Object Oriented Programming

ICT2122

Introduction to Object Oriented Programming

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Lesson 01

Course Plan

- Lectures – 02 Hours per Week
- Evaluation
  - 04 Quizzes
  - Mid Term Evaluation

Eligibility and Evaluation Criteria

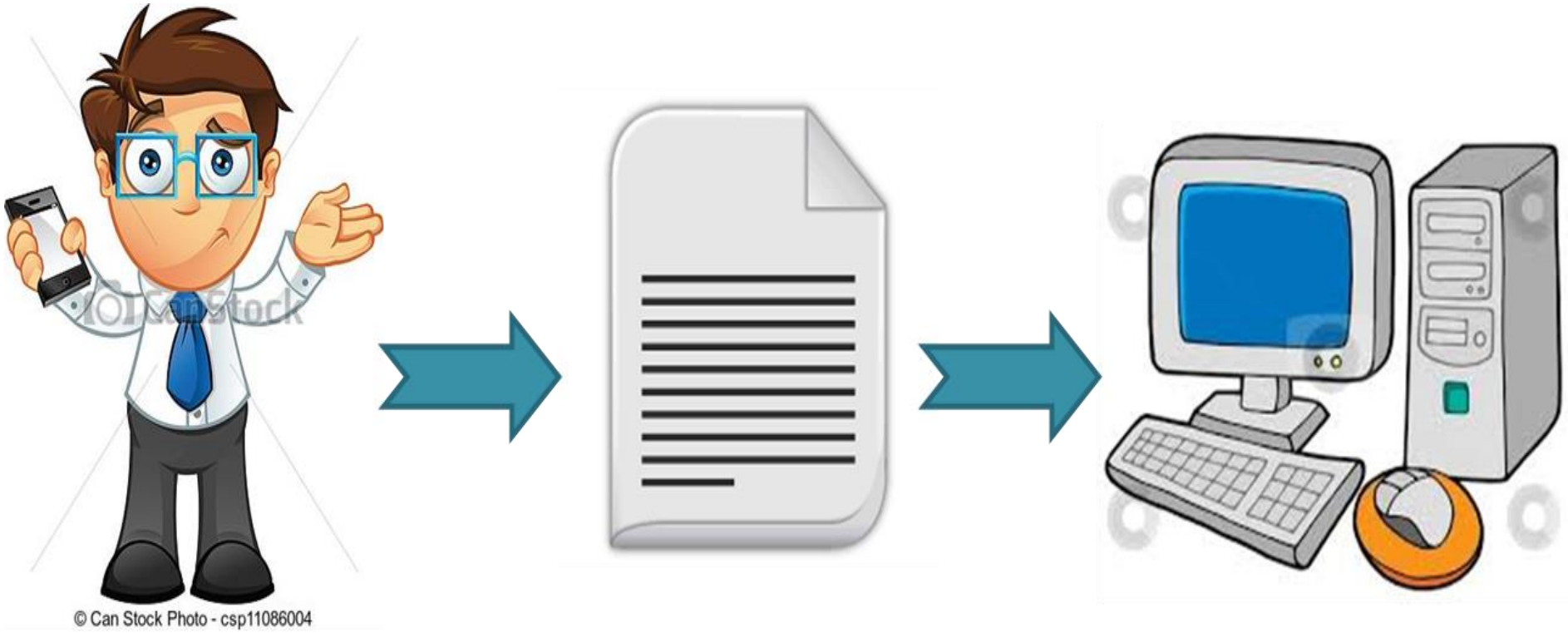
- Eligibility
  - **80%** Attendance is **MANDATORY**
- Evaluation Criteria
  - 10% From Quizzes
  - 20% Mid Term Evaluation
  - 70% From Final Exam
    - Theory Paper

Outline

- What is Object Oriented Programming
- Fundamentals of Object Orientation
- Why Object Orientation ?
  - Modularity
  - Information-hiding
  - Code re-use
  - Pluggability and debugging ease
- Understanding Classes and Objects
- Real-World Scenario
- Class
- Object
- Instance
- Instantiation

