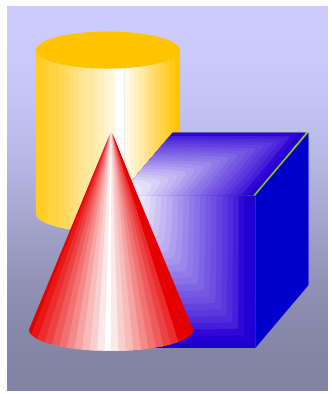
SmartImpart™

Object Orientation

Unit 1

Introduction to Object Oriented Approach

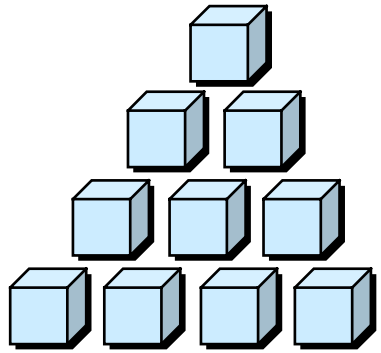


Introduction to Object Oriented Approach

- Topics
  - Procedural approach to Object-Oriented approach
  - What is an Object
  - Why choose the OO approach
  - What is a Class
  - Identifying Classes

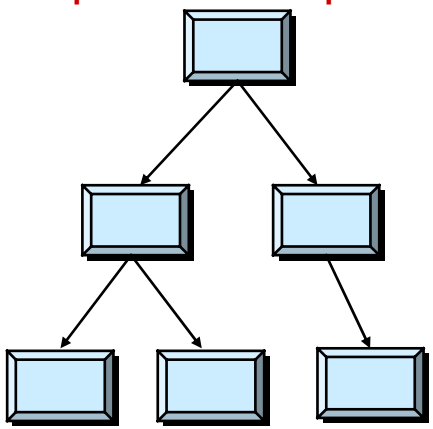
The procedural approach

- The procedural approach
  - Deals with functions as the **building blocks**
  - Easy to start with
  - Higher comfort level for a new programmer
- Simple decomposition technique for
  - Modularity
  - Reusability
  - Complexity



Functions are the building blocks

Top – down decomposition



Fit falls of Structured Programming Approach

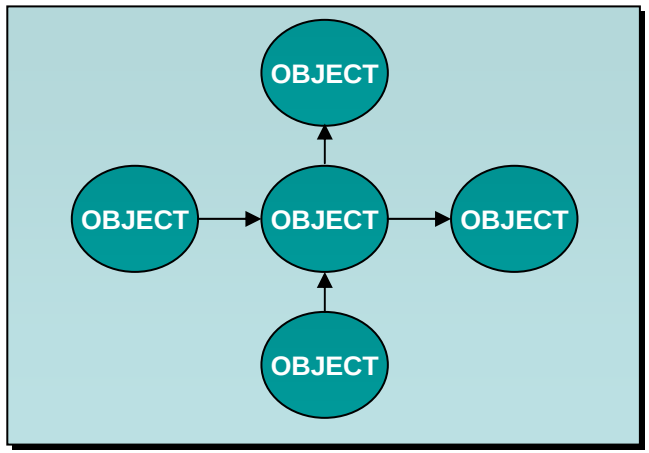
- Programs became harder to maintain.
- Existing functionality was hard to alter without adversely affecting all of the system's functionality.
- New programs were essentially built from scratch. Consequently, there was little return on the investment of previous efforts.
- Programming was not conducive to team development. Programmers had to know every aspect of how a program worked and could not isolate their efforts on one aspect of a system.
- It was hard to translate business models into programming models.
- It worked well in isolation but did not integrate well with other systems.

