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JAVA INSTITUTE FOR ADVANCED TECHNOLOGY

Department of Examinations

Course – (Leading To)	Birmingham City BSc (Hons) Se - Top Up
Unit Name	Business Component Development II
Unit Id	JIAT/BCD II
Assignment Id	JIAT/BCD II/EX/01
Assignment Summary	Develop a banking system using EJB, focusing on time-based operations with Timer Services, secure transaction management, and robust security
Duration	2 Weeks
Submission Via	Online (Student Portal)
Document Format	Document Format (Pdf)

GUIDELINES FOR CANDIDATES

- Your studies will be governed by the Java Institute Academic Regulations on Assessment, Progression and Awards.
- Students are expected to use reference books, the Internet, journals and other similar sources in order to accomplish the task specified above.
- Students are expected to refrain from repeating any content in their research document.
- At the re-assessment attempt, the mark is capped and the maximum mark that can be achieved is 40%.

CHEATING AND PLAGIARISM

Both cheating and plagiarism are totally unacceptable, and the Institute maintains a strict policy against them. It is YOUR responsibility to be aware of this policy and to act accordingly.

The basic principles are:

- Don't pass off anyone else's work as your own, including coding examples. This is plagiarism and is viewed extremely seriously by the Institute.
- Don't submit a piece of work in whole or in part that has already been submitted for assessment elsewhere. This is called duplication and, like plagiarism, is viewed extremely seriously by the Institute.
- Always acknowledge all of the sources that you have used in your assignment or project.

- If you are using the exact words of another person, always put them in quotation marks.
- Check that you know whether the assignment is to be produced individually or whether you can work with others.
- If you are doing group work, be sure about what you are supposed to do on your own.
- Never make up or falsify data to prove your point.
- Never allow others to copy your work.
- Never lend disks, memory sticks, or copies of your coursework to any other student. in the Institute; this may lead to you being accused of collusion.

LEARNING OUTCOMES:

This assignment addresses the following unit learning outcomes:

1. Demonstrate a clear understanding regarding the role of time services in Business Component Development while being able to create, integrate and handle the timer services of the application.

2. Identify and define the main concepts relating to Interceptor classes and methods, including the association of multiple business Interceptor methods with an enterprise bean.

3. Clearly describe transaction demarcation management, including the types of transaction, evaluating the most applicable transaction for a given scenario.

4. Undertake a critical analysis of the security architecture required in an application, in addition to the security measures taken to ensure the privacy of a session, while paying special attention to programmatic authorization.

5. Define best practices and state the benefits of using EJB technology best practices while integrating exception handling to the application for further optimization.

6. Distinguish the exception handling methods that are specific to Enterprise Java Beans and be able to optimize the performance of the application through exception handling.

7. Integrate the organisation EJB components in a split directory structure, including the package and deploy where an appropriate deployment tool as well as appropriate packaging have to be selected.

ASSIGNMENT DETAILS:

Title: Developing a Banking System with EJB and Time Services

SITUATION:

A national bank is planning to overhaul its core banking system to improve the efficiency of its operations and enhance customer service. The new system will handle critical banking functions such as managing customer accounts, processing financial transactions, and generating periodic reports. A key requirement is the ability to perform time-sensitive operations like scheduled fund transfers, automated interest calculations, and daily balance updates. These operations need to be executed at precise intervals to ensure the smooth functioning of the bank's services.

To achieve this, the bank has chosen to develop the system using Enterprise JavaBeans (EJB), with a specific focus on integrating EJB Timer Services. Timer Services will allow the system to schedule and execute tasks automatically at specified times, ensuring that operations like fund transfers and interest calculations occur without manual intervention. Additionally, the system must ensure that all transactions are processed securely and efficiently, with proper transaction demarcation management to maintain data integrity across the system.

Task 1 – EJB Application (30 marks)

Analyse the scenario provided and design a suitable EJB-based solution that integrates time services. Implement the solution and document it in a technical report (up to 1000 words).

> **Note:** The technical report has a limit of 1000 words, excluding the report pro-forma formatting, any figures, test plans and program source code. Any program source code included in your technical report must be written in Java.

- **Analysis of the Scenario (10 marks)**
  - Clearly articulate the banking operations that require time-sensitive processing, such as scheduled fund transfers and interest calculations.
  - Identify the key components of the system, including the EJB Timer Services, which will manage these operations.
  - Discuss potential challenges, such as ensuring data consistency during concurrent transactions and handling failures in scheduled tasks.
  - Include a brief evaluation of non-functional requirements (NFRs), such as reliability, availability, and security.
- **Design of the EJB Solution**
  - Time Services Integration (**5 marks**)
    - Detail how EJB Timer Services will be used to schedule and manage operations like fund transfers and interest calculations.
    - Describe how timers will be configured, triggered, and managed within the system to ensure timely execution.
    - Provide a code snippet that demonstrates how to create and configure an EJB Timer.

Highlight the use of **@Schedule** annotation or programmatic timer creation and include comments on how the timer triggers operations.

- Outline a basic test strategy to ensure timer tasks execute reliably and under load.

