Exercises
Identification of Classes and Relationships

E-1: Name different types of relationships between classes ?

E-2: Difference between Association and Aggregation relationships between classes ?

E-3: How from Requirements Description you can identify Objects/Classes ?

E-4: The software to be designed will support the operations of a technical library of a university. The Librarian can check-in and checkout books borrowing and return. He can also search books. This includes the searching for and lending of technical library materials, including books, videos, and technical journals. All library items have a registration code (research area code + running number). Each borrower can borrow up to 10 items. Each type of library item can be borrowed for a different period of time (books 6 weeks, journals 3 days, videos 1 week). If returned after their due date, the employee will be charged a fine, based on the type of item (books Rs. 10:-/day, journals and videos Rs. 20:-/day). Materials will be lent to employees only if they have (1) no overdue lendable items, (2) fewer than 10 articles out, and (3) total fines less than Rs.100.

- Identify Classes and Relationships between classes.
- Draw Basic Class Diagram

E-5: A university operates a fleet of 20 buses, 8 vans and 4 coasters that serve approximately 3,000 students in different programs. The bus operation involves 10 regular routes, plus special routes for activities, athletic events, and summer sessions. The university employs 20 full time drivers and 10 to 15 part-time drivers. A dispatcher coordinates the staffing and routes and relays messages to drivers regarding students and parents who call about pickup and drop-off arrangements.

- Identify Objects, Actors and Operations

E-6: Activity in the store begins when a customer arrives at a Point of Sale Terminal (POST) checkout with items to purchase. The cashier records the universal product code (UPC) from each item. The System determines the item price and adds the item to the running sales transaction. If there is more than one of the same items, the cashier can enter the quantity as well. The description and the price of the current item are displayed.

- By performing noun analysis, identify Objects/Classes and relationships between Classes.
- Create a basic diagram by drawing relationships between classes.

E-7: The security alarm is activated by pressing the Set button. The set button is illuminated when the security alarm is activated. The security alarm has a detector that sends a trip signal when motion is detected. The detector is enabled when the security alarm is activated. If the trip signal occurs while the security alarm is set, a high-pitched tone (alarm) is emitted. A three digit code must be entered to turn off the alarm tone. Correct entry of the code deactivates the security alarm. If a mistake is made when entering the code, the user must press the Clear button before the code can be re-entered.

- By performing noun analysis, identify Objects/Classes and relationships between Classes.
- Create a basic diagram by drawing relationships between classes.

E-8: Draw diagrams to link the following classes using association, aggregation, inheritance, and multiplicity where appropriate.

1. hotel room, booking, guest.
2. club member, adult member, junior member.
3. exam paper, instruction, question, solution.
4. animal, mammal, bird, reptile, dog, horse, parrot.
5. sentence, word, letter, punctuation.
6. academic staff, lecturer, professor, student.

E-9: 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:

- 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.
- Each floor, except the first floor and top floor has two buttons, one to request and 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.
- When an elevator has no requests, it remains at its current floor with its doors closed.

Identify meaningful classes in the Elevator Example.
Identify relationships between classes.
Draw classes and relationships.

E-10: Following table list object-oriented concepts and short definitions. Match the concept to the definition that best describes it.

Concept	**Definition**
aggregation	a relationship between two classes where one is a specialization of another
association	the ability of one operation to be implemented by different methods
attribute	abstracting common features into a superclass
class	code implementing an operation
data hiding	concealing internal details of an object
encapsulation	creation of an object
generalization	data item defined as part of a class or object
inheritance	instance of a class
instatiation	interface of a method
message	packaging together data and operations
method	relationship between classes
object	request for a service to be executed
operation	template for objects
polymorphism	whole-part relationship