Fit falls of Structured Programming Approach

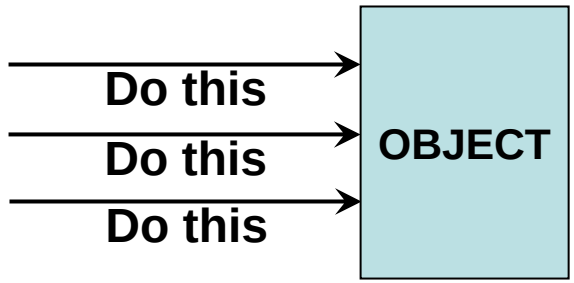
- In addition to these shortcomings, some evolutions of computing systems caused further strain on the structural program approach:
  - Nonprogrammers demanded and were given direct access to programs through the incorporation of graphical user interfaces and their desktop computers.
  - Users demanded a more-intuitive, less-structured approach to interacting with programs.
  - Computer systems evolved into a distributed model where the business logic, user interface, and backend database were loosely coupled and accessed over the Internet and intranets.

OO Approach

- An Object oriented approach views systems and programs as a collection of interacting objects.



- An object is a thing in a computer system that is capable of responding to messages



Benefits of OO Approach

- A more intuitive transition from business analysis models to software implementation models
- The ability to maintain and implement changes in the programs more efficiently and rapidly
- The ability to more effectively create software systems using a team process, allowing specialists to work on parts of the system
- The ability to reuse code components in other programs and purchase
- components written by third-party developers to increase the functionality of their programs with little effort
- Better integration with loosely coupled distributed computing systems
- Improved integration with modern operating systems
- The ability to create a more intuitive graphical user interface for the users

What is Object-Oriented Programming Language

- **Restrictive** – The programming language that supports both object classes and class inheritance.
- **Loose** - Any programming language that provides mechanisms that can be used to exploit encapsulation is (at least to some degree) object-oriented.

OO Programming Languages

- Simula – 1960
- Smalltalk – 1970
- C++ - 1983
- Objective C – 1984
- Java – 1995
- .Net Languages - 2000

Over 200 OO Languages

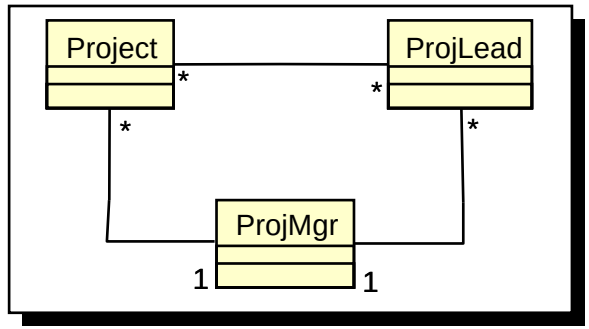
What are Objects?

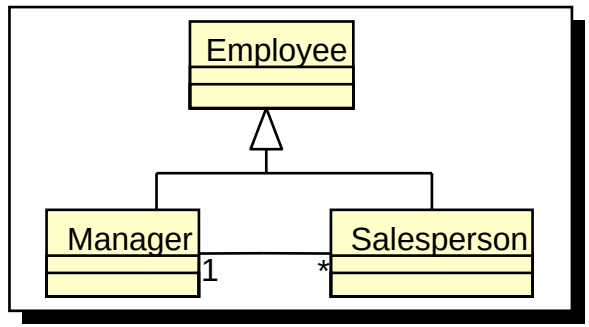
- You interact with *objects* everyday
  - A customer
  - An order
  - Your car
  - The telephone

- An object represents an entity – physical, conceptual or software
  - **Physical entity**
    - Employee, Customer, Supplier
  - **Conceptual entity**
    - Sales, Policy, TaxCalculator
  - **Software entity**
    - Linked List, Expression, Connection, etc.
- ***A programmer should make a good effort to capture the conceptual entities in addition to physical entities which are relatively straight forward to identify***

Why choose the Object Oriented approach?

- The OO approach deals with classes as the building blocks
- Allows Real World Modeling
- The idea of OOP is to try to approach programming in a more natural way by grouping all the code that belongs to a particular object—such as an account or a customer — together
- Raise the level of abstraction
- Applications can be implemented in the same terms in which they are described by users
- Easier to find nouns and construct a system centered around the nouns than actions in isolation





What is a Class?