- Transaction Demarcation Management (**5 marks**)
  - Explain the types of transactions that the system will handle, such as local versus global transactions.
  - Evaluate which transaction demarcation strategy is most appropriate for different banking scenarios, such as processing loans or transfers.
  - Include a code example that demonstrates transaction management in EJB, using **@TransactionAttribute** annotations. Show how to handle different transaction types and provide comments explaining the rationale behind your choice.

- Security Architecture (**5 marks**)
  - Describe the security model for the EJB-based system, including authentication, authorization, and role-based access control.
  - Explain how Java EE security annotations such as **@RolesAllowed**, **@PermitAll**, and @**DenyAll** will be applied to secure EJB methods for different user roles.
  - Discuss how **JAAS (Java Authentication and Authorization Service)** or container-managed security will be configured in the application server.

- Sequence Diagrams (**5 marks**)
  - Provide sequence diagrams that illustrate the flow of operations during a scheduled transaction.
  - Demonstrate interactions between Timer Services, transaction management, and security components.
  - Include notes on performance implications and concurrency scenarios.

- Submit the working sample code and project with a well-organized structure, including packages and classes.

Task 2 – Descriptive explaining (approx. 400 words, 30 marks)

Evaluate the effectiveness of utilizing the J2EE platform for creating scalable and secure applications, with a specific focus on the Banking System

1. Usage of Time Services (**10 marks**)
   - Discuss how time services facilitate the automation of critical ERP functions, such as scheduled inventory updates and periodic reporting.
   - Explain the advantages of automating these processes in terms of operational efficiency and accuracy.
   - Provide a code snippet showing the implementation of a scheduled task using EJB Timer Services.

- Highlight the configuration details, timing settings, and include error-handling logic.
- Describe how test cases and monitoring tools are used to ensure task reliability.

2. Transaction Management (**10 marks**)
   - Explain the transaction demarcation strategies used in the ERP system.
   - Include a code example that illustrates transaction management, especially using **UserTransaction**.
   - Discuss decision-making involved in transaction strategies and testing approaches to ensure data integrity.

3. Security Measures (**10 marks**)
   - Analyse the security architecture required to protect ERP system data.
   - Emphasize the role of programmatic authorization.
   - Provide code snippets using **@RolesAllowed** and exception handling for unauthorized access.
   - Describe testing techniques used to validate role-based access and security event logging.

Task 3 - Critical Analysis (approx. 200 words for each topic, 30 marks)

Critically analyse the following topics based on your designed solution:

1. Interceptor Methods
   - Evaluate interceptors in managing cross-cutting concerns like logging and security. **(3 marks)**
   - Compare approaches to implementing interceptors in the ERP system. **(3 marks)**
   - Provide code examples for interceptors and explain their performance implications. **(2 marks)**
   - Suggest unit testing strategies for interceptors to ensure modular and efficient design. **(2 marks)**

2. Exception Handling
   - Analyse different exception handling strategies and their impact on reliability and user experience. **(3 marks)**
   - Evaluate your approach using sample test cases and metrics. **(3 marks)**
   - Provide examples with **@ApplicationException** and explain how rollback scenarios are managed. **(4 marks)**

3. Split Directory Structure
    - Evaluate how your directory structure affects system scalability and development efficiency. **(4 marks)**
    - Compare alternatives and justify your structure. **(3 marks)**
    - Reflect on how the structure facilitates test automation and code reuse. **(3 marks)**

Task 4 - Critical Description (approx. 200 words, 10 marks)

Impact of EJB Best Practices:

- Analyse the performance implications of implementing EJB best practices, with metrics or benchmarks. **(3 marks)**
- Evaluate trade-offs between different best practices. **(2 marks)**
- Assess the maintainability and scalability benefits of these implementations. **(2 marks)**
- Provide real-world examples or test results demonstrating how best practices improve reliability and performance. **(3 marks)**

-END OF ASSIGNMENT-

Assignment Submission Guidelines for Students

Students are advised to strictly follow the guidelines specified herein when formulating and submitting research assignments.

Important Information for Students

1. The assignment should be submitted only as a soft copy in a PDF format on or before the specified assignment due date.
2. The soft copy of the assignment should be uploaded to the student portal using the NIC.
3. The submission date provided for all assignments are the final dates on which you can hand upload the assignments. Please note that late submissions are not allowed.
4. Plagiarism is treated as a serious offence and the work you produce should be individual and original. However, note that students will have to work in groups in certain scenarios.
5. All sources of information in any assignment must be referenced using the "Harvard referencing" system, where a reference listing should be included at the end of the assignment.
6. Please contact your branch on assignments, re-submission, and related procedures.
7. Students are expected to maintain a backup of all assignments. The Java Institute for Advanced Technology retains all the rights to re-call soft copies of any assignment at any time during the course.
8. Students should use the attached assignment coversheet and declaration of authentication form to the assignment.
9. Students are expected to provide the following information in their assignment coversheet:
    - Student name
    - NIC No
    - Subject name
    - Subject code
    - Branch
10. Assignment Report Rules
    - Paper Size: A4
    - Word Count:2000 words
    - Line Spacing:1.5
    - Header and Footer:1 inch
    - Basic Font Size:12pt
    - Heading:16pt
    - Sub-headings:14pt, Bold
    - Body:12pt, Justified Aligned
    - Font Style: Times New Roman/Calibri