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

**Autonomous Institute Affiliated to VTU**

## August 2024 Supplementary Examinations

**Programme: B.E.** **Semester: VI**
**Branch: Computer Science and Engineering** **Duration: 3 hrs.**
**Course Code: 20CS6PCOMD** **Max Marks: 100**
**Course: Object Oriented Modelling And Design**

**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 | CO | PO | Marks |
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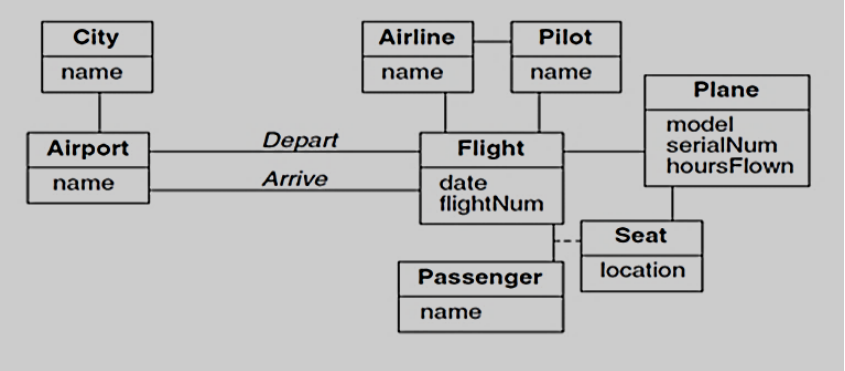
| 1 | a) | Decide which model(s) (class, state, interaction) are relevant for the following aspects of a computer chess player. A video display will show the board and pieces. A cursor controlled by a mouse will indicate human moves. Of course, in some cases, more than one model may apply. Explain your answers.<br>i. User interface that displays computer moves and accepts human moves<br>ii. Representation of a configuration of pieces on the board<br>iii. Consideration of a sequence of possible legal moves<br>iv. Validation of a move requested by the human player | *CO1* | *PO1* | **5** |
| | b) | Consider the partially completed class model of an air transportation system as shown in Figure below and add at-least six association end names. Add only meaningful association end names that are different from the class names.<br>  | *CO2* | *PO2* | **7** |
| | c) | Prepare a class diagram for the incomplete scenario given below based on the group of classes such **as automobile, engine, wheel, brake, brake light, door, battery, muffler, tail pipe**. Add at least 10 relationships (associations) to each diagram. Use association names and association end names where needed. Also use qualified associations and show multiplicity. You may | *CO3* | *PO3* | **8** |

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| | | | show attributes or operations.<br>An automobile is composed of a variety of parts. An automobile has one engine, one exhaust system, many wheels, many brakes, many brake lights, many doors, and one battery. An automobile may have 3, 4 or 5 wheels depending on whether the frame has 3 or 4 wheels and the optional spare tire. Similarly a car may have 2 or 4 doors. The exhaust system can be further divided into smaller components such as a muffler and tailpipe. A brake is associated with a brake light that indicates when the brake is being applied. | | | |
| | | | **UNIT - II** | | | |
| | 2 | a) | Categorize the following relationships into generalization, aggregation, or association. Beware, there may be n-ary associations in the list, so do not assume every relationship involving three or more classes is a generalization. Justify and explain your answers.<br>i. A dining philosopher uses a fork.<br>ii. A file is an ordinary file or a directory file.<br>iii. A polygon is composed of an ordered set of points.<br>iv. A drawing object is text, a geometrical object, or a group.<br>v. A person uses a computer language on a project. | *CO1* | *PO1* | **5** |
| | | b) | Electrical machines may be categorized for analysis purposes into alternating current (ac) or direct current (dc). Some machines run on ac, some on dc, and some will run on either. A few examples of electrical machines include large synchronous motors, small induction motors, universal motors, and permanent magnet motors. Most motors found in the home are usually induction or universal. An ac machine may be synchronous or induction. Universal motors are typically used where high speed is needed, such as in blenders or vacuum cleaners. They will run on either ac or dc. Permanent-magnet motors are frequently used in toys and will work only on dc. Prepare a class diagram showing how the categories and the machines just described relate to one another. | *CO3* | *PO3* | **7** |
| | | c) | Prepare a class diagram for an interactive diagram editor. A sheet is a collection of lines and boxes. A line is a series of line segments that connect two boxes. Each line segment is specified by two points. A point may be shared by a vertical and a horizontal line segment in the same line. A selection is a collection of lines and boxes that have been highlighted in anticipation of an editing operation. A buffer is a collection of lines and boxes that have been cut or copied from the sheet. The above description does not express the constraint that a line or a box belongs to exactly one buffer or one selection or one sheet. Use generalization to express the constraint by creating a superclass for the classes Buffer, Selection, and Sheet. | *CO3* | *PO3* | **8** |