A **class** gives a generic notion of what objects look like

Employee
Class

Instantiate (create)

An employee
Joe

An **object** is an instance of a class

Classes are used to distinguish one type of object from another

Employee

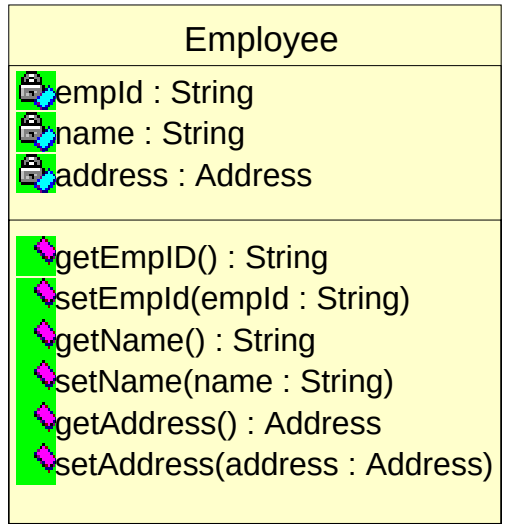
Reg. Customer

Customer

Types

Class

- User defined type
  - Encapsulates all the data and operations pertaining to an entity
  - Provided a Single representation to all the attributes defining the entity
  - Passing single representations is easier



- Data types as collections
  - A struct in C encapsulates only data. Used as a data structure to store different types of data
  - An array is used to store different elements of the same type

Identifying Classes

A trainer trains many trainees on a given technology in this course, which contains many modules – each module is comprised of different units and each unit has many topics.

- Identify the different classes from the above problem statement

Procedural approach

- Focus is on identifying **VERBS**
- Connections between functions established through Function Calls

OO approach

- Focus is on identifying **NOUNS**
- Connections between classes established through Relationships ('Is-a' and 'Has-a')

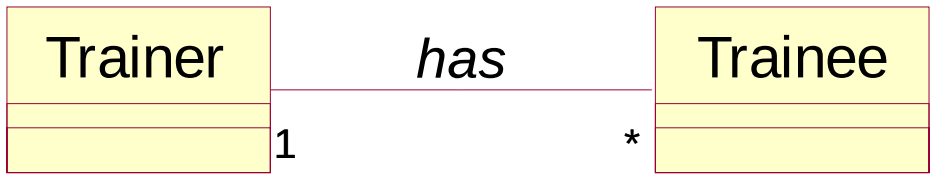
Identifying Classes

- Trainer
- Trainee
- Course
- Technology
- Module
- Unit
- Topic

- Identify the different connections (relationships) between the above classes

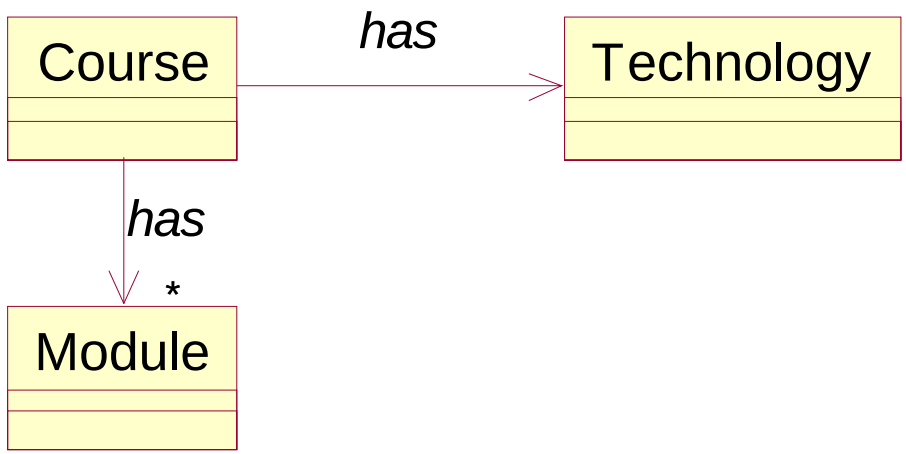
Identifying Relationships

- Trainer - Trainee
  - Trainer ‘HAS’ many Trainees
  - Every Trainee ‘HAS’ a Trainer



