Software Design Patterns

PAC 1: Design Principles and Analysis Patterns
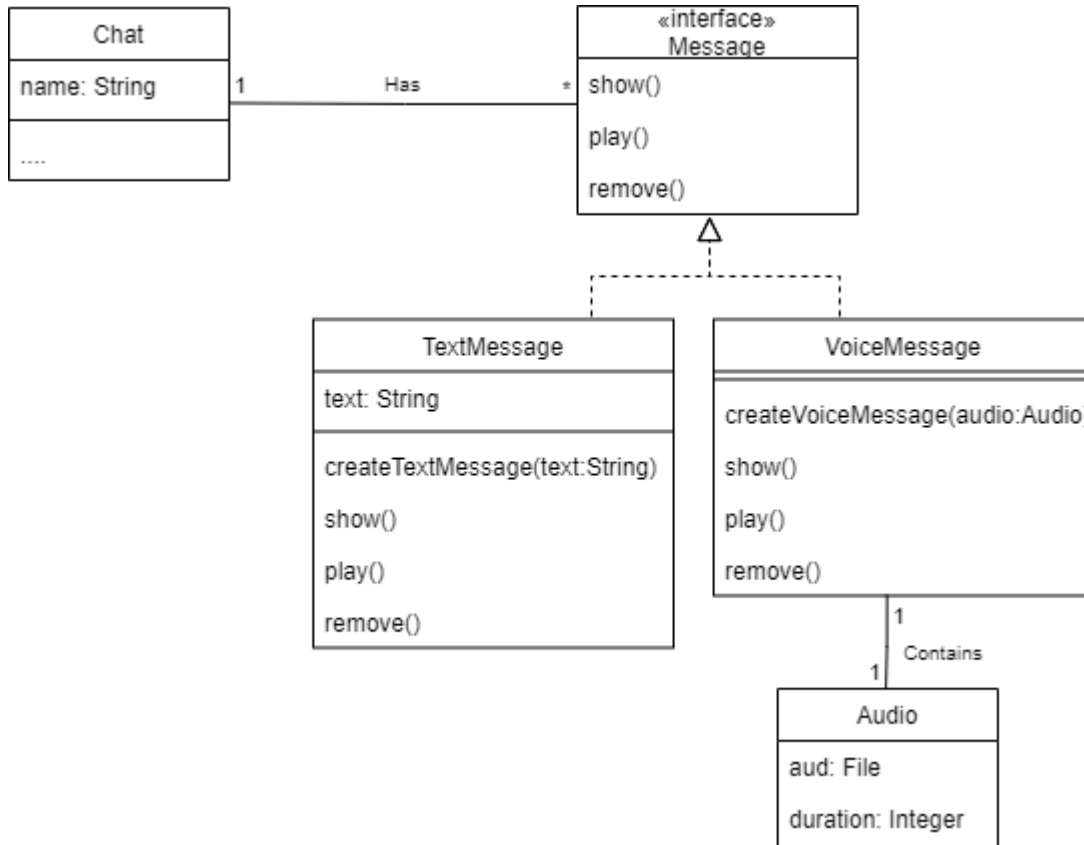
(evaluated on 50 points)

Question 1 (12.5 points)

Statement

We are designing an instant messaging system for smartphones. The system allows you to create chats to send text and voice messages. Below is the class diagram with the classes and operations that are defined in the system.

Class Diagram

Integrity constrains
- A chat is identified by its name (*name*)

Below is the description of the different operations of the class diagram:

TextMessage::createTextMessage(text: String): Creates an object of the class *TextMessage* and assigns the value of the parameter to the attribute *text*.

TextMessage::show(): shows the text (value of the attribute *text*).

TextMessage::play(): does nothing.

TextMessage::remove(): removes the object on which the operation is invoked.

VoiceMessage::createVoiceMessage(audio: Audio): Creates an object of the class *AudioMessage* and assigns to it the object *audio*.

VoiceMessage::show(): does nothing.

VoiceMessage::play(): Plays the audio associated with the object on which the operation is invoked.

VoiceMessage::remove(): Removes the object on which the operation is invoked and the audio object it is associated with.


It is requested:
   a) (5 points) Examining the class diagram of the system, we realize that the current design violates some design principle. What design principle do you think is being violated and why?
   b) (7.5 points) Provide a class diagram that satisfies the violated design principle.

Question 2 (12.5 points)

Statement

The smartphone instant messaging system in the previous question also allows for user-specified chats to be backed up (it is not relevant to this question to know how this is set up). In the current version of the system, backups are recorded in a log file that is on the phone itself. Below is the fragment of the class diagram that allows you to manage these backups.

Class Diagram
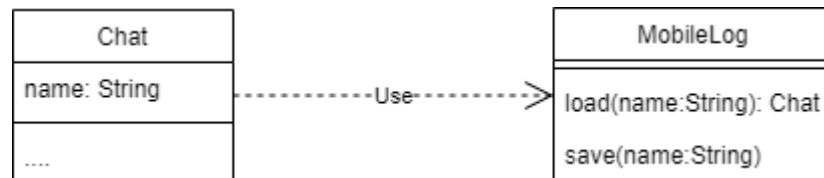
Note: The Use relationship establishes a usage dependency between the class *Chat* and the class *MobileLog*. That is, the class*Chat* uses class operations*MobileLog*.

We realize that the current system for keeping backup copies of chats is not very robust since the loss of the device also means the loss of the backup copies. That is why we decided to add to our system the possibility to save the backups remotely using an external service (which can be represented as a class with the name *ExternalService*).

It is requested:
  a) (5 points) The current dependency of the class *Chat* with the class *MobileLog* makes it difficult to add to our system the ability to save backups remotely anymore that some design principle is violated. What design principle do you think is being violated and why?
  b) (7.5 points) Provide a class diagram that satisfies the violated design principle.

Question 3 (15 points)

Statement

We want to design an app to manage the information of a fitness club. This club offers its users activities (pilates, cycling, etc...). Activities have a name that identifies them and a description. The club has rooms that are identified by their name and have a capacity. For example, the room called Tonification has a capacity for 20 people. The club plans activities in the different rooms it has on specific dates and times and offers a set of places for that planned activity. For example, the club has planned two pilates activities on September 30, one from 12 to 1:30 in the morning for 15 people and another from 17 to 18 in the afternoon for 20 people, in the Toning room. On the same day from 12 to 13 in the morning in the Cardio room there is a planned cycling activity for 15 people and from 15 to 17 there is another in the Hard Cardio room for 30 people.There cannot be more than one activity scheduled for the same activity that starts on the same date and time. Nor can there be more than one activity planned in a room for the same date and time.

It is requested:

a) (5 marks) State which analysis pattern we should use to represent the information described and briefly justify why.

b) (10 points) Propose a static analysis diagram where the identified analysis pattern and associated integrity constraints apply.

Question 4 (10 points)

Statement

In the app of the previous question we want to add the information of the monitors and the planned activities they lead. Monitors have a name that identifies them and their working hours. The working hours of each monitor are a continuous schedule (no breaks, for example monitor Pep works from 8 a.m. to 4 p.m. and monitor Maria works from 2 p.m. to 8 p.m.) and this schedule is the same every day (from Monday to Friday).

It is requested:

a) (2.5 points) State which analysis pattern we should use to represent the information described and briefly justify why.
b) (7.5 points) Propose a static analysis diagram where the identified analysis pattern and associated integrity constraints apply.