## CPU Scheduling

## key concepts

round robin, shortest job first, MLFQ, multi-core scheduling, cache affinity, load balancing

## reading

Three Easy Pieces: Chapter 7 (CPU Scheduling), Chapter 8 (Multi-level Feedback), Chapter 10 (Multi-CPU Scheduling)

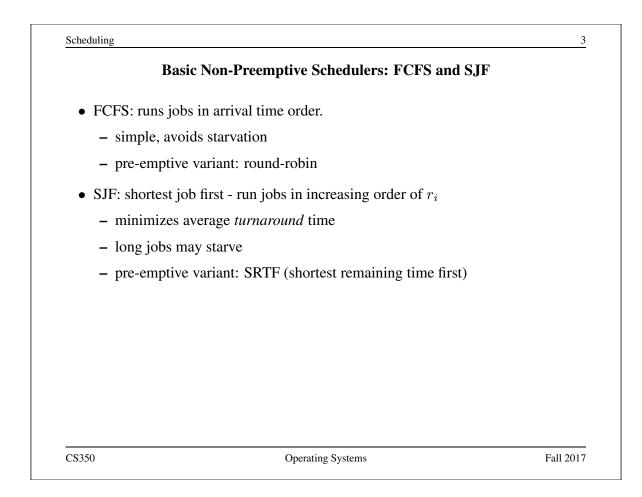
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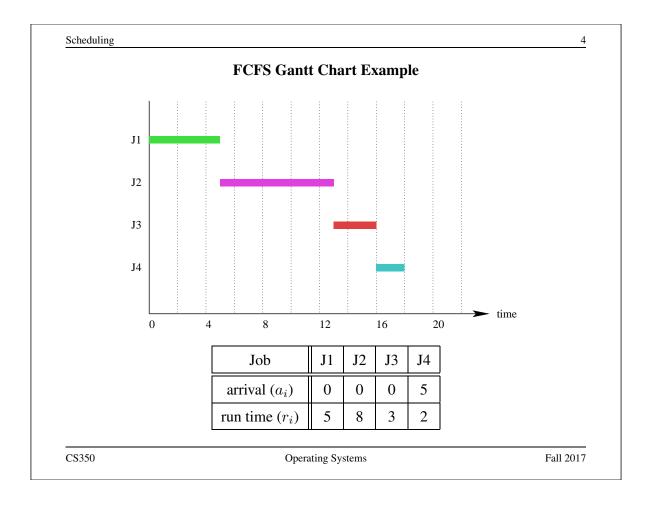
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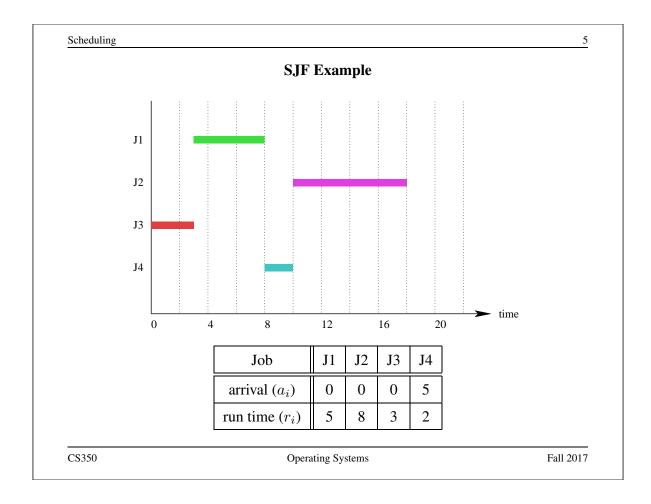
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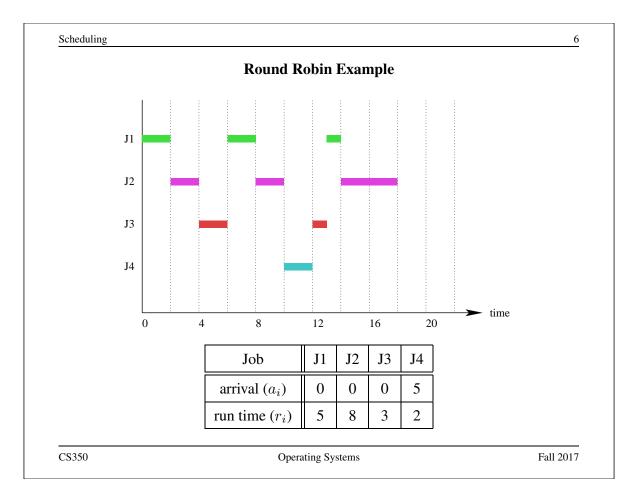
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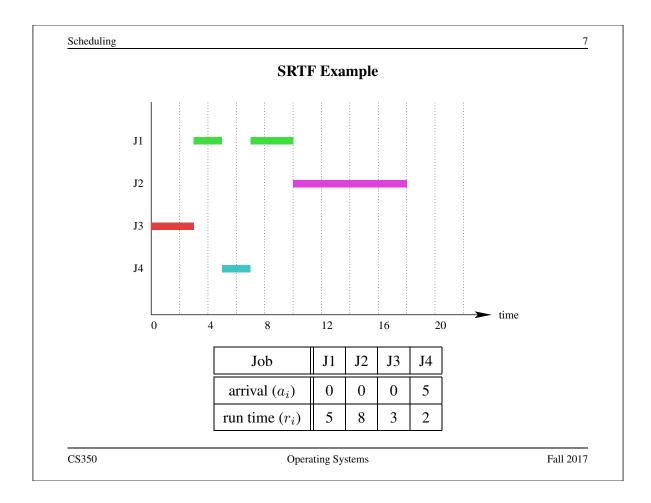
	Simple Scheduling Model
• We are given	a set of <i>jobs</i> to schedule.
• Only one job	can run at a time.
• For each job,	we are given
– job arrival	time $(a_i)$
– job run tin	the $(r_i)$
• For each job,	we define
– response t	ime: time between the job's arrival and when the job starts to run
<ul> <li>turnaround running.</li> </ul>	I time: time between the job's arrival and when the job finishes
	de when each job should run, to achieve some goal, e.g., minimiz round time, or minimize average response time.