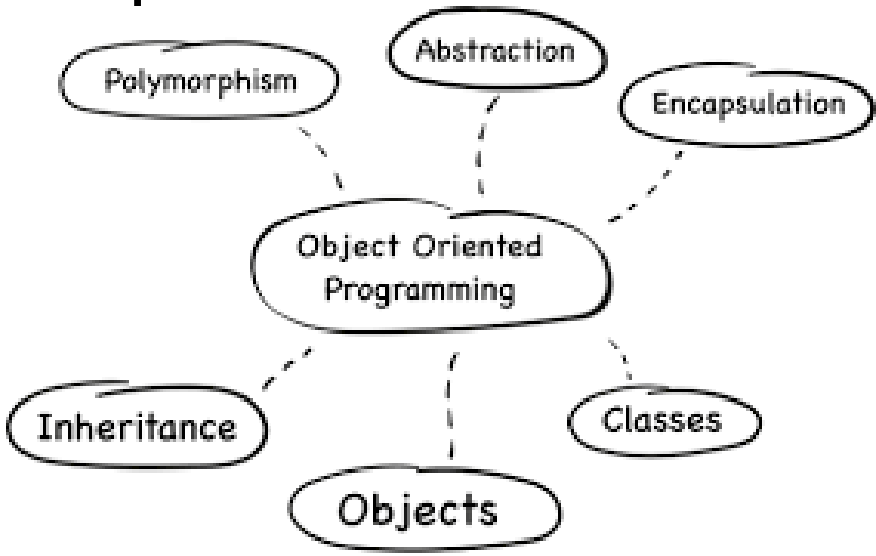
What is Programming?

- The process of writing computer programs



What is Object Oriented Programming

- Object-oriented programming
  - is a paradigm
  - based on the concept of wrapping pieces of data, and behavior related to that data,
  - into special bundles called objects,
  - which are constructed from a set of "blueprints",
  - defined by a programmer,
  - called classes.



Fundamentals of Object Orientation

A program is viewed as

- A collection of objects
  - Objects pass messages to each other
  - Each object decided what to do with a received message
- It is more meaningful to talk about an object-oriented system than a program
  - An object-oriented system is a set of interacting objects organized into classes

Fundamentals of Object Orientation

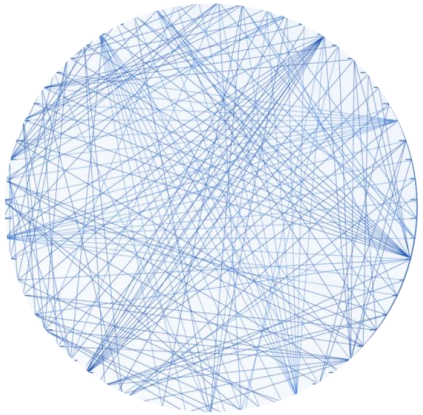
- Focus is on data and not on function
  - Definition of data and its attribute and how it will be manipulated is the focus
  - Exact mechanism of manipulation (procedure or algorithm) is not a primary focus

Why Object Orientation ?

- For keeping large software projects manageable by human programmers
  - Modularity
  - Information-hiding
  - Code re-use
  - Pluggability and debugging ease

Modularity

- The source code for an object can be written and maintained independently of the source code for other objects.
- Once created, an object can be easily passed around inside the system.



Non-modular

Modular

Information-hiding

- By interacting only with an object's methods, the details of its internal implementation remain hidden from the outside world.

Code re-use

- If an object already exists (perhaps written by another software developer), you can use that object in your program.
- This allows specialists to implement/test/debug complex, task-specific objects, which you can then trust to run in your own code.

Pluggability and debugging ease

- If a particular object turns out to be problematic, you can simply remove it from your application and plug in a different object as its replacement.
- This is analogous to fixing mechanical problems in the real world. If a bolt breaks, you replace it, not the entire machine.

Understanding Classes and Objects

A class is like a cookie cutter; it defines the shape of objects

Objects are like cookies; they are instances of the class

Photograph courtesy of Guillaume Brialon on Flickr.

