

**Birla Institute of Technology and Science, Pilani**

First Semester 2017-18

C/SS G514: Object Oriented Analysis and Design

Comprehensive Exam: PART-B (Open Book)

Date : 11.12.17(AN)

Duration : 105 Minutes

Weightage : 40 marks (20%)

---

1. Give a state diagram that describes the process of passing a graduate course as a set of concurrent activities. The process has as follows: To pass, a student has to attend all but two lectures, present to the class a paper she read, and complete a course project, due on the last day of the term. To give her presentation, the student is given a date by the instructor, prepares her presentation, and gives it on the assigned day. At any time, the student can drop the course.

Make sure to define events, conditions, actions for transitions in your diagram, where appropriate.

[8]

2. BITSMusicN!ghts is a famous Music festival, held in BITS every year. Since its first edition in 1964, it has gone through several major changes regarding its structure, length and location, but the tickets have always been sold in a traditional way: through two events agencies. The organizers decided to completely modernize the tickets selling system and created the following concept.

From this year on, the tickets will be sold in three distinct ways: traditionally, i.e. by the two events agencies, in electronic format directly on the festival website, and through SSMS. All parties will have access to the same unique tickets database of the new system, to avoid double selling. A partnership with the SSMS taxi company needs to be set up, such that SSMS can sell combi-tickets including both the festival admission fee and the taxi ride to the festival venue at reduced price, from anywhere in NCR. This way, more music fans would have easier and cheaper access to BITSMusicN!ghts. Moreover, the system will have to be extended to support not only Hindi, but also English, Punjabi and Bengali. Since tickets will also be sold online, Paytm will be contracted to provide and ensure the security of the online payment service. The BITSMusicN!ghts event manager will take care and negotiate all these details with the involved parties.

Additionally, upon arrival at the festival venue, each participant has to self-check in at a touch screen terminal, which scans the barcodes on his/her ticket and issues a bracelet with an electronic chip. This can be used to load money, such that whenever (s)he wants to purchase snacks or beverages, (s)he does not have to use cash any more, thus reducing waiting times. This measure was initiated by the program manager and will be deployed by WristSolutions Inc. Lastly, according to the GST laws, the way the payment transactions are performed has to be audited by an external company at the end of the festival, since this is a public event, where the municipality of Pilani is also involved - allowing free use of the public space.

(a) Identify all the use cases in the BITSMusicN!ghts case study and represent them in a UML use case diagram. Note: Do not forget to document your assumptions, if you make any.

(b) Identify a set of classes which might be used to model the system from an object oriented point of view. Use the classes to construct a class diagram to show the structure of the system. Show the key attributes and methods of each class on the diagram. Show the navigability and visibility information. Explain the use of GRASP patterns for assigning the responsibilities to various classes.

(c) Draw a Collaboration Diagram that describes the processing of tickets at the self-check in terminal. Explain the use of GRASP patterns for assigning the responsibilities to various classes.

[3+6+3=12]

3. For each of the following design problems, state the most appropriate design pattern to use to construct a solution and give a brief one-sentence explanation for your choice.

(a) Your program can send content to a printer. You want to ensure that different parts of the program don't command the printer to print output belonging to multiple documents simultaneously, mixed together.

(b) You are writing a library that allows client code to read and write compressed data for storing in files. You've written several classes that implement encode() and decode() methods of a CompressedFile interface. These classes use different algorithms with different characteristics. Rather than requiring the client to choose among them, you want the client to be able simply to request a CompressedFile object and be given an instance of the best available implementation for the particular kind of file.

(c) You have an application that reads and writes files on the local file system. Without changing the existing application any more than absolutely necessary you would like to modify it so it can read and write files stored at a different location on the network, even though reading and writing data over the network requires using a different API and a different set of methods than reading and writing data stored in local files.

[4\*3=12]

4. A program is to accept a person's age and determine what actions the person is allowed to take based on the age, with more actions allowed as a person gets older. For example, in the US a person is allowed to purchase cigarettes at 18, to purchase alcohol at 21, to become a congressman at 25, to become a senator at 30, to become president at 35, and to join AARP (American Association of Retired People) at 50. Would the core of this program be constructed using design pattern(s), generic(s), or inheritance? Why? Give the Code Fragments that show the implementation of the solution.

[8]

\*\*\*\*\*  
\*\*\*\*\*