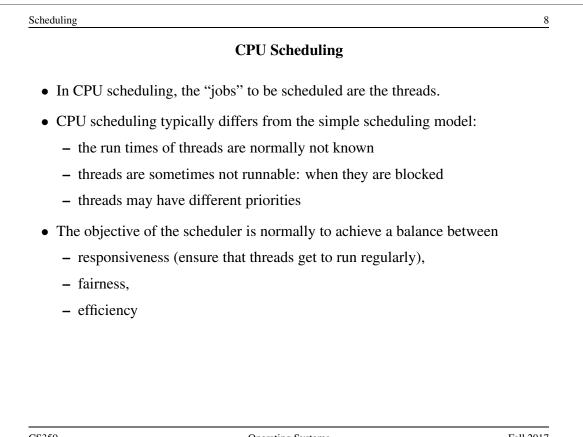


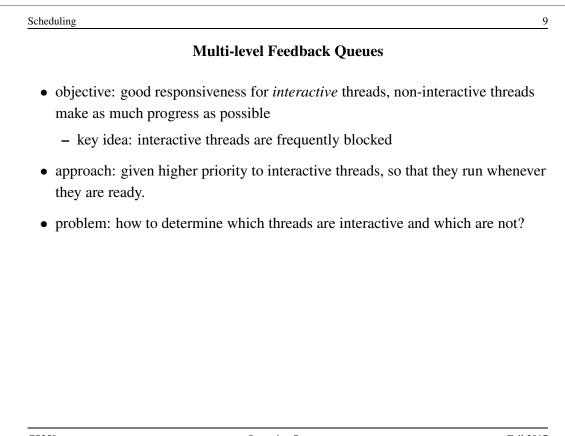








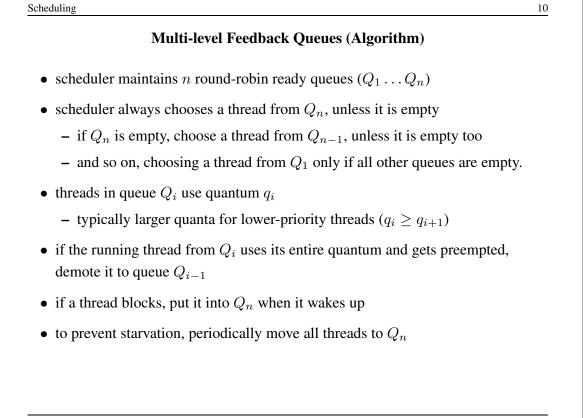


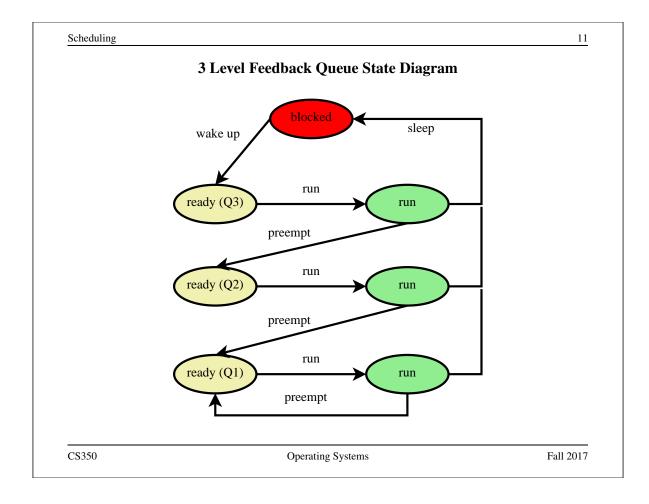


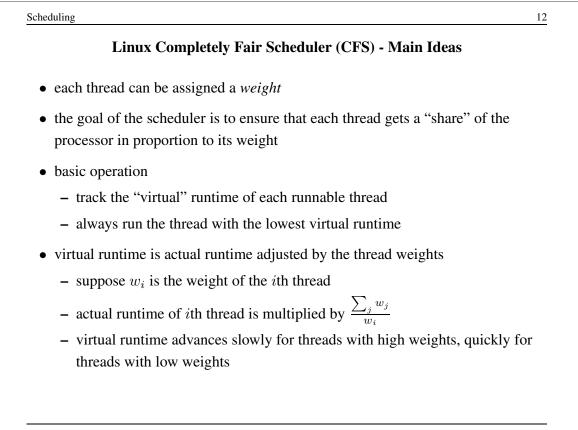
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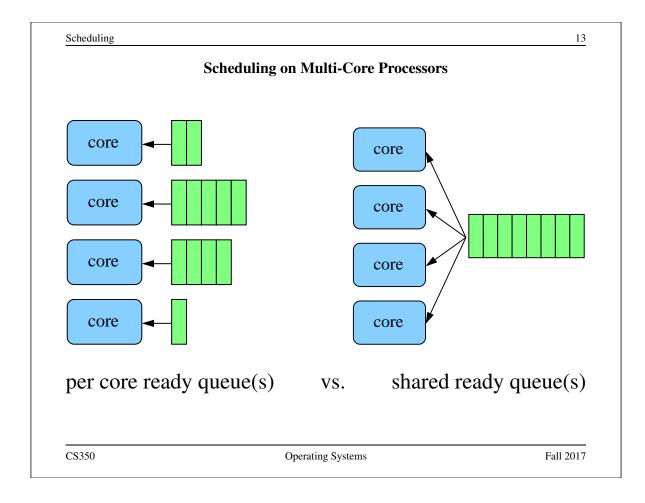
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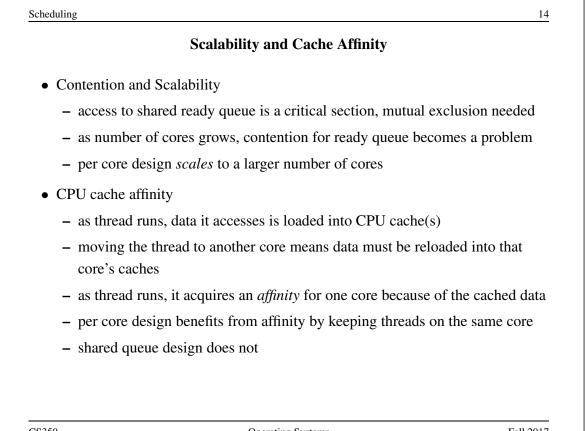
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## Load Balancing

- in per-core design, queues may have different lengths
- this results in *load imbalance* across the cores
  - cores may be idle while others are busy
  - threads on lightly loaded cores get more CPU time than threads on heavily loaded cores
- not an issue in shared queue design
- per-core designs typically need some mechanism for *thread migration* to address load imbalances
  - migration means moving threads from heavily loaded cores to lightly loaded cores

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