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B.M.S. College of Engineering, Bengaluru-560019

Autonomous Institute Affiliated to VTU

August 2022 Semester End Main Examinations

Programme: B.E.

Branch: Computer Science and Engineering

Course Code: 20CS6PCOMD

Course: Object Oriented Modelling and Design

Semester: VI

Duration: 3 hrs.

Max Marks: 100

Date: 16.08.2022

Instructions: 1. Answer any FIVE full questions, choosing one full question from each unit.
2. Missing data, if any, may be suitably assumed.

UNIT - I

- 1 a) Explain the stages involved in Object Oriented Methodology. 6
- b) Analyze and identify the list of classes that you would expect each of the following systems to handle.
 i) A program to compute and store bowling scores.
 ii) A catalog store order entry system.
 iii) A telephone voice mail system with delivery options, message forwarding, and group lists.
- c) Prepare a class diagram for the group of classes given below. Add relationships (association and generalizations) to your diagram. Use association names where needed and show multiplicity. Show minimum two attributes and methods for each class. Explain your diagram.
 school, playground, principal, school board, classroom, book, student, teacher, cafeteria, restroom, computer, desk, chair, ruler, door, swing

UNIT - II

- 2 a) Discuss different restructuring techniques of workarounds for multiple inheritance with the issues to consider when selecting best workaround. 8
- b) Analyze the following relationships and categorize into generalization, aggregation, association or ternary association. Explain your answers
 i) A dining philosopher uses a fork
 ii) A file is an ordinary file or directory file
 iii) File contains records.
 iv) A polygon is composed of ordered set of points
 v) A person plays for a team in a certain year
- c) Prepare a class diagram for a graphical document editor that supports grouping. Assume that a document consists of several sheets. Each sheet contains drawing objects, including text, geometrical objects and groups. A group is simply a set of drawing objects, possibly including other groups. A group must contain at least two drawing objects. A drawing object can be a direct member of at most one group. Geometrical objects include circles, ellipses, rectangle, lines and squares.

Important Note: Completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
 Revealing of identification, appeal to evaluator will be treated as malpractice.

OR

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| 3 | a) Define Events. Explain different kinds of events | 8 |
| b) | Illustrate the following UML constructs with examples. | 6 |
| | i) Qualified Associations | |
| | ii) Aggregation and composition | |
| | iii) Bags and Sequences | |
| c) | Prepare a State diagram for the following scenario.
Consider the class for telephone line with following activities and states: As a start of a call, the telephone line is idle. When the phone receiver is picked from hook, it gives a dial tone and can accept the dialing of digits. If after getting dial tone, if the user doesn't dial number within time interval then time out occurs and phone line gets idle. After dialing a number, if the number is invalid then some recorded message is played. Upon entry of a valid number, the phone system tries to connect a call, routes it to proper destination. If the called person answers the phone, the conversation can occur. When called person hangs up, the phone disconnects and goes to idle state. Draw the state transition diagram for above description of telephone line. | 6 |

UNIT - III

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| 4 | a) Discuss the different ways of concurrency handling in state modeling with an example. | 6 |
| b) | A product is to be installed to control elevators in a building with m floors. The problem concerns the logic required to move elevators between floors according to the following constraints:
<input type="checkbox"/> Each elevator has a set of m buttons, one for each floor. These illuminate when pressed and cause the elevator to visit the corresponding floor. The illumination is canceled when the elevator visits the corresponding floor.
<input type="checkbox"/> Each floor, except the first floor and top floor has two buttons, one to request an up-elevator and one to request a down-elevator. These buttons illuminate when pressed. The illumination is canceled when an elevator visits the floor and then moves in the desired direction.
<input type="checkbox"/> When an elevator has no requests, it remains at its current floor with its doors closed. | 6 |
| c) | Analyze and prepare a sequence diagram corresponding to the scenario. | |

- c) Prepare state diagrams for the following scenario:

ATM is initially turned off. After the power is turned on, ATM performs startup action and enters Self-Test state. If the test fails, ATM goes into Out of Service state, otherwise there is trigger less transition to the Idle state. In this state ATM waits for customer interaction.

