CS F213 - Object Oriented Programming

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https://github.com/JenniferRanjani/Object-Oriented-Programming-with-Java

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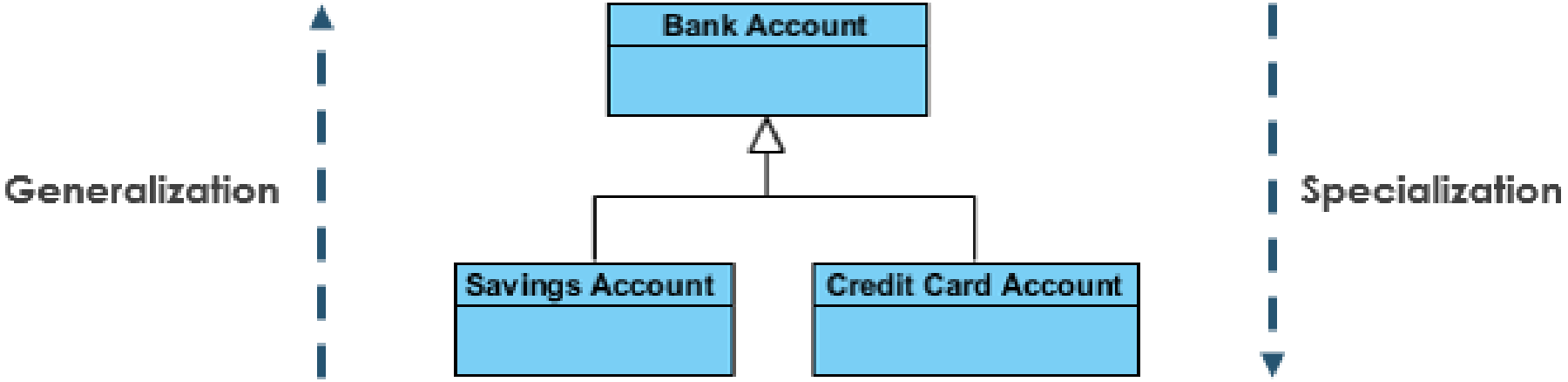
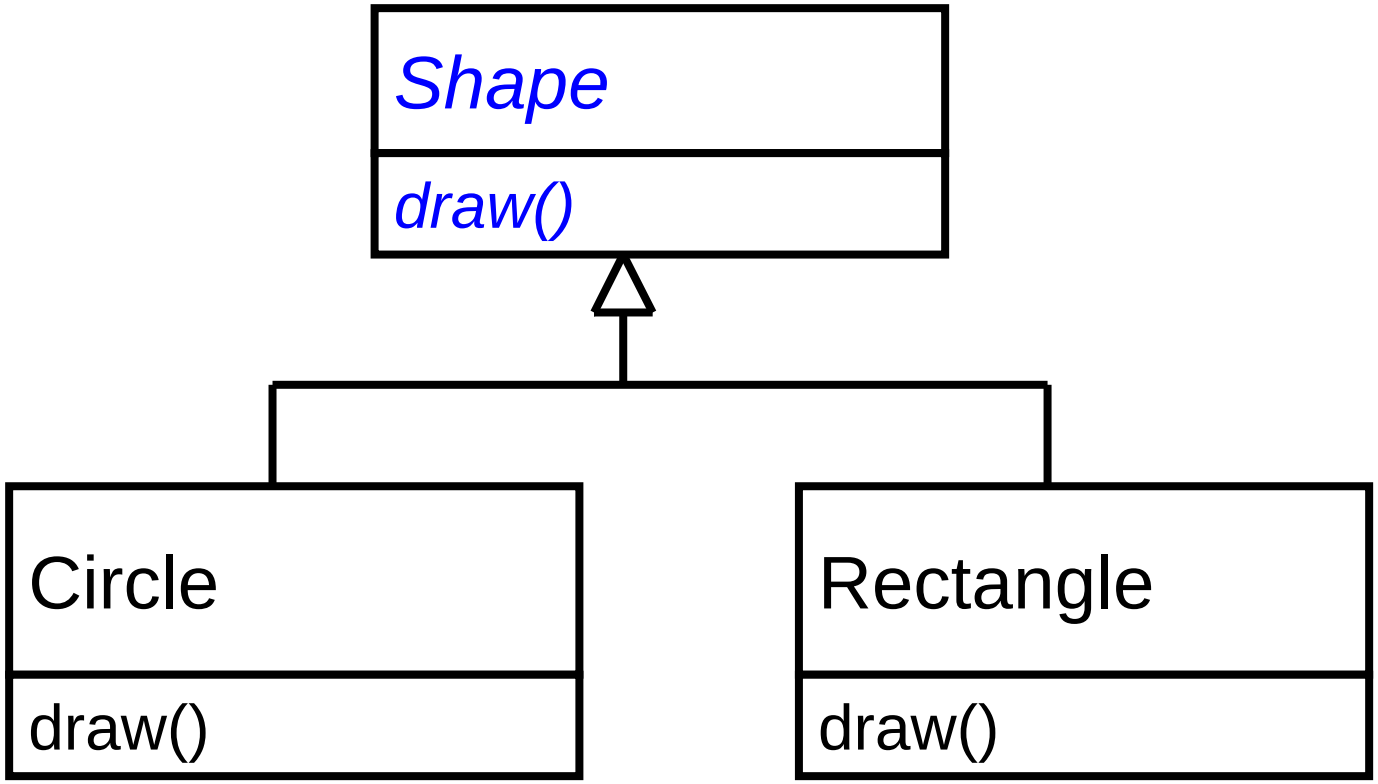
Generalization (Inheritance) vs. Specialization