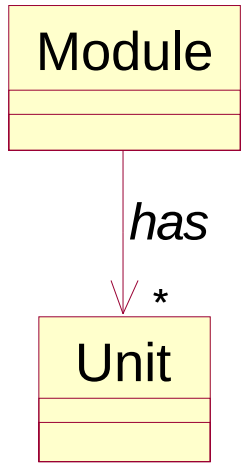
Identifying Relationships

- Course – Technology
- Course - Module
  - Course ‘HAS’ an associated Technology
  - Course ‘HAS’ many Modules

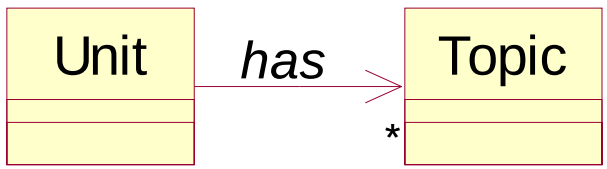


Identifying Relationships

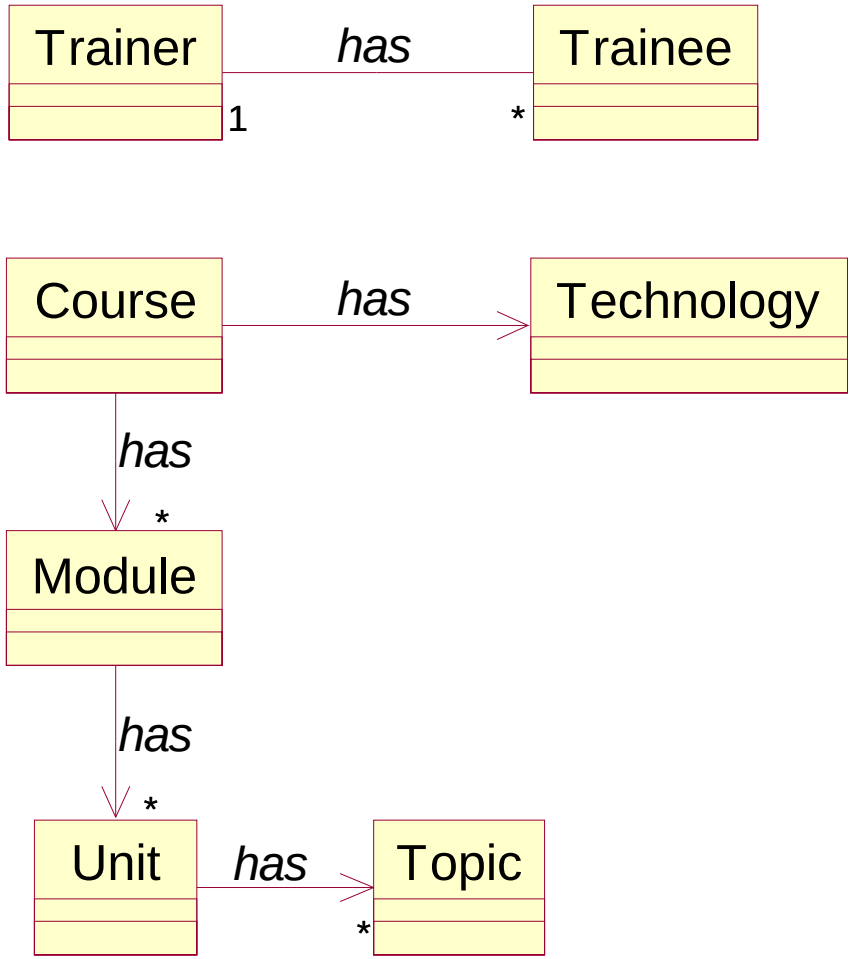
- Module – Unit
  - Module ‘HAS’ many Units