Now you know…

- Class
- Object
- Instance
- Instantiation
- Let's try to go for proper understanding and definitions in the latter part of this lecture.

A Real-World Scenario

" …customers are allowed to have different types of bank accounts, deposit money, withdraw money and transfer money between accounts. "

- Start with, "Procedural" approach….

A Real-World Scenario

- Procedural Approach

```
boolMakeDeposit(intaccountNum,floatamount);
float Withdraw(intaccountNum,floatamount);

structAccount {
        char *name;
        int accountNum;
        float balance;
        char accountType;
};
```

A Real-World Scenario

- Procedural Approach
  - Focus is on procedures
  - All data is shared: no protection
  - More difficult to modify
  - Hard to manage complexity

A Real-World Scenario

" …customers are allowed to have different types of bank accounts, deposit money, withdraw money and transfer money between accounts. "

- Now, "Object Oriented" approach….

A Real-World Scenario

- Object Oriented Approach

" … customers are allowed to have different types of bank accounts, deposit money, withdraw money and transfer money between accounts. "

Nouns represent objects (classes) in the domain.

A Real-World Scenario

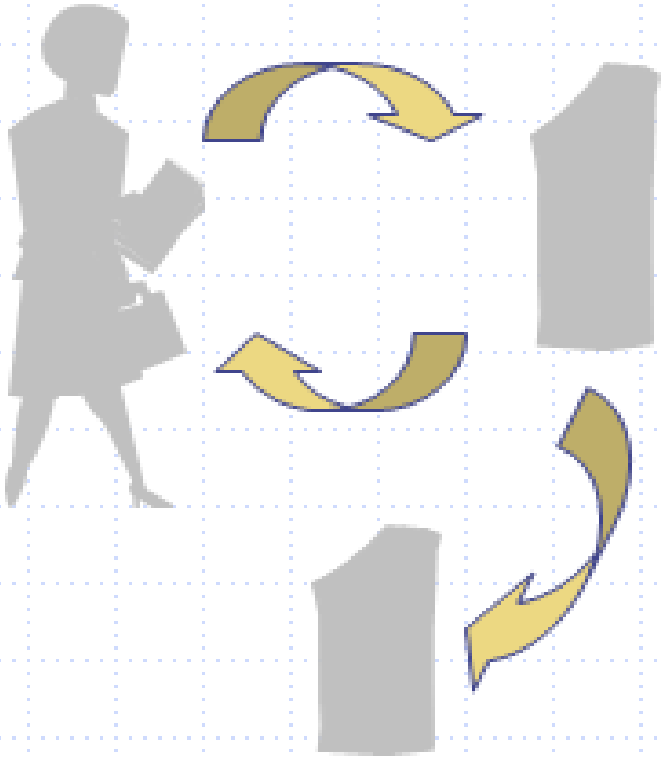
- Object Oriented Approach

" … customers are allowed to have different types of bank accounts, deposit money, withdraw money and transfer money between accounts. "