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| | | | **OR** | | | |
| | 3 | a) | Differentiate between Aggregation and Association. | *CO2* | *PO2* | **3** |
| | | b) | Prepare a state diagram for the control of a telephone answering machine. The machine detects an incoming call on the first ring and answers the call with a pre-recorded announcement. When the announcement is complete, the machine records the caller's message. When the caller hangs up, the machine hangs up and shuts off.<br>i. Place the following in the diagram: call detected, answer call, play announcement, record message, caller hangs up, announcement complete.<br>ii. The telephone answering machine activates on the first ring. Revise the state diagram so that the machine answers after five rings. If someone answers the telephone before five rings, the machine should do nothing. Be careful to distinguish between five calls in which the telephone is answered on the first ring and one call that rings five times | *CO3* | *PO3* | **10** |
| | | c) | Design a class diagram for the following requirement with association and multiplicity details. A bank has many branches. In each zone, one branch is designated as the zonal head office that supervises the other branches in that zone. Each branch can have multiple accounts and loans. An account may be either a savings account or a current account. A customer may open both a savings account and a current account. However, a customer must not have more than one savings account or current account. A customer may also procure loans from the bank | *CO3* | *PO3* | **7** |
| | | | **UNIT - III** | | | |
| | 4 | a) | Explain the different ways of handling concurrency in state model with suitable examples. | *CO1* | *PO1* | **5** |
| | | b) | Three-phase induction motors will spin either clockwise or counterclockwise, depending on the connection to the power lines. In applications requiring motor operation in both directions, two separate contactors (power relays) might be used to make the connections, one for each direction. Also, in some applications of large motors, the motor starts through a transformer that reduces the impact on the power supply. The transformer is bypassed by a third contactor after the motor has been given enough time to come up to speed. There are three momentary control inputs: requests for forward, reverse, or off. When the motor is off, forward or reverse requests cause the motor to start up and run in the requested direction. A reverse request is ignored if the motor is starting or running in the | *CO2* | *PO2* | **7** |

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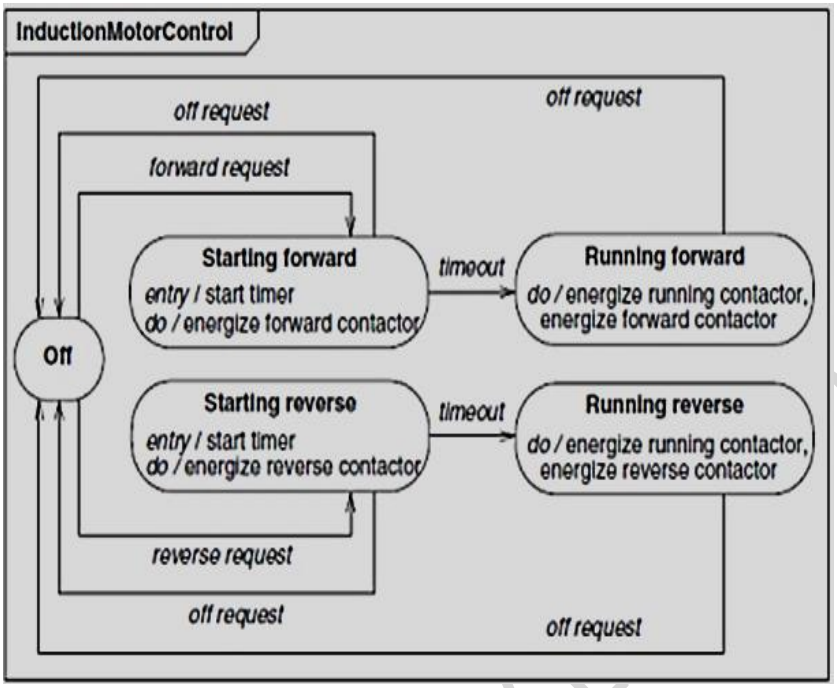
| | | | forward direction. and vice versa. An off request at any time shuts the motor off. Figure below is a state diagram for one possible motor control. Convert it from a single state diagram into two concurrent state diagrams, one to control the direction of the motor and one for starting control.<br>  <br> | | | |
| | | c) | Consider stock management software that records all transactions that occur for a portfolio. For example, stocks may be purchased and sold. Dividend payments may be received. Complex situations can occur, such as stock splits. The current contents of a portfolio can be determined by replaying the transaction log. The portfolio has some initial contents, and all subsequent changes are captured via the transaction log. The changes in the transaction log are then applied through the target date to determine the current contents.<br>Construct a separate procedural sequence diagram to<br>i. Show the calculation of the contents of a portfolio as of some date. Limit the detail in your diagram to four message flows.<br>ii. Compute the value of a stock portfolio as of a specified date. First compute the contents of the portfolio (the previous exercise) and then multiply the quantity of each stock by its value on the specified date to determine the overall value of the portfolio. | *CO3* | *PO3* | **8** |
| | | | **OR** | | | |
| | 5 | a) | Consider a computer email system.<br>i. List three actors. Summarize each(One sentence)<br>ii. One use case is to get email, List four additional use cases at a comparable level of abstraction. | *CO3* | *PO3* | **10** |

