



Basics of CPU Scheduling (Practice)

**ICS332
Operating Systems**

Henri Casanova (henric@hawaii.edu)

(q1) Round-Robin Scheduling

- **Job A** (first in the ready queue initially):
 - CPU burst time 4ms (starts with a CPU burst)
 - I/O burst time 2ms, doing I/O on the disk
- **Job B**:
 - CPU burst time 5ms (starts with a CPU burst)
 - I/O burst time 2ms, doing I/O on the NIC (Network Interface Card)
- Round-Robin Scheduling, **time quantum 5ms**, no context-switch overhead
- Plot the CPU utilization time-line for 27ms as ASCII art
- On average, how much time does A spend in the Ready state before being scheduled?

(q1) Answer

- **Job A** (first in the ready queue initially):
 - CPU burst time 4ms (starts with a CPU burst)
 - I/O burst time 2ms, doing I/O on the disk
- **Job B**:
 - CPU burst time 5ms (starts with a CPU burst)
 - I/O burst time 2ms, doing I/O on the NIC (Network Interface Card)
- Round-Robin Scheduling, **time quantum 5ms**, no context-switch overhead
- Plot the CPU utilization time-line for 27ms as ASCII art
- On average, how much time does A spend in the Ready state before being scheduled?

CPU : **AAAABBBBAAAABBBBAAAABBBBB**

Disk : **AA AA AA**

NIC : **BB BB**

Each time A becomes ready, it has to wait 3ms for B to finish its time-quantum before it can run. **On average it spends 3ms in the Ready State**

(q2) Round-Robin Scheduling

- **Job A** (first in the ready queue initially):
 - CPU burst time 4ms (starts with a CPU burst)
 - I/O burst time 3ms, doing I/O on the disk
- **Job B**:
 - CPU burst time 2ms (starts with a CPU burst)
 - I/O burst time 2ms, doing I/O on the NIC (Network Interface Card)
- Round-Robin Scheduling, **time quantum 5ms**, no context-switch overhead

- Plot the CPU utilization time-line for 21ms as ASCII art
- In the long run, what fraction of the time is the CPU idle?

(q2) Answer

- **Job A** (first in the ready queue initially):
 - CPU burst time 4ms (starts with a CPU burst)
 - I/O burst time 3ms, doing I/O on the disk
- **Job B**:
 - CPU burst time 2ms (starts with a CPU burst)
 - I/O burst time 2ms, doing I/O on the NIC (Network Interface Card)
- Round-Robin Scheduling, **time quantum 5ms**, no context-switch overhead
- Plot the CPU utilization time-line for 21ms as ASCII art
- In the long run, what fraction of the time is the CPU idle?

CPU : **AAAABBIAAAABBIAAAABB**

Disk : **AAA** **AAA** **AA**

NIC : **BB** **BB**

Both jobs are doing I/O,
the CPU has nothing to do

The CPU is idle for 1/7-th of the time (7-ms repeating pattern, with 1 sec of idle time)

(q3) Round-Robin Scheduling

- **Job A** (first in the ready queue initially):
 - CPU burst time 3ms (starts with a CPU burst)
 - I/O burst time 3ms, doing I/O on the disk
- **Job B**:
 - CPU burst time 6ms (starts with a CPU burst)
 - I/O burst time 3ms, doing I/O on the NIC (Network Interface Card)
- Round-Robin Scheduling, **time quantum 5ms**, no context-switch overhead
- Plot the CPU utilization time-line for 29ms as ASCII art
- On average, how much time does A spend in the Ready state before being scheduled?

(q3) Solution

- **Job A** (first in the ready queue initially):
 - CPU burst time 3ms (starts with a CPU burst)
 - I/O burst time 3ms, doing I/O on the disk
- **Job B:**
 - CPU burst time 6ms (starts with a CPU burst)
 - I/O burst time 3ms, doing I/O on the NIC (Network Interface Card)
- Round-Robin Scheduling, **time quantum 5ms**, no context-switch overhead
- Plot the CPU utilization time-line for 29ms as ASCII art
- On average, how much time does A spend in the Ready state before being scheduled?

CPU : AAABBBBBAABIIAAABBBBBAABIIAAA

Disk : AAA AAA AAA AAA

NIC : BBB BBB

Bs' time quantum is over, but its CPU burst isn't!

B finishes its CPU burst

When A becomes ready, every other time it can't run for 2 sec, and every other time it runs immediately. **On average it spends 1ms in the Ready State**

Repeating pattern: AAABBBBBAABII