Verbs represent actions (methods) on the objects

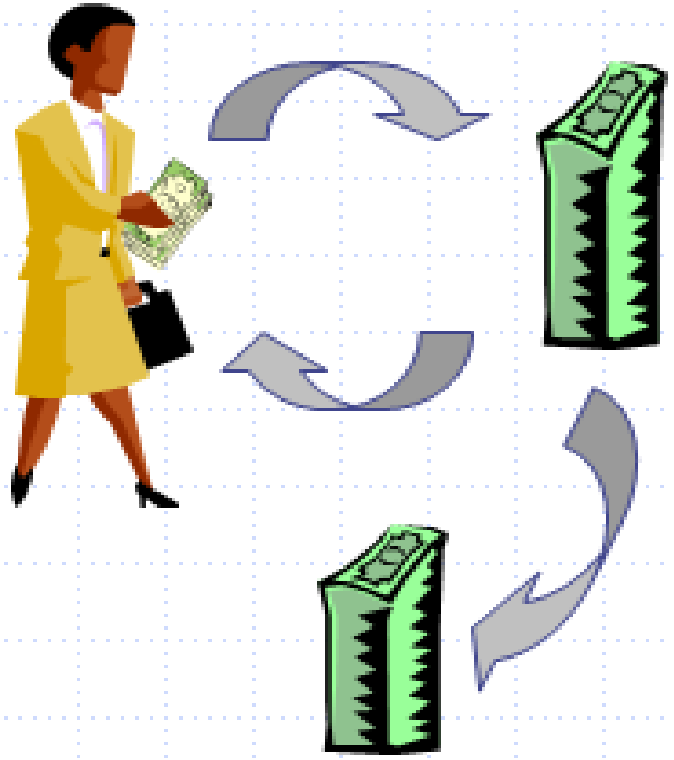
Procedural Vs Object Oriented

Procedural



Withdraw, deposit, transfer

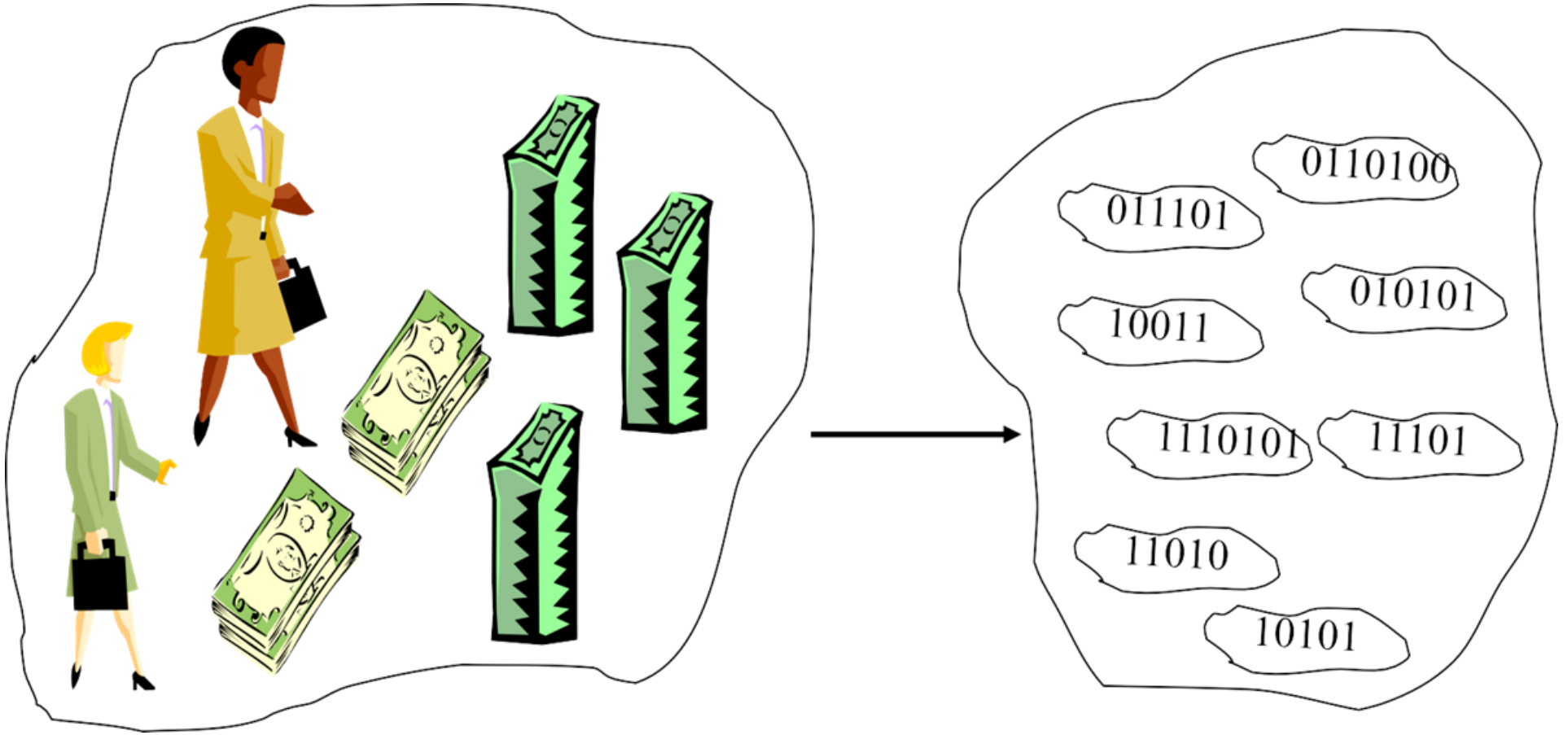
Object Oriented



