GX1337

OLLSCOIL NA hÉIREANN
NATIONAL UNIVERSITY OF IRELAND, GALWAY

SUMMER 1999 EXAMINATION

B.Sc. Computing Studies

Advanced Programming (CT406)

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Time Allowed: 2 Hours
Answer any three questions

1. (a) Describe what you would consider to be good attributes in terms of the design of a large software system. Consider in your answer the related concepts of *coupling*, *cohesion*, *interface* and *encapsulation.*

   (b) Describe the concepts of *polymorphism* and *inheritance*. Are there any potential problems with using inheritance?

   (c) Give the full C++ or JAVA class definition for an object that represents a typical (text only) E-Mail message. Show then how you would reuse this class in the definition of a new (derived) class for messages that can include attachments e.g. an attachment could be a MS Word file or a multimedia clip in a supported MIME format.

2. (a) What earlier methods / notations are credited as the main influences on UML.

   (b) Draw a UML use case diagram for the following problem description.
   "The system is an ECG monitor. The ECG has a chart printer and a remote display for use by a surgeon. The ECG captures and displays waveforms. Alarms can go off if a problem is detected. The surgeon can configure the display of waveforms on the remote display. The software is upgraded and the sensors are calibrated by a technician."

   (c) Draw a UML interaction (sequence or collaboration) diagram for the following scenario:
   "A user updates the value of a threshold on an object of type ControlPanel (instance named centralOffice). If an error count number reported by a transducer is larger than the threshold on the ControlPanel an alarm message is sent to a number of management systems."

3. For the Employee Directory Service described in the following narrative:

"The service is used to hold details on employees within a company and should provide a high level of availability i.e. it should use some form of replication in case an individual copy of the directory service becomes unavailable. Employees within a company should be allowed to register themselves with the service - typically they will use the service to register their Name, Department, E-Mail address, Phone Number and any other relevant details.
As this is an internet based service, it should also include some security features. Specifically it should not allow <u>any</u> access to requests from outside the companies internet domain(s) and should also use the concept of capabilities (security tokens) to further restrict access to the directory itself i.e. when a user registers with the service, the user is returned a capability which allows that user full access to his / her directory entry (including the right to modify or delete the entry). All other users should be returned reduced capabilities which allow only read / search access to directory entries. The only exception is that the designated manager of the service should also have the capability to delete any entries within the service."

(a) Derive a top level Class Diagram for this system, showing important attributes, methods and links between classes.

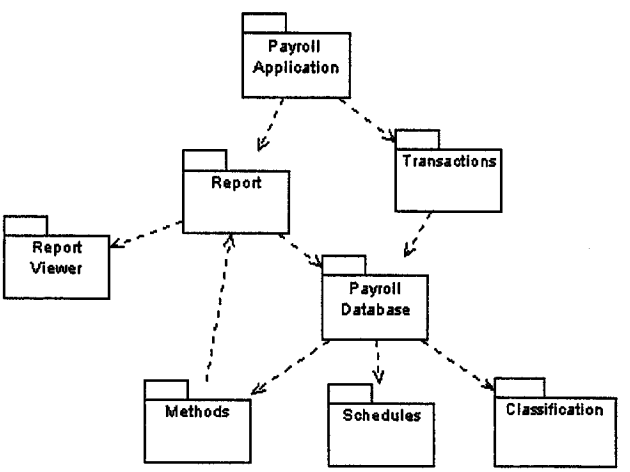
(b) Should any of the resulting classes be defined as *abstract classes* or *interfaces*?

(c) Discuss how the *Proxy* and *Observer* Design Patterns might be used in the design or extension of this system.

4. (a) What is meant by the term *"Software Reflection"* and give examples of where it's used.

(b) Describe the dependency inversion principle. Illustrate using an example (which includes a class diagram). What are the consequences of applying the principle on small systems?

(c) What problem does this diagram indicate? How would you solve the problem?



Why would the PayrollDatabase package/component export an abstract interface? What principle does this illustrate?