The ATM state changes from Idle to Serving Customer when the customer inserts banking or credit card in the ATMs card reader. On entering the Serving Customer state, the entry action read Card is performed. Note, that transition from Serving Customer state back to the Idle state could be triggered by cancel event as the customer could cancel transaction at any time. Serving Customer state is a composite state with sequential substates Customer Authentication, Selecting Transaction and Transaction. Customer authentication and Transaction are composite states by themselves which is shown with hidden decomposition indicator icon. Serving Customer state has

triggerless transition back to the Idle state after transaction is finished. The state also has exitaction ejectCard which releases customer's card on leaving the state, no matter what caused the transition out of the state.

OR

- 5 a) Explain Procedural Sequence models with a suitable example. 4
- b) A library lends books and magazines to members, who are registered in the system. Also, it handles the purchase of new titles for the library. Popular titles are bought in multiple copies. Old books and magazines are removed when they are out of date or in poor condition. A member can reserve a book or magazine that is not currently available in the library, so that when it is returned or purchased by the library, the person is notified. The library can easily create, replace and delete information about the titles, members loans and reservations in the system.
i) List the actors. Explain the relevance of each actor.
ii) Identify the use cases and purpose of each use case.
iii) Prepare use case diagram for the above system.
iv) Prepare a normal and exception scenario for any one use case
- c) A company is manufacturing a new product and must coordinate several departments. The product starts out as a raw marketing idea that goes to engineering. Engineering simulates the function of the product and prepares a design. Manufacturing reviews the design and adjusts it to confirm to existing machinery. Engineering approves the revisions and customer service then looks at the design- a good design must enable ready repair.
Engineering approves the customer service proposals and ensures that the resulting design still meets the target functionality.
Construct an activity diagram for this process. Use swimlanes to show the various interactions. Show the changes in the state of the design as the activity diagram proceeds.

UNIT - IV

- 6 a) Define System Conception. List and explain the questions that must be answered by a good system concept. 6
- b) Illustrate with an example, the steps for constructing an Application class Model. 6
- c) Consider the ATM System. Identify the criteria would that you would take into consideration to select the right classes. Explain with an example. 8

UNIT - V

- 7 a) Explain the ways of Downward Recursion in the design process. 6
- b) Analyze the following systems, list the applicable style of system architecture: batch transformation, continuous transformation, interactive interface, dynamic simulation, real-time system, and transaction manager. Explain your answer. 8

1. An electronic chess companion: The system consists of a chess board with a built-in computer, lights, and membrane switches. The human player registers move by pressing chess pieces on the board, activating membrane switches mounted under each square. The computer indicates moves through

lights also mounted under each square. The human moves the chess pieces for the computer. The computer should make only legal moves, should reject attempted illegal moves, should reject attempted illegal human moves, and should try to win.

2. An airplane flight simulator for a video game system: The video game system has already been implemented and consists of a computer with joystick and pushbutton inputs and an output interface for a color television. Your job is to develop the software for the computer to display the view from the cockpit of an airplane. The joystick and pushbutton control the airplane. The display should be based on a terrain description stored in memory. When your program is complete, it will be sold on cartridges that plug into the video game system.

3. A floppy disk controller chip: The chip is going to use a microprogram for internal control. You are concerned with the microprogram. The chip bridges the gap between a computer and a floppy disk drive. Your portion of the control will be responsible for positioning the read/write head and reading the data. Information on the diskette is organized into tracks and sectors. Tracks are equally spaced circles of data on the diskette. Data within a track is organized into sectors. Your architecture will need to support the following operations: Find track 0, find a given track, read a track, read a sector, write a track, and write a sector.

4. A sonar system: You are concerned with the portion of the system that detects undersea objects and computes how far they are. This is done by transmitting an acoustic pulse and analyzing any resulting echo. A technique called correlation is used to perform the analysis, in which a time-delayed copy of the transmitted pulse is multiplied by the returned echo and integrated for many values of time delay. If the result is large for a particular value of time delay, it is an indication that there is an object with a range that corresponds to that delay.

- c) Explain the different possibilities of fine-tuning classes to be considered before implementation. 6