Customer, money, account

Mapping the world to software

- Objects in the problem domain are mapped to objects in software

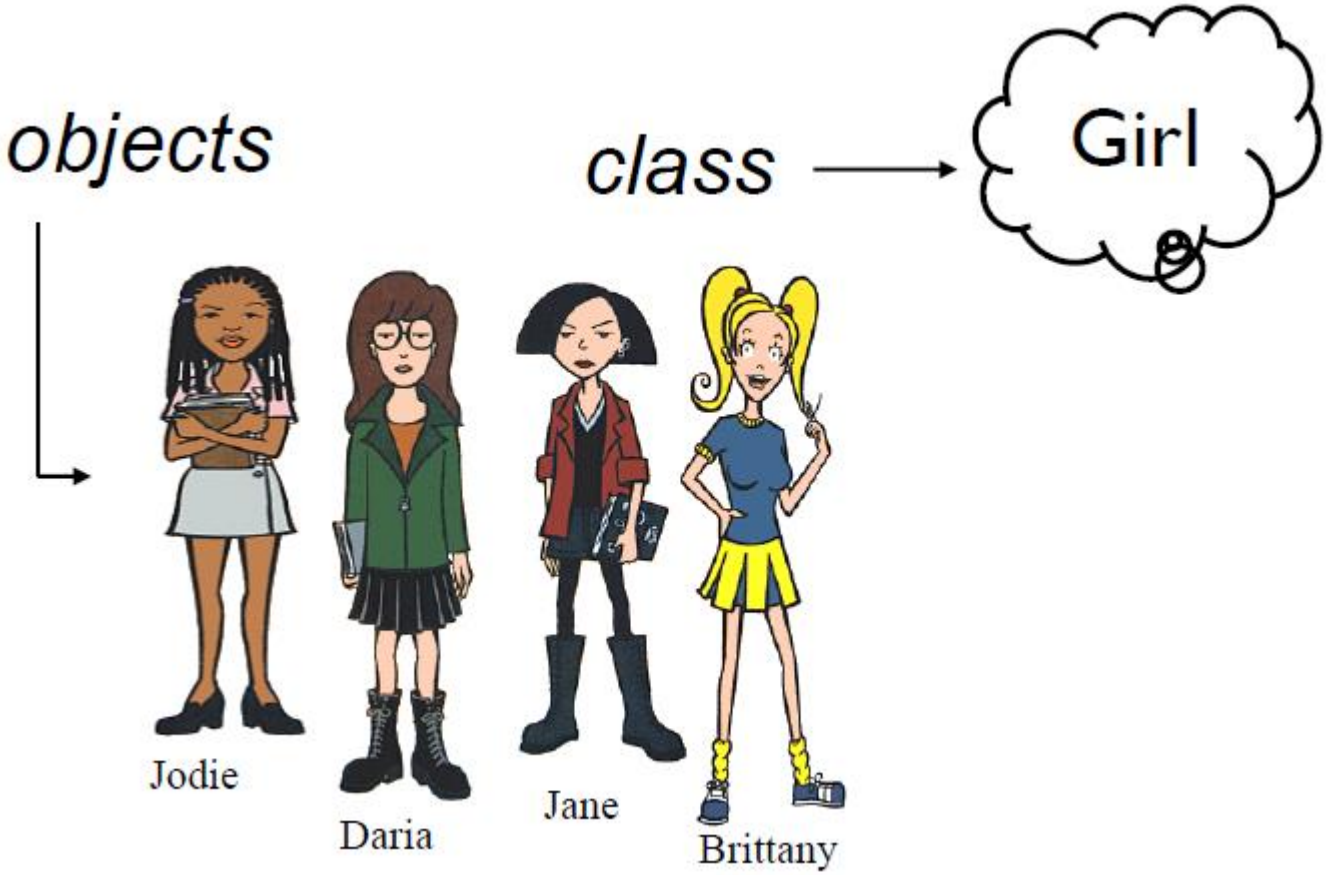


Object Oriented Approach

- Data and operations are grouped together.

