

COMP 333: OOP and Java

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Object-Oriented Programming (OOP)

OOP (Minimal Definition)

- *Objects* contain *fields* holding data
- Objects can pass *messages* to each other

–Notably, this definition **doesn't** include words like method, class, encapsulation, polymorphism

OOP (Explicit Methods)

- *Objects* contain *fields* holding data and *methods* holding executable procedures
- ~~Objects can pass messages to each other~~
- Objects can call methods on other objects/
have their methods called on

–More specific. Note that calling a method isn't necessarily straightforward – we might not have the method, we might have a backup plan if we don't have the method, and determining the correct method may be complex

OOP (As Commonly Understood)

- *Objects* contain *fields* holding data and *methods* holding executable procedures
- Objects can call methods on other objects/have their methods called on
- Objects *encapsulate* their state using *access modifiers*
- On a call, the correct method may be chosen at runtime, which is a form of *polymorphism*
- Methods can be *overridden*, allowing for more specific behavior
- *Abstraction* allows for *interfaces* to contain only immediately relevant information
- *Classes* define a template to make objects from
- Classes may *inherit* fields and methods from other classes
- *All good ideas* are object-oriented

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 - All good ideas are object-oriented
- Not specific to OOP

- Encapsulation is possible in C
- Anything with higher-order functions allows polymorphism
- Typeclasses (which are unrelated to OOP classes) allow overriding and inheritance
- Abstraction existed before computers did

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Specific to
class-based
OOP

–Prototype–based OOP doesn't have classes

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Many OOP languages
do not support this

–Commonly dynamic languages don't support proper encapsulation (Python, Ruby)

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 - *All good ideas* are object-oriented
- Often considered a bad idea

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OOP was originally
heralded as a
silver bullet

Core Concept: Virtual Dispatch

Virtual Dispatch

- AKA dynamic dispatch, polymorphism
- The method/code actually called is determined at runtime

Virtual Dispatch Use

- Allows for abstracting over computation
- The computation itself becomes a parameter

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```
void foo(SortRoutine s) { ... }
```

–For example, I can define a method that takes a sorting routine...

Virtual Dispatch Use

- Allows for abstracting over computation
- The computation itself becomes a parameter

```
void foo(SortRoutine s) { ... }
```

```
foo(new InsertionSort());  
foo(new MergeSort());
```

–...and then call it with different sorting routines

–InsertionSort makes sense on data that you know to be nearly sorted, and MergeSort works best when the data is not nearly sorted

Virtual Dispatch vs. `if`

- Both conditionally execute code
 - `if`: based on if condition is true/false
 - Virtual dispatch: based on the specific runtime method passed
- `if`'s that are used to select between different code behaviors are undesirable
- Smalltalk has `ifTrue:ifFalse:` method on its boolean type

Virtual Dispatch Example in Java