- Unit – Topic
  - Unit ‘HAS’ many Topics



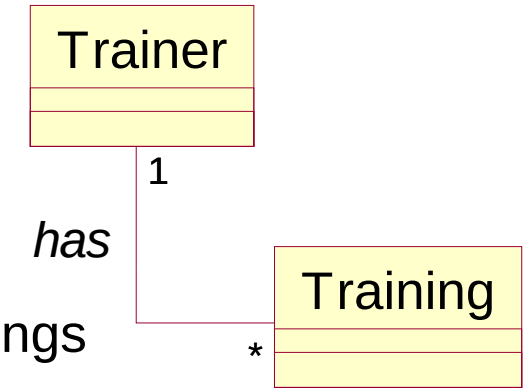
The OO Model



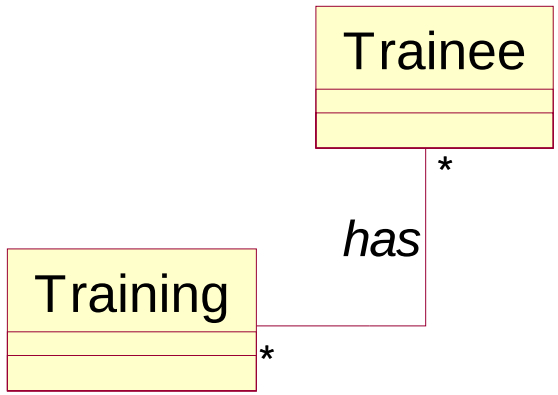
- How do you relate the Trainer & Trainee to the Course?

Conceptual Entity

- Trainer – Training
  - A Trainer (HAS) conducts many Trainings
  - A Training HAS a Trainer

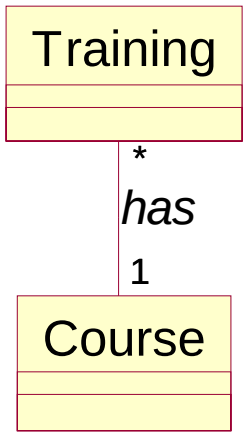


- Trainee – Training
  - A Trainee (HAS) attends many Trainings
  - A Training HAS a many Trainees