Objects and Classes

- Classes reflect concepts, objects reflect instances that embody those concepts.



Objects as instances of Classes

- The world conceptually consists of objects
- Many objects can be said to be of the same type or class
  - My bank account, your bank account, Bill Gates' bank account
- We call the object type a class
  - Type of my bank account is BankAccount
  - Type of bill gate's bank acc is BankAccount

Instantiation

- An Object is instantiated from a Class

```
BankAccount myAccount;
myAccount = new BankAccount();

BankAccount gatesAccount;
gatesAccount = new BankAccount();
```

Objects and Classes

- Class
  - Visible in source code
  - The code is not duplicated
- Object
  - Own copy of data
  - Active in running program
  - Occupies memory
  - Has the set of operations given in the class

What Is an Object?

- Object is an instance of a class.

https://docs.oracle.com/javase/tutorial/java/concepts/object.html

Characteristics of Objects

- State (the properties n their values)
  - Dog : name, color, breed, etc…
  - Bank Account: balance, interest rate, etc…
- Behavior
  - Defines interaction with the outside world. (Methods)
  - Dog: making sound (barking), wagging tail, etc…
  - Bank Account: Withdraw, deposit, etc..
- Identity
  - How to differentiate two objects of the same class. Eg: ID, Account Number, Serial No, etc…

How to start…

- Think the real world, be natural.
- Identify objects
- For each object
  - Think what possible states can this object be in?
  - Think what possible behavior can this object perform?

Starting objects…

- Alan Kay's 5 rules
  - Everything is an object
  - A program is a bunch of objects telling each other what to do by sending messages
  - Each object has its own memory made up of other objects
  - Every object has a type
  - All objects of a particular type can receive the same messages (invoke methods)

What Is a Class

- A blueprint of an object.

https://docs.oracle.com/javase/tutorial/java/concepts/class.html

Class

- In the real world, you'll often find many individual objects all of the same kind. There may be thousands of other bicycles in existence, all of the same make and model.
- Each bicycle was built from the same set of blueprints and therefore contains the same components.
- In object-oriented terms, we say that your bicycle is an instance of the class of objects known as bicycles.
- A classis the blueprint from which individual objects are created.

Instance

- An instance is a specific realization of any object.
- An object may be different in several ways, and each realized variation of that object is an instance.

