Unit 20: Applied Programming and Design Principles

Assignment Brief

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| Student Name/ID Number |  |
| Unit Number and Title | Unit 20: Applied Programming and Design Principles |
| Academic Year | 2024-2025 |
| Unit Tutor |  |
| Assignment Title | Discuss design principles and design the application architecture based on scenario's requirements |
| Issue Date | 1/1/2024 |
| Submission Date |  |
| Submission Format | |
| *Format:*   * **A report specified in Activity 1, 2, 3 and 4** * You must use font *Calibri size 12, set number of the pages and use multiple line spacing at 1.5. Margins must be: left: 1.25 cm; right: 1 cm; top: 1 cm and bottom: 1 cm.* * You should use in text references and a list of all cited sources at the end of the essay by applying Harvard referencing style. * The recommended word limit is *1500-2000 words (+/-10%)*, excluding the tables, graphs, diagrams, appendixes and references. You will not be penalized for exceeding the total word limit. * The cover page of the report has to be the Assignment front sheet 1 (to be attached with this assignment brief).   *Submission:*   * Students are compulsory to submit the assignment in due date and in a way requested by the Tutor. * The form of submission will be a soft copy posted on <http://cms.btec.edu.vn/>. * Remember to convert the Word file into PDF file before the submission on CMS. Students are advised to use latex to write the assignment.   *Note:*   * The individual Assignment *must* be your own work, and not copied by or from another student or from anywhere. * If you use ideas, quotes or data (such as diagrams) from books, journals or other sources, you must reference your sources, using the Harvard style.   Make sure that you understand and follow the guidelines to avoid plagiarism. Failure to comply this requirement will result in a failed assignment. | |
| Unit Learning Outcomes | |
| LO1 Investigate the impact of SOLID development principles on the OOP paradigm  LO2 Design a large dataset processing application using SOLID principles and clean coding techniques | |
| Transferable skills and competencies developed | |
| Computing-related cognitive skills   * Demonstrate knowledge and understanding of essential facts, concepts, principles and theories relating to computing and computer applications * Use such knowledge and understanding in the modelling and design of computer-based systems for the purposes of comprehension, communication, prediction and the understanding of trade-offs * Recognise and analyse criteria and specifications appropriate to specific problems, and plan strategies for their solutions * Analyse the extent to which a computer-based system meets the criteria defined for its current use and future development * Deploy appropriate theory, practices and tools for the design, implementation and evaluation of computer-based systems.   Computing-related practical skills   * The ability to evaluate systems in terms of quality attributes and possible trade-offs presented within the given problem * The ability to plan and manage projects to deliver computing systems within constraints of requirements, timescale and budget * The ability to recognise any risks and safety aspects that may be involved in the deployment of computing systems within a given context * The ability to deploy effectively the tools used for the construction and documentation of computer applications, with particular emphasis on understanding the whole process involved in the effective deployment of computers to solve practical problems * The ability to critically evaluate and analyse complex problems, including those with incomplete information, and devise appropriate solutions, within the constraints of a budget.   Generic skills for employability   * Intellectual skills: critical thinking; making a case; numeracy and literacy * Self-management: self-awareness and reflection; goal setting and action planning, independence and adaptability; acting on initiative; innovation and creativity * Contextual awareness, e.g. the ability to understand and meet the needs of individuals, business and the community, and to understand how workplaces and organisations are governed. | |
| **Vocational scenario** | |
| **Student Information Management System (SIMS)**  The university wants to modernize its student information system to improve efficiency and maintainability. Students will work in teams to design and implement a robust SIMS that follows object-oriented principles, SOLID principles, clean coding practices, and incorporates multiple design patterns.  Your team has been selected to implement the system. Your team needs to have a primary analysis of the user requirements, and system design.  **Functional Requirements:**   1. Student Registration:  * System should allow for the efficient registration of new students. * Capture and store essential student information, including personal details and academic records.  1. Course Management:  * Provide functionality for administrators to manage courses offered by the university. * Assign students to courses based on their academic program.  1. User Authentication and Authorization:  * Ensure secure user authentication for students, faculty, and administrators. * Implement role-based access control to restrict system functionalities based on user roles.   **Non-Functional Requirements:**   1. Scalability:    * The system should be scalable to accommodate a growing number of students and courses over time. 2. Performance:  * Ensure that the system responds to user requests within acceptable time frames, even during peak usage.  1. Security:  * Implement robust security measures to protect sensitive student information and ensure data integrity.  1. Usability:  * Design a user-friendly interface that accommodates users with varying levels of technical expertise.  1. Accessibility:  * Ensure the system is accessible to users with disabilities, complying with accessibility standards.  1. Reliability:  * The system should be reliable, with minimal downtime for maintenance or unexpected issues. | |
| Assignment activity and guidance | |
| **Task 1**  You need to present to the University how good design principles could lead to good impacts for the quality of the system. Your presentation is recommended to have the following discussions:   1. Investigate Object-Oriented Paradigm:   Read literature on object-oriented programming and understand key concepts like encapsulation, inheritance, polymorphism, and abstraction.   1. Class Relationships:   Identify real-world scenarios for association, aggregation, and composition relationships.   1. SOLID Principles:   Study some of SOLID principles (SRP, OCP, LSP, ISP, DIP) and understand their importance in software design.  (Approximately 500 words)  **Task 2**  Your team has some new programmers. As an experienced leader, you want to explain how clean coding techniques can impact on the use of data structures and operations when writing algorithms:   1. Clean Coding Techniques:  * Study and practice clean coding techniques such as meaningful naming, modularity, comments, and consistency.  1. Impact on Data Structures and Operations:  * Provide examples and explain how clean coding techniques work on Data Structures and Operations   **Task 3**  Design the application's architecture and a suitable testing regime for SIMS. Your team noticed that the SIMS's data is a big dataset, and it will be stored as a CSV file. The team also has decided to implement the application by using ASP .NET Core. Your report should have the following components:   * A use case diagram * A class diagram * A package diagram * An explanation of how SOLID principles have been applied in your team design.   Make sure that your design make use of SOLID principles.  Some diagrams and (Approximately 200 words for diagrams' explanation)  **Task 4 (M,D)**  If capable, analyse how creational, structural, and behavioural design patterns are used in practices or in your team proposed solution.  (Approximately 400 words)  **Task 5 (M,D)**  Analyse the SIMS application and evaluate how adhering to SOLID principles has influenced the design and development.  (Approximately 400 words) | |
| **Recommended Resources**  **Please note that the resources listed are examples for you to use as a starting point in your research – the list is not definitive.**   * Slides and Labs of the course at https://flm.poly.edu.vn/ | |

**Learning Outcomes and Assessment Criteria**

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| Pass | Merit | Distinction |
| LO1 Investigate the impact of SOLID development principles on the OOP paradigm | | LO1 and LO2  **D1** Evaluate the impact of SOLID development principles on object- orientated application development. |
| **P1** Investigate the characteristics of the object- orientated paradigm, including class relationships and SOLID principles.  **P2** Explain how clean coding techniques can impact on the use of data structures and operations when writing algorithms. | **M1** Analyse, with examples, each of the creational, structural and behavioural design pattern types. |  |
| **LO2** Design a large dataset processing application using SOLID principles and clean coding techniques | |
| **P3** Design a large data set processing application, utilising SOLID principles, clean coding techniques and a design pattern.  **P4** Design a suitable testing regime for the application, including provision for automated testing. | **M2** Refine the design to include multiple design patterns. |