TP1: Design Principles and Patterns – Object-oriented Architectures

This assignment concentrates on the topics of object-oriented architectures and design and more specifically on design principles and patterns. All questions concern AmazeFile (https://github.com/TeamAmaze/AmazeFileManager), a file manager application for Android. To answer the questions, you can use any of the tools recommended on Moodle and the Introductory slides or any other relevant tool. In any case, you need to explicitly cite any tools and sources you have used to complete this assignment. Submit a single document per team with the answers to the questions. Include the name of your team and the names of all team members in the report. Include all external references, including articles, links, documentation and tools.

Deadline: 04-Oct, 23h59

Question 1: Software architecture analysis (20 points)

You are asked to analyse the architecture of AmazeFile with the goal to understand its organization. Focus mostly on the "app" module without including in your results test code or non-code files (like images). Specifically, you are asked to:

1. Create an architecture (package) UML diagram to illustrate the architecture of the system. (5 points)
    a. Make sure your figures are clear (not too small or zoomed out).
    b. Use vector images (e.g., EPS or PDF) to ensure the quality of the image.
    c. Remove any details that are not necessary for your architecture discussion (e.g., methods, attributes or even classes) to avoid overloaded figures.
    d. Feel free to use multiple diagrams (e.g., focusing on specific parts) to facilitate the rest of the discussion.
    e. Make sure that all elements referenced in the discussion are present in the diagram.
2. By referring to the styles of architecture presented in the course, identify the architectural style(s) for the implementation of the system. (5 points)
3. By referring to the standard organization pattern as per the employed style(s), identify the role of each module (package) in the architecture. (10 points)
    a. For example, if a client-server architecture is identified, what modules are part of the client side and which ones of the server side?
    b. If you identify more than one style, a module can have a role in more than one style. Make sure to clearly describe the roles for each of the identified styles.
4. Format of the answer:
    a. Write a section about the Architecture of AmazeFile.
    b. In this section, briefly present the architecture of the system and the styles that are present in it.
    c. Present your diagram(s) and comment how the diagrams show the styles you have identified.

d. Write one subsection for each one of the styles you have identified and discuss the roles of the different modules. You can add more diagrams here to facilitate the discussion for each style.

Question 2: Design Patterns (30 points)

You are asked to:

1. Find and name 3 (GoF) design patterns present in AmazeFile. (6 points)
    - Use the UML diagrams to identify the patterns.
    - You need to present one example of three different patterns (do not present a pattern with two instances in the system).
2. Present each of the patterns as they are present in AmazeFile (9 points)
    - You can present a pattern either with a UML diagram (class or sequence) or with code snippets or both.
    - Do not present the generic UML diagram for the pattern (e.g., observer-subject). Use the names and diagrams as they appear in AmazeFile.
3. Describe the patterns in detail: what is the functionality of the pattern in the system? What are the roles of each class? (15 points)
    - What is the AmazeFile functionality that is implemented by the pattern (in other words describe the role of the pattern in the context of AmazeFile).
    - Do the same for the modules/classes/methods that are part of the pattern. For example, if you present the Observer pattern, what class is the observer and what class is the subject? In Template method, which is the template method and which are the static and which are the variable parts of the method?
4. Format of the answer:
    - Write a section about the design patterns present in AmazeFile. Write a small paragraph summarizing your findings (what patterns you found, what they are used for etc.)
    - Write one subsection for each pattern including:
        - The UML diagram or the code snippet
        - The functionality of the pattern
        - The role of each class in the pattern

Question 3: SOLID Design Principles (30 points)

You are asked to:

1. Find and name an instance of 3 different SOLID principles (an instance per principle) present in AmazeFile. (6 points)
    a. Same as in patterns, 3 instances for 3 different principles (not 2 instances of the same principle)
2. Present a UML diagram for each of the principles as manifested in AmazeFile (9 points)
    a. As in the patterns, you can use UML diagrams (one or multiple) or code snippets that best describe each principle.
    b. Do not use the generic terms of the principles, but how it appears in the system.
3. Describe the role of the classes (or the code snippets) relevant to the principle (15 points)
    a. Same as in the patterns.
4. Format of the answer:
    a. Same as in the patterns.

b. One subsection per principle.

Question 4: Violation of SOLID Design principles (20 points)

You are asked to:

1. Find one violation of one SOLID principle in AmazeFile and name the violated principle (2 points).
2. Present the UML diagram and code snippets necessary to present the violation (4 points).
3. Explain why this constitutes a violation (justify your arguments) (6 points)
    a. Present scenarios of maintainability or understandability, where the violation will start causing problems. For example, if it's an instance of OCP, what happens if we add new types?
4. Fix the violation and present a diagram and/or code snippets with the corrected version (8 points).
    a. You can fix the violation by applying a refactoring or any other change.
    b. Describe all the steps of the change and present the corrected version.
    c. Does your fix overcome the problems caused by the violation as presented before?

Note of evaluation

The submitted report will be evaluated on the accuracy and detail of the responses and the quality of its writing. Treat this as an official and professional report to management and colleagues.

Note on completing the assignment

Tools to automatically identify design patterns or design principles are mainly products of research and they are not known for their stability or for their usability. You are always free to experiment with these tools, but your main tools are the UML generation tools, which implies studying diagrams. This is an expected challenge for this assignment.