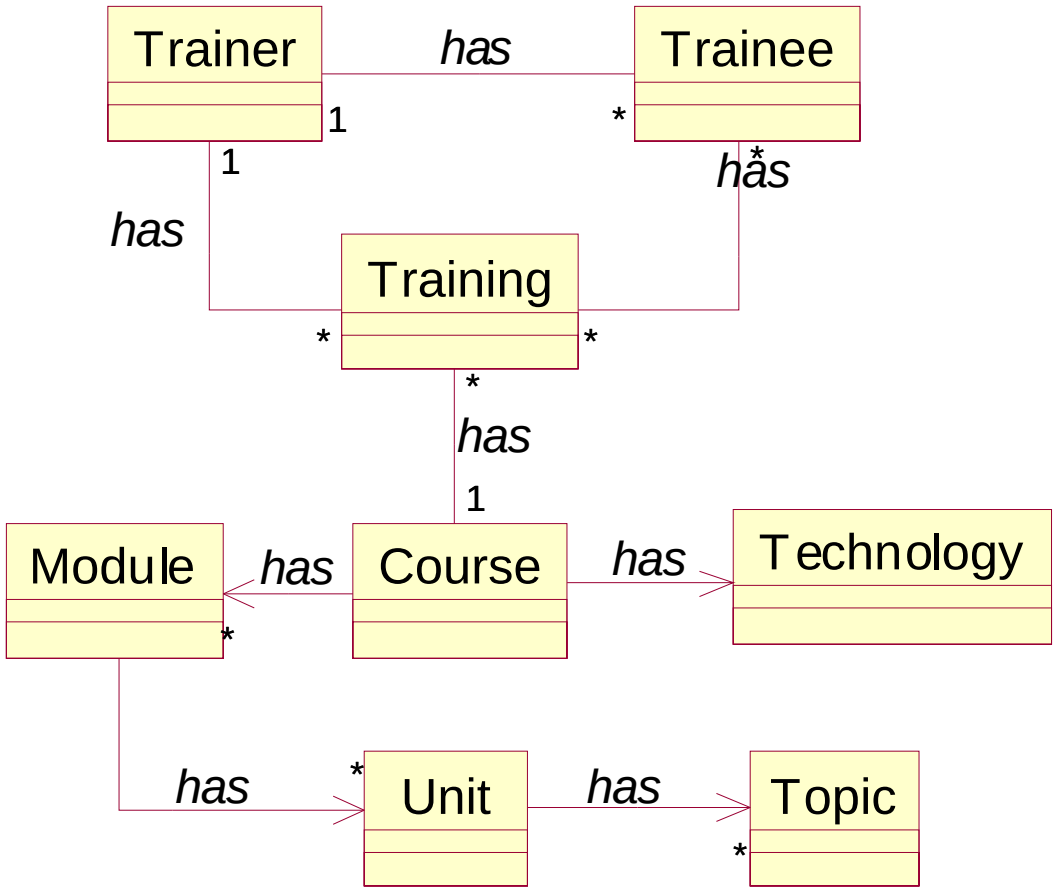


Conceptual Entity

- Training - Course
  - The Training (HAS) an association with a Course (conducted for a Course)
  - A Course HAS many Trainings



Solution



- Easier to model real-world problems through the OO approach than through the procedural approach

Exercise

A company sells different items to customers who have placed orders. An order can be placed for several items. However, a company gives special discounts to its registered customers.

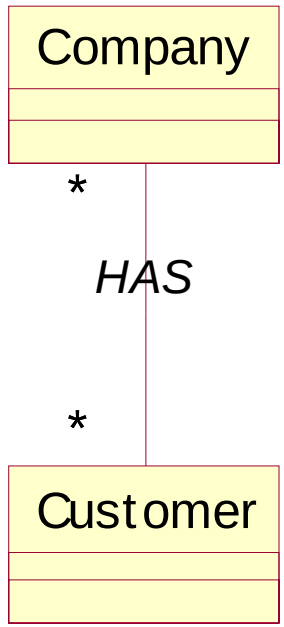
- Identify the different classes from the above problem statement
- Identify the different connections (relationships) between the above classes

Identifying Classes

- Company
- Item
- Order
- Customer
- RegCustomer

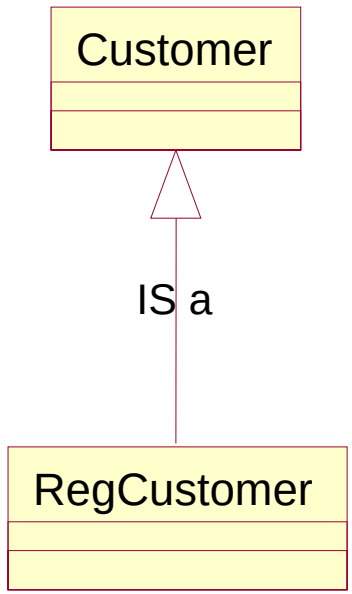
Identifying Relationships

- Company - Customer
  - Company ‘HAS’ many Customers
  - Customer ‘HAS’ many Companies



