ISO 9001:2008 Certified Institute

JAVA INSTITUTE FOR ADVANCED TECHNOLOGY

Department of Examinations

Course – (Leading To)	Birmingham City University BSc (Hons) SE - Top Up
Unit Name	Object Oriented Design Patterns II
Unit Id	JIAT/OODP II
Assignment Id	JIAT/OODP II /EX/01
Assignment Summary	This assignment requires the application of Object-Oriented Design Patterns which they studied at the class to solve practical, real-world problems. Students must analyze given scenarios, select appropriate Design Patterns, and provide a justified implementation. The assignment is structured into five tasks, each contributing equally to the final grade. All tasks are compulsory and must be submitted via the online portal by the specified deadline.
Duration	2 Week
Submission Via	Online (Student Portal)
Document Format	Document Format (Pdf)

GUIDELINES FOR CANDIDATES

- **Answer all questions**
- 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 reassessment 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.

ASSIGNMENT BRIEF:

You are required to complete the following tasks by applying appropriate data structures and algorithms to the given scenarios. Each task requires a thorough understanding of the concepts and their application in solving real-world problems.

GlobeMed Healthcare Management System

GlobeMed is a large healthcare organization that operates several hospitals, clinics, and pharmacies across the country. Currently, the organization struggles with managing patient records, scheduling appointments, handling billing, and coordinating care across its facilities. The existing systems are outdated and not well-integrated, leading to inefficiencies, errors, and poor patient experiences.

To address these issues, GlobeMed's management has decided to implement a comprehensive **Healthcare Management System**. This system should integrate patient records, appointment scheduling, billing, and care coordination into a single, efficient platform. The system will need to support various types of healthcare professionals (doctors, nurses, pharmacists) and handle complex processes such as insurance claims and medical reporting.

The project has been assigned to **MediTech Solutions**, where you are a senior software engineer responsible for leading the development team. You are expected to design and implement the system using appropriate **design patterns** to ensure scalability, maintainability, and ease of use.

In this assignment, you will work on six parts. In parts A, B, C, D, E, and F, you will focus on different components of the system, applying your knowledge of design patterns. Part G and H provides instructions for the mid-assignment checkpoint for feedback, final presentation and report.

Part A: Patient Record Management (15 marks)

GlobeMed needs a system for managing patient records, including personal details, medical history, and treatment plans, securely and accessibly for authorized personnel only.

- **Tip**: When choosing design patterns for this part, consider data security, privacy, and the need for authorized data access. Examples: Adapter for data interoperability.

1. Identify the most suitable design pattern for managing secure, accessible patient records. (3 marks)
2. Analyze how the identified pattern could be used to securely manage and retrieve patient data. (4 marks)
3. Critically evaluate the benefits of using this design pattern, specifically for data security, accessibility, and maintainability. (8 marks)

Part B: Appointment Scheduling (15 marks)

Efficient appointment scheduling is necessary for consultations, diagnostics, and surgeries across GlobeMed facilities. Patients need to book appointments with different healthcare professionals while the system manages staff schedules.

- **Tip**: Look for patterns that support scheduling flexibility and real-time conflict management, such as Command to encapsulate scheduling requests.

1. Identify the most suitable design pattern for the scheduling functionality. (3 marks)
2. Provide a UML class diagram to demonstrate the selected design pattern's mechanism. (4 marks)
3. Critically evaluate the pattern's benefits for appointment management, especially in multi-location scenarios. (8 marks)

Part C: Billing and Insurance Claims (15 marks)

GlobeMed needs a flexible, decoupled billing and insurance claims processing system for various services. This includes consultations, treatments, and medications, and should support billing directly or through insurance.

- **Tip**: Focus on patterns that allow decoupling of billing from claims processing to increase flexibility, such as the Chain of Responsibility for multi-step claim approvals.

1. Identify the most suitable design pattern for handling billing and insurance claims. (3 marks)
2. Analyze how this pattern enables flexible billing processes in the system. (4 marks)
3. Explain the design pattern's role in implementing insurance claim processing, especially for scalability. (8 marks)

Part D: Managing Medical Staff Roles and Permissions (15 marks)

GlobeMed employs a diverse range of medical staff, including doctors, nurses, pharmacists, and administrative personnel. Each role requires different levels of access to the system and specific permissions to perform various tasks. Based on this requirement:

i. Identify the most suitable design pattern to manage roles and permissions in the system. (3 marks)
ii. Analyze how the identified design pattern can be used to implement role-based access control in the system. (4 marks)
iii. Write a sample code snippet demonstrating the application of the design pattern to fulfill this requirement. (8 marks)

Part E: Generating Medical Reports (15 Marks)

GlobeMed needs to generate various reports, such as patient treatment summaries, diagnostic results, and financial reports. The system should allow for the separation of report generation logic from core medical data objects. Based on this requirement:

i. Identify the most suitable design pattern to separate report generation logic from medical data objects. (3 marks)
ii. Explain how the identified design pattern allows you to extract necessary information and generate reports. (4 marks)
iii. Critically evaluate the benefits of using the selected design pattern for maintainability and report flexibility. (8 marks)

Part F: Security Considerations (15 marks)

Healthcare data is sensitive, so the system must enforce robust security for all components. Consider factors like data encryption, user authentication, and access logging.

1. Identify and justify design patterns for secure data handling across the system (patient records, billing, etc.). As examples you can use include Decorator for additional data handling layers. (5 marks)
2. Explain how these patterns address specific security risks in healthcare, such as unauthorized data access or data tampering. (5 marks)
3. Discuss security best practices, like secure coding, encryption, and access control, that complement these patterns for enhanced protection. (5 marks)

Part G: Mid-Assignment Checkpoint for Feedback (Optional)

Midway through the assignment (suggested time: one week), you may submit initial work for feedback on any parts completed or in progress. This will help refine your approach and address any challenges early on.

Part H: VIVA and Documentation (10 Marks)

i. You are expected to develop the Healthcare Management System based on the given scenario.
ii. You will demonstrate your application in a VIVA session, where you will explain your use of design patterns, discuss architectural choices, and answer questions related to the design, functionality, and overall system structure. (5 marks)
iii. You are also expected to create comprehensive documentation, including a UML class diagram and working code, to illustrate the design and functionality of your application. (5 marks)

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