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| | | | iii. Prepare a use case diagram for a computer email system.<br>iv. Prepare a sequence diagram for getting an email and sending an email | | | |
| | | b) | Consider the scenario for the Copy Machine. Initially the copy machine is off. When power is turned on, the machine reverts to a default state- **one copy, automatic contrast and normal size**. While the machine is warming, it flashes the ready light, when the machine completes internal testing; the ready light stops flashing and remains on. Then the machine is ready for coping. The operator may change any of the parameters when the machine is ready. The operator may Increment or decrement the number of copies, change the size etc. When the parameters are properly set, the operator pushes the start button to begin making copies. Normally copying proceeds until all copies are made. Occasionally the machine may jam or run out of paper. When the machine jams, the operator may clear the issue and the machine will resume making copies. Adding papers allows the machine to proceed after out of paper. Design the advanced state diagram by considering all possible states for the Copy Machine. | *CO3* | *PO3* | **10** |
| | | | **UNIT - IV** | | | |
| | 6 | a) | The following are tentative specifications for a simple diagram editor that could be used as the core of a variety of applications.<br>"The editor will be used interactively to create and modify drawings. A drawing contains several sheets. Drawings are saved to and loaded from named ASCII files. Sheets contain boxes and links. Each box may optionally contain a single line of text. Text is allowed only in boxes. The editor must automatically adjust the size of a box to fit any enclosed text. The font size of the text is not adjustable. Any pair of boxes on the same sheet may be linked by a series of alternating horizontal and vertical lines. The editor will be menu driven, with pop-up menus. A three-button mouse will be used for menu, object, and link selections.<br><br>The following are some operations the editor should provide: create sheet, delete sheet, next sheet, previous sheet, create box, link boxes, enter text, group selection, cut selections, move selections, copy selections, paste, edit text, save drawing, and load drawing. Copy, cut, and paste will work through a buffer. Copy will create a copy of selections from a sheet to the buffer. Cut will remove selections to the buffer. Paste will copy the contents of the buffer to the sheet. Each copy and cut operation overwrites the previous contents of the buffer. Pan and zoom will not be allowed; sheets will have fixed size. When boxes are moved, enclosed text should move with them and links should be | *CO2* | *PO2* | **8** |

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| | | | stretched."<br>The following is a list of candidate classes. Prepare a list of classes that should be eliminated. Give a reason for each elimination. If there is more than one reason, give the main one.<br>**character, line, x coordinate, y coordinate, link, position, length, width, collection, selection, menu, mouse, button, computer, drawing, drawing file, sheet, pop-up, point, menu item, selected object, selected line, selected box, selected text, file name, box, buffer, line segment coordinate, connection, text, name, origin, scale factor, corner point, end point, graphics object**. | | | |
| | | b) | Prepare sequence diagrams for the scenario given below<br>The ATM displays a menu of accounts and commands.<br>The user selects an account withdrawal.<br>The ATM asks for the amount of cash.<br>The user enters $100.<br>The ATM verifies that the withdrawal satisfies its policy limits.<br>The ATM contacts the consortium and bank and verifies that the account has sufficient funds.<br>The ATM dispenses the cash and asks the user to take it.<br>The user takes the cash.<br>The ATM displays a menu of accounts and commands. | *CO2* | *PO2* | **6** |
| | | c) | Justify with different criteria, how incorrect and unnecessary classes are removed in Domain class modeling | *CO2* | *PO2* | **6** |
| | | | **UNIT - V** | | | |
| | 7 | a) | For each of the following systems, identify the applicable style(s) of system architecture Explain your selection(s). For systems that fit more than one style, group features of the system by style.<br>i. An electronic chess companion. The system consists of a chess board with a built-in computer, lights, and membrane switches. The human player registers moves 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 human moves, and should try to win.<br>ii. 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.<br>iii. A floppy disk controller chip. The chip is going to use a | *CO2* | *PO2* | **10** |

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| | | | 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.<br>iv. A sonar system. You are concerned with the portion of the system that detects undersea objects and computes how far away they are (range). 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 | | | |
| | | b) | Discuss the different tasks involved in the process of design optimization? Explain any one in detail? | *CO1* | *PO1* | **5** |
| | | c) | Explain any two architectural styles, suited for system design | *CO1* | *PO1* | **5** |

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