- **Generalization:** It is a mechanism for combining similar classes into a single more general class.
- It defines the commonalities among the set of entities.
- **Specialization:** It is the reverse of generalization i.e. creating new subclasses from an existing class.

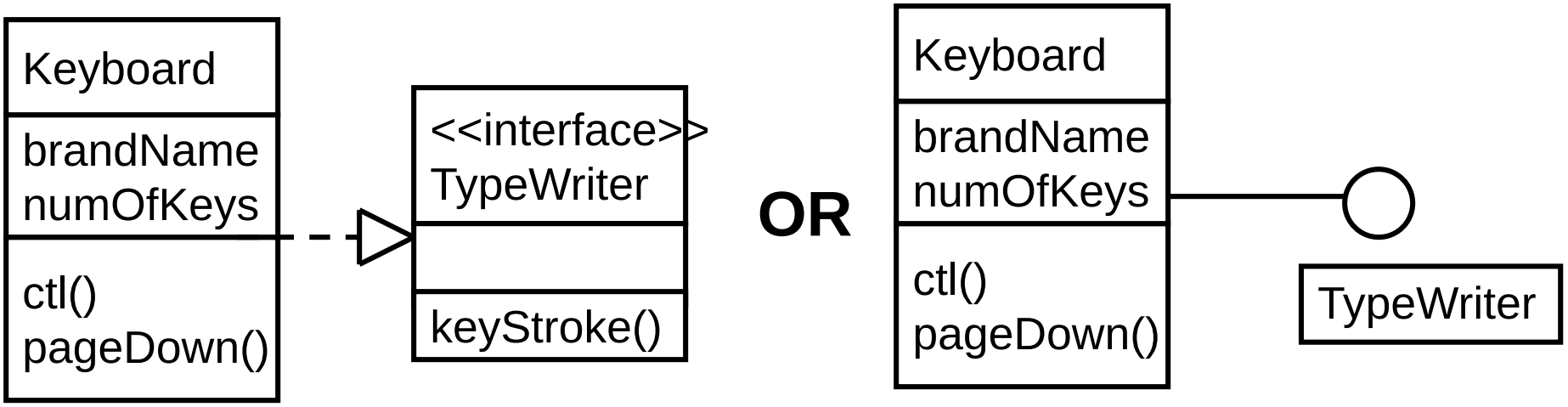
Example


Generalization
