CSGE602055 Operating Systems
CSF2600505 Sistem Operasi
Week 08: Scheduling

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http://rms46.vlsm.org/2/207.html
Always check for the latest revision!

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Operating Systems 2018-1 (Room 3114 Tue/Thu)
Class: A (10:00-12:00) | B (13:00-15:00) | C (16:00-18:00)

Week	Schedule	Topic	OSC9
Week 00	06 Feb - 12 Feb 2018	Overview 1	Ch. 1, 16
Week 01	13 Feb - 19 Feb 2018	Overview 2 & Scripting	Ch. 1, 2
Week 02	20 Feb - 26 Feb 2018	Protection, Security, Privacy, & C-language	Ch. 14, 15
Week 03	27 Feb - 05 Mar 2018	I/O, BIOS, Loader, & Systemd	Ch. 13
Week 04	06 Mar - 12 Mar 2018	Addressing, Shared Lib, & Pointer	Ch. 8
Week 05	13 Mar - 19 Mar 2018	Virtual Memory	Ch. 9
Reserved	20 Mar - 24 Mar 2018		
Mid-Term	03 Apr 2018	13:00 - 15:30 (UTS)	
Week 06	05 Apr - 11 Apr 2018	Concurency: Processes & Threads	Ch. 3, 4
Week 07	12 Apr - 18 Apr 2018	Synchronization	Ch. 5, 7
Week 08	19 Apr - 25 Apr 2018	Scheduling	Ch. 6
Week 09	26 Apr - 07 May 2018	File System & Persistent Storage	Ch. 10, 11, 12
Reserved	08 May - 14 May 