Identifying Relationships

- Customer - RegCustomer
  - RegCustomer ‘IS’ a Customer

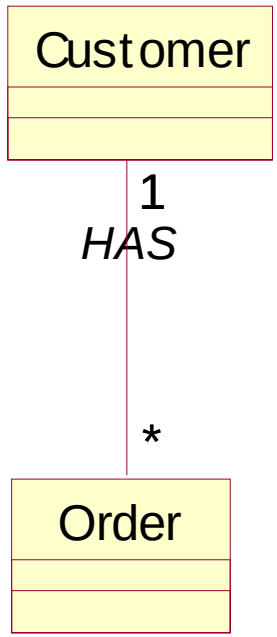


Identifying Relationships

- Item - Order
  - Order HAS many Items
  - Item HAS many Orders

Identifying Relationships

- Customer - Order
  - Customer HAS many Orders
  - Order HAS one Customer



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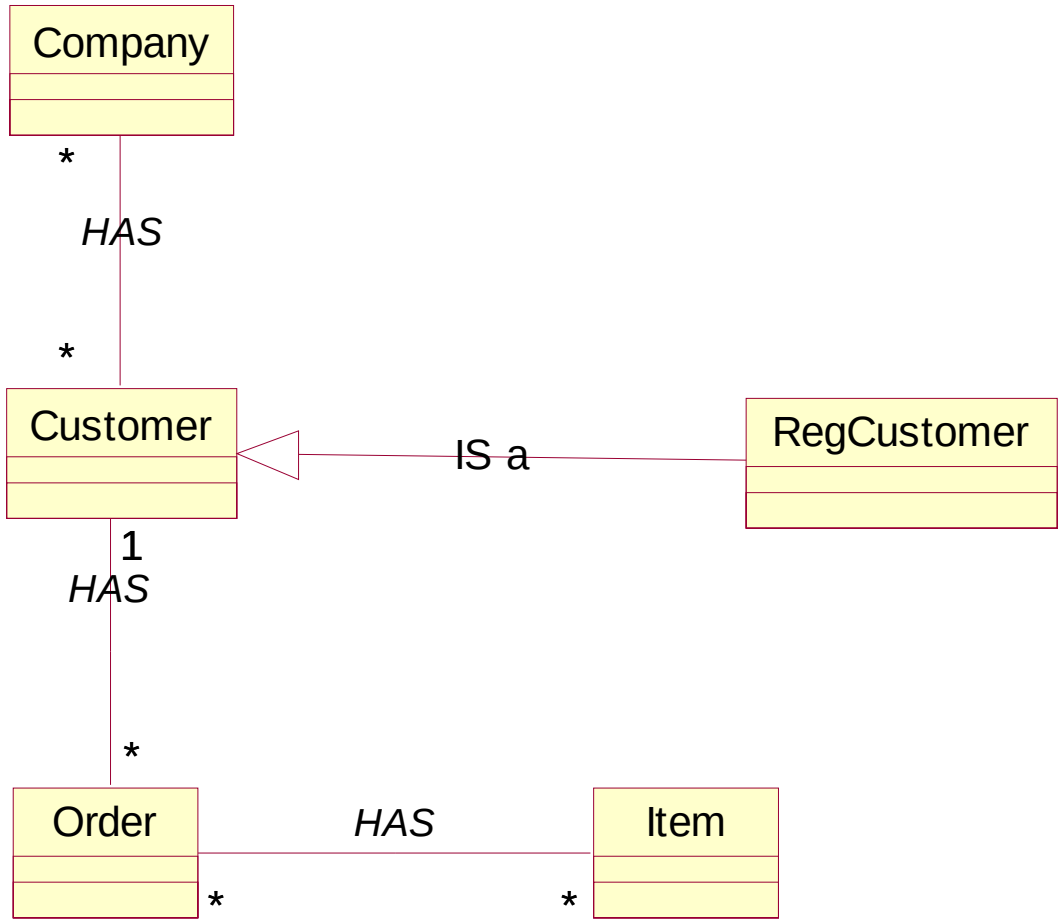

Question Time

Please try to limit the questions to the topics discussed during the session.

Participants can clarify other doubts during the breaks.

Thank you.