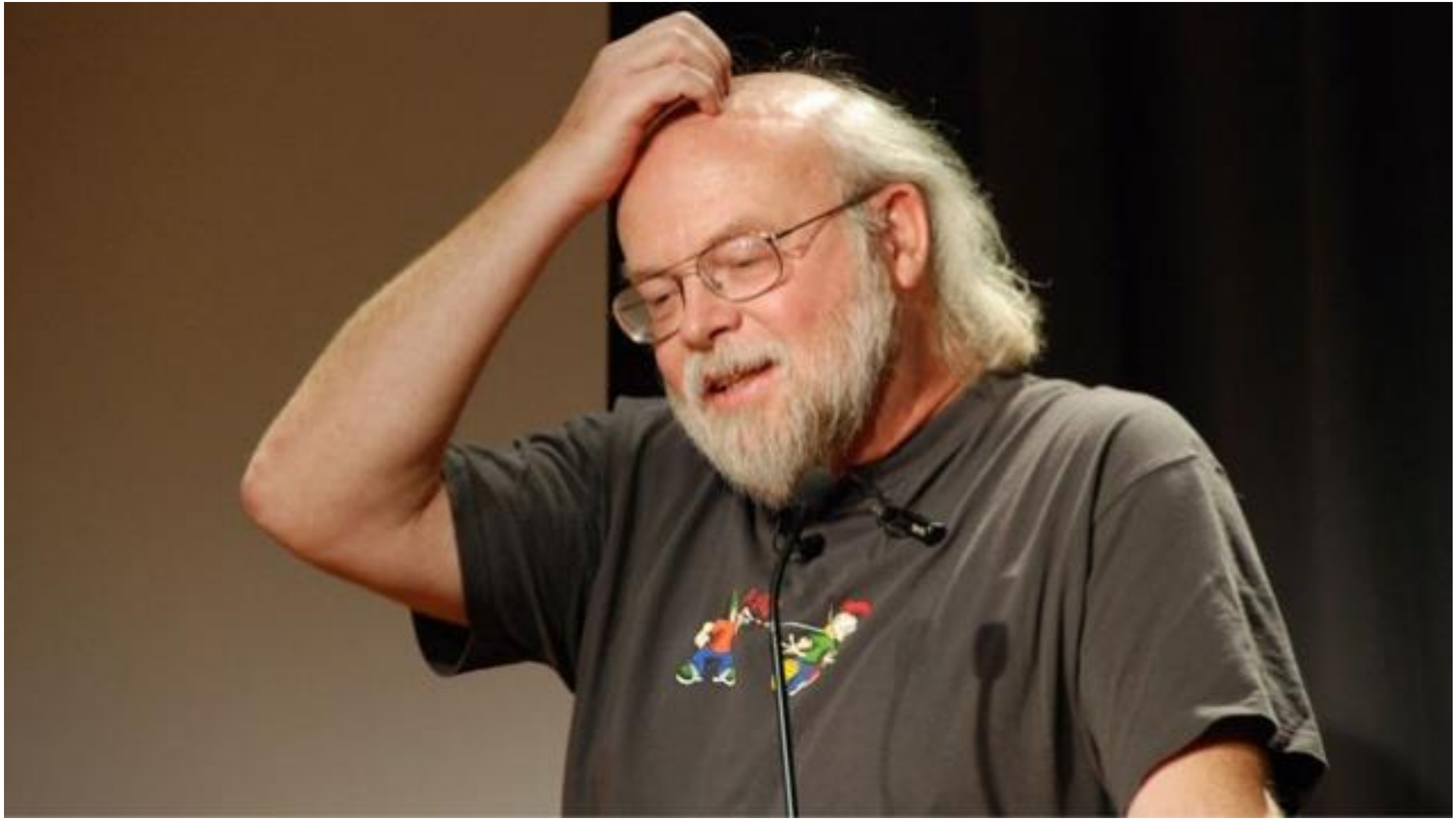
Instantiation

- Instantiation is the creation of a real instance or particular realization of an abstraction or template, such as a class of objects or a computer process.

- (The creation of a realized instance is called instantiation.)

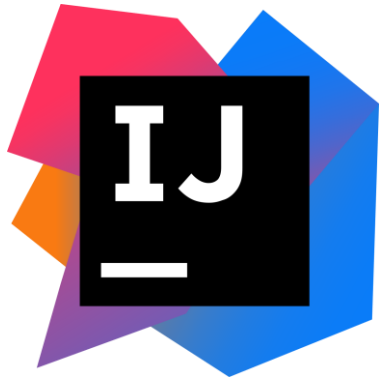
Advantages of OOP

- Ease of modeling real world in software context
- Object-oriented systems can be easily upgraded from small to large scale.
- It is easy to partition the work in a project based on objects.
- Object-oriented programming offers a new and powerful model for writing computer software.
- It reduces software maintenance and developing costs. Etc…



IntelliJ IDEA

- https://account.jetbrains.com/login



- https://www.jetbrains.com/help/idea/getting-started.html

Summary

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References

- https://docs.oracle.com/javase/tutorial/java/concepts/index.html
- How To Program (Early Objects)
  - By H .Deitel and P. Deitel
- Headfirst Java
  - By Kathy Sierra and Bert Bates

Questions ???

Thank You