Benefit Analysis Method (CBAM) to assess which alternative solution to use to implement a middleware system upgrade for a fleet management application that tracks the real-time locations of delivery trucks. CBAM considers existing utility and expected utility in the decision-making process.

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• Every 1000 location update per minute gives a utility of 100 points and every 50 milliseconds improvement gives a utility of 300 points.

• By implementing each alternative, you anticipate that the middleware can dynamically allocate resources based on the network conditions in a better way.



a)

A Fleet Management Application has a reliability/availability of 99.95%. A proposal to improve the system by having a parallel system was envisaged. A legacy system is available with the company which will have no additional cost but has a reliability of only 70%. Compute the overall reliability of the system if this system is introduced. 3

After introducing this system, the company was informed that all location updates need to be updated to individual fleet operators on a real-time basis. This system has a reliability/availability of 98%. What would be the impact on system reliability/availability? 3

b) 3+3+3

Use the Cost-Benefit Analysis Method (CBAM) to assess which alternative solution to use to implement a middleware system upgrade for a fleet management application that tracks the real-time locations of delivery trucks. CBAM considers existing utility and expected utility in the decision-making process.

• The current middleware system processes 1,000 location updates per minute with an average response time of 200 milliseconds. The theoretical minimum possible is 50 milliseconds with upto 5000 location updates per minute. The current utility is computed as 5000 utility points.

The cost for each improvement is presented below:

|  |  |  |  |
| --- | --- | --- | --- |
| 2000 updates/min | 3000 updates/min | 4000 updates/min | 5000 updates/min |
| 3 Lakhs | 7 Lakhs | 10 Lakhs | 20 Lakhs |

|  |  |  |
| --- | --- | --- |
| 150 milliseconds | 100 milliseco | 50 milliseco |
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• Three alternative approaches to upgrading infrastructure have been presented. Alternative 1 requires provides 4000 location updates per minute at with 100 seconds response time; Alternative 2 requires provides 2000 location updates per minute at with 50 seconds response time; Alternative 2 requires provides 4000 location updates per minute at with 150 seconds response time.

• Every 1000 location update per minute gives a utility of 100 points and every 50 milliseconds improvement gives a utility of 300 points.

• By implementing each alternative, you anticipate that the middleware can dynamically allocate resources based on the network conditions in a better way.