CPU Scheduling

- Schedulers in the OS

- Structure of a CPU Scheduler
  - Scheduling = Selection + Dispatching

- Scheduling Algorithms
  - FIFO/FCFS
  - SPF / SRTF
  - Priority-Based

Schedulers

- long-term (admission) scheduler
- short-term (CPU) scheduler
- medium-term (memory) scheduler
Focus: Short-Term Scheduling

• Recall: Motivation for multiprogramming -- have multiple processes in memory to keep CPU busy.
• Typical execution profile of a process/thread:

```
start
CPU burst
wait for I/O
CPU burst
wait for I/O
CPU burst
wait for I/O
CPU burst
terminate
```

• CPU scheduler is managing the execution of CPU bursts, represented by processes in ready or running state.

Scheduling Decisions

“Who is going to use the CPU next?!”

```
ready

running

waiting
```

Scheduling decision points:
- 1. The running process changes from running to waiting (current CPU burst of that process is over).
- 2. The running process terminates.
- 3. A waiting process becomes ready (new CPU burst of that process begins).
- 4. The current process switches from running to ready.
Structure of a Scheduler

- PCB
- scheduler
- dispatcher
- CPU
- ready queue
- select process
- start new process

First-Come-First-Served (FCFS/FIFO)

- append at the end of queue
- head
- tail
- PCB
- CPU

- Advantages:
  - very simple
- Disadvantages:
  - long average and worst-case waiting times
  - poor dynamic behavior (convoy effect)
(Fixed) Priority Scheduling

- Whenever CPU is idle, picks process with highest priority.
- Priority:
  - process class, urgency, pocket depth.
- Unbounded blocking: Starvation
  - Increase priority over time: aging

Conceptually

Priority Queues

Selector (compare priorities)

Priority queue

$q=f(p)$
**Round-Robin**

- FIFO with preemption after time quantum
- Method for time sharing
- Choice of time quantum:
  - large: FCFS
  - small: Processor sharing
- Time quantum also defines context-switching overhead

**Multilevel Feedback Queue Scheduling**

(conceptually)

- Selector (compare priorities)
- Aging
- Demotion

- FCFS (quantum = infinity)
- Quantum = 16 ms
- Quantum = 4 ms
- Quantum = 2 ms