Bank Account
Savings Account
Credit Card Account
Specialization

Abstract class and abstract methods

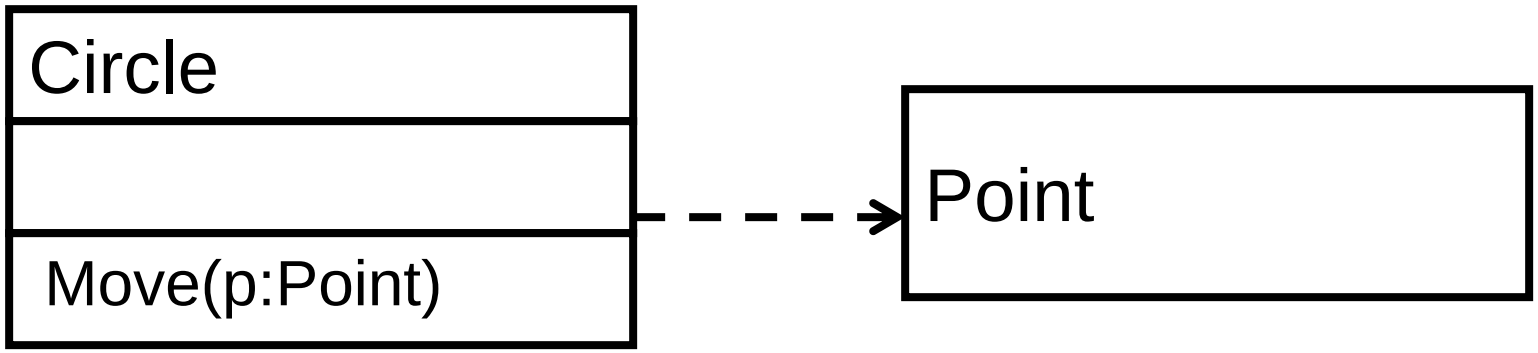


Realization - Interface

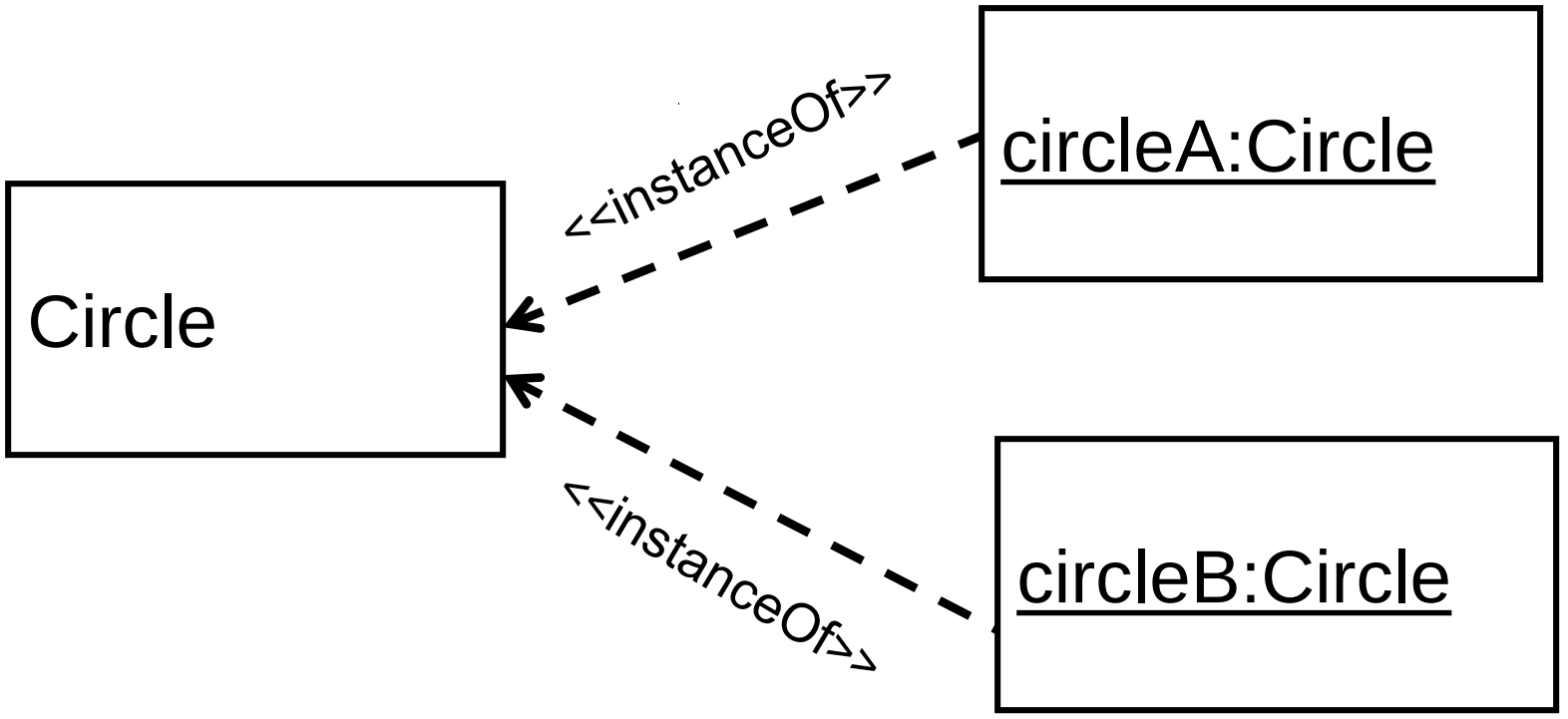


Dependency

- Change in specification of one class can change the other class. This can happen when one class is using another class.



Dependency – Classes & Objects



Multithreaded Programming

Multitasking

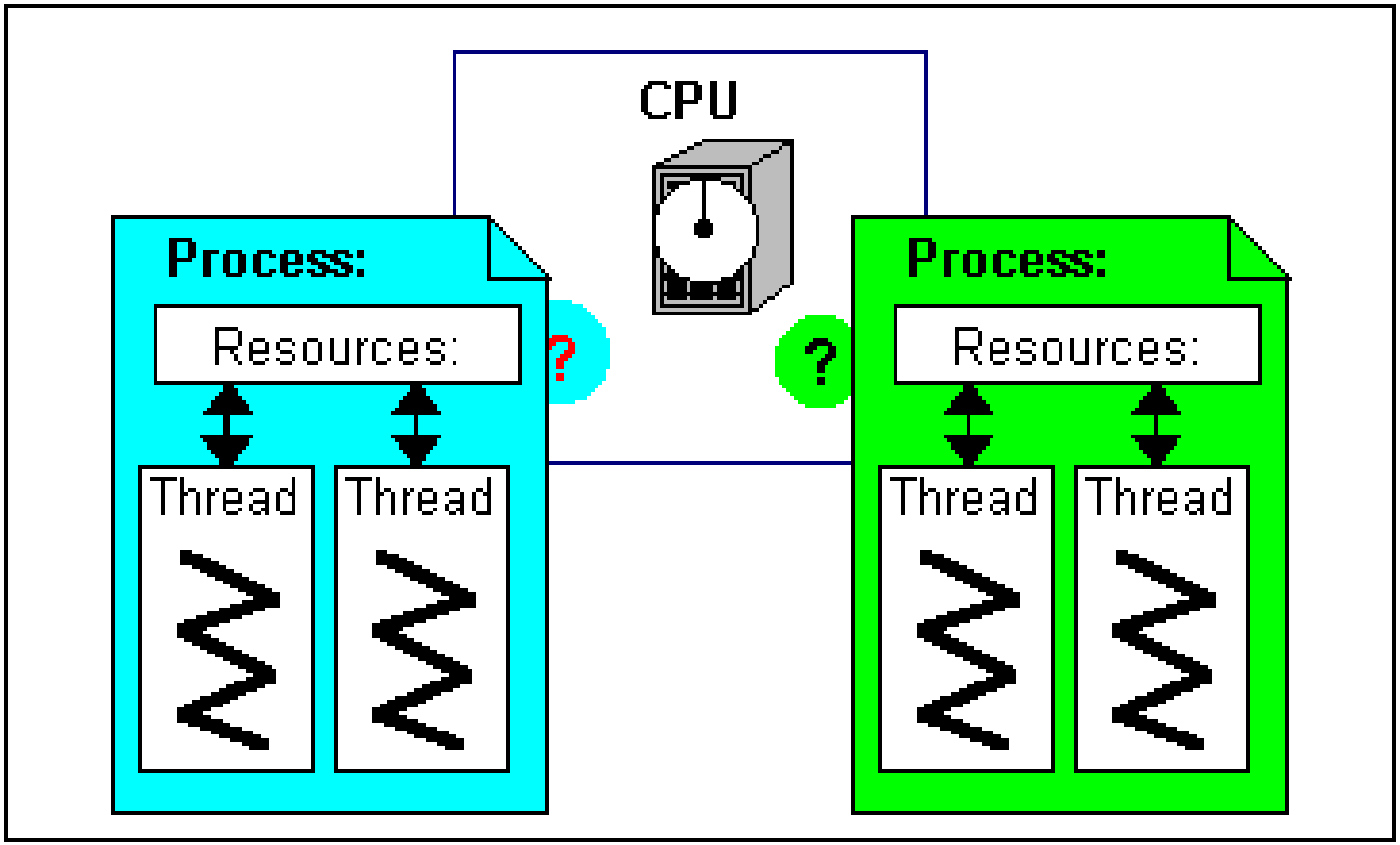
Process based

- Program in execution is called as a process
- Two or more programs running concurrently.
- Eg. Browsing and listening to music

Thread based

- Thread is a part of the program that has separate path of execution
- A single program that can perform two or more tasks simultaneously.
- Eg. Formatting using a text editor at the same time it is printing.

Process vs. Thread



Thread Model

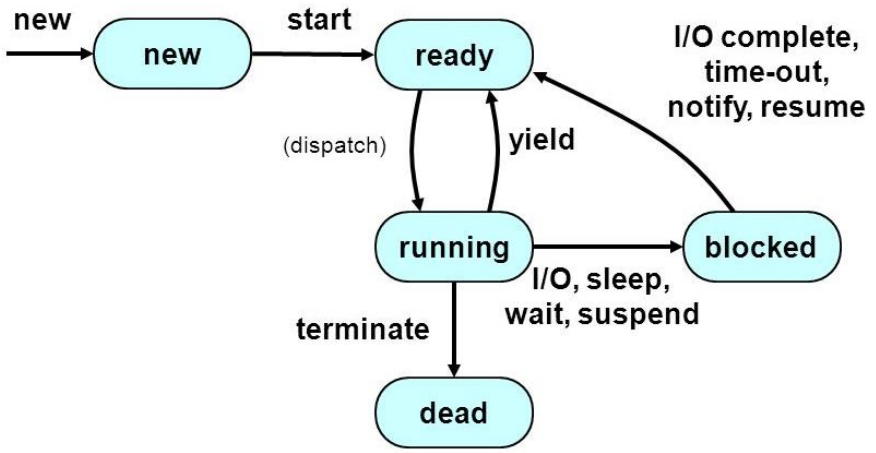
- All Java class libraries are designed with multithreading in mind.

- Single threaded systems use event loop with polling
  - Threads run a infinite loop
  - It polls a single event queue, let say, waiting for a network file to be read
  - The program wait until the event handler returns which wastes the CPU time.
  - When a thread blocks for a resource, entire program stops running

- Java Multithreading
  - Eliminates loop/polling mechanism
  - One thread can pause without stopping the other parts of the program
  - Eg. It allows animation loops to sleep for a second without causing the whole system to pause
  - One thread that is blocked pauses.

Thread States

- ***Ready to run (New):*** First time as soon as it gets CPU time.
- ***Running:*** Under execution.
- ***Suspended:*** Temporarily not active or under execution.
- ***Blocked:*** Waiting for resources.
- ***Resumed:*** Suspended thread resumed, and start from where it left off.
- ***Terminated:*** Halts the execution immediately and never resumes.



Thread Priorities

- Priorities determine how thread should be treated with respect to the others
- Priorities are integers that specify relative priority of one thread to another.
- Higher priority does not mean that the thread runs faster.
- When switching from one thread to the next, the priority is used for deciding which one to choose next – context switch

Rules determining Context Switch

innovate achieve lead

- A thread can voluntarily relinquish control
  - When explicitly yielding, sleeping or when blocked
  - The highest priority thread that is ready to run is given the CPU
  - Non-preemptive multitasking
- A thread can be preempted by a higher priority thread
  - When a lower priority thread that does not yield the processor is simple preempted by a higher priority thread no matter what it is doing
  - As soon as the higher priority thread want to run, it does
  - Preemptive Multitasking
- Some operating systems, time slice equal priority threads in round robin fashion. For others, thread should voluntarily yield otherwise it will not run.