University of Colombo, Sri Lanka

University of Colombo School of Computing

DEGREE OF BACHELOR OF INFORMATION TECHNOLOGY (EXTERNAL)

Academic Year 2023— 2^{nd} Year Examination — Semester 4

IT4206 — Enterprise Application Development

Part 2 - Structured Question Paper

(2 Hours for both Part 1 and Part 2)

To be completed by the candidate							
Index Number							

Important Instructions

- This paper has **two (2) parts, Part 1 and Part 2**.
- The total duration of **both Part 1 and Part 2 is 2 hours**.
- The final mark for the paper will be determined by averaging the scores of Part 1 and Part 2, each of which is graded out of **100**.
- The medium of instructions and questions is English. Students should answer in the medium of English language only.
- This paper (Part 2) has **2 questions** on **7 pages**. Answer **both** questions.
- Write your answers **only on the space provided** on this question paper.
- Do not tear off any part of this question paper. Under no circumstances may this paper (or any part of this paper), used or unused, be removed from the Examination Hall by a candidate.
- Note that questions appear on both sides of the paper. If a page or part of a page is not printed, please inform the supervisor/invigilator immediately.
- Any electronic device capable of storing and retrieving text, including electronic dictionaries, smartwatches, and mobile phones, is not allowed.
- Calculators are **not allowed**.
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To be completed by the examiners

1	
2	
Total	

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1. (a). *Cross cutting* concerns is one of the major concerns in modern software. List down **two (2)** other concerns.

[4 marks]

Core Concerns, Plumbing. Topic 1 - Page 27

(b). Describe the cross cutting concerns of modern software.

[8 marks]

These are the secondary operations that are necessary to keep the overall system running correctly and efficiently. Topic 1 - Page 29

(c). Write the *WebSocket* annotations used to mark a function for invocation in two scenarios when,

- a new connection is established to the specific endpoint.
- handling incoming messages.

[6 marks]

@OnOpen,
@OnMessage, Topic 10 - Page 24

(d). Session bean is one type of JavaBean. List down two (2) other JavaBean types.

[6 marks]

Any two of the following
Entity Beans, Message driven beans, Singleton session beans, Topic 11 - Page 7

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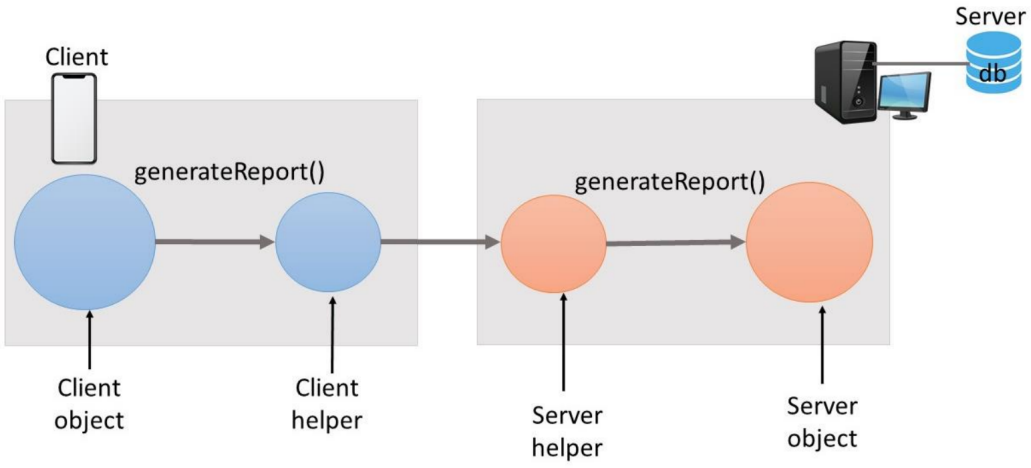
(e). Illustrate the process of *Remote Method Invocation (RMI)* using a diagram including all the components where a client calls a method called *"generateResults()"* from a server.

[16 marks]

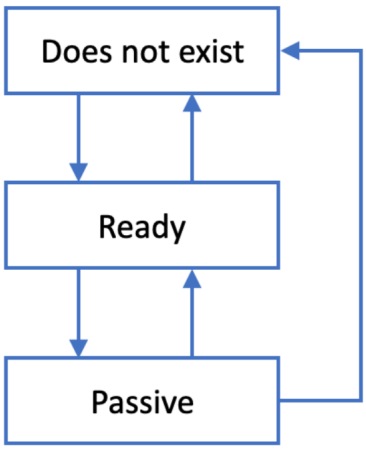
Topic 2 - Page 14
similar figure as follows (2 mark for each component/arrows)



(f). Illustrate the life cycle of a stateful session bean using a diagram.

[10 marks]

Topic 11- page 32
similar diagram as follows (2 mark for each component)



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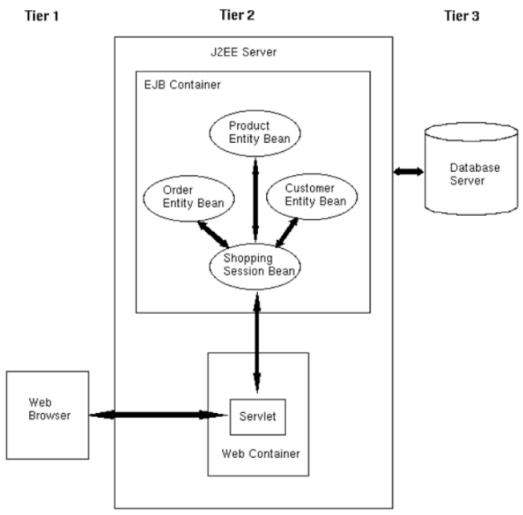
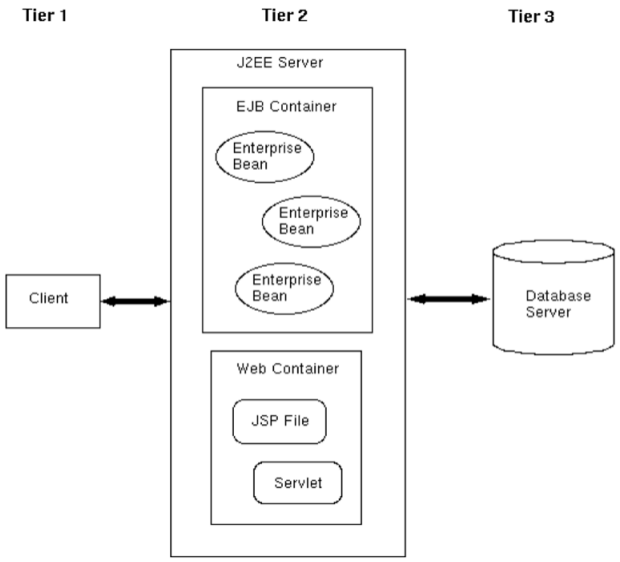
2. (a). The 3-tier architecture is a popular architectural pattern adopted by many software platforms in the industry. Frameworks and components such as web servers, servlets, JavaServer Pages (JSP), Enterprise JavaBeans (EJBs), data persistence (databases), and thin clients (web browsers) collectively reside in different tiers in a 3-tier architecture. Using a diagram, represent the accepted allocation of the above-mentioned components in a typical 3-tier architecture. The connectivity of the components should be clearly stated in the diagram.

[10 marks]

Either one of the diagrams with 3-tier separation and components in the correct tier.





Index Number | | | | | | | |

(b). Relational Databases (RDBMS) are the most popular persistence model for data storage in business platforms. Storing and retrieving data from relational databases could be done by direct access to a relational model using Java Database Connectivity (JDBC) and Structured Query Language (SQL) or using Object Relational Mapping (ORM). Briefly describe three (3) advantages of using ORM over direct SQL-based methods through JDBC.

[10 marks]

1. ORM maps the relational data (data in tables) to the attributes of the objects in an object-oriented language like Java. E.g. Vachar to String, INTEGER to int/Integer, etc.
2. Query optimisation and caching in ORM and not present in JDBC
3. Database portability – heterogeneous databases are possible with ORM – because the object mapping and DBMS are isolated.

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(c). When using Object-Relational Mapping (ORM) in applications for processing relational data, there can be performance bottlenecks due to reading and writing large datasets from a database. Lazy loading and Eager loading are two popular methods employed in ORM data processing with relational databases. Briefly describe the difference between Lazy and Eager loading methods, and propose which method is suitable for situations involving large datasets and performance bottlenecks.

[10 marks]

With lazy loading, entities can map relationships, but only load those relationships when needed.
With eager loading most relationships are frequently reloaded from a relational DB to the ORM object data model. (5 marks)

Lazy loading is more suitable for large data sets and performance bottleneck-related situations due to only loading the relationships when needed/on-demand. (5 marks)

(d). Representational State Transfer (REST) is an architectural style that enables services to work best on the Web. Describe three (3) principles in RESTful services that enable building applications that are simple, lightweight, and fast.

[10 marks]

(Any 3 of the below)
1. Resource identification through URI: A RESTful web service exposes a set of resources that identify the targets of the interaction with its clients.
2. Uniform interface: Resources are manipulated using a fixed set of four create, read, update, and delete operations: PUT, GET, POST, and DELETE.

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3. Self-descriptive messages: Resources are decoupled from their representation so that their content can be accessed in a variety of formats, such as HTML, XML, plain text, PDF, JPEG, JSON, and others.
4. Stateful interactions through hyperlinks: Every interaction with a resource is stateless; that is, request messages are self-contained.

(e). HTTP stands for Hypertext Transfer Protocol. It defines a protocol used by web browsers and servers to communicate with each other. HTTP is an application protocol that is referred to as a stateless protocol.
Servlet support for HTTP is so common that the *javax.servlet.http* package is dedicated to supporting the HTTP protocol. Describe four (4) methods that can be used by HTTP-based servlets to manage sessions and overcome the stateless nature of the HTTP protocol.

[10 marks]

Four ways of managing sessions
Cookies
URL Rewriting
HttpSession
Hidden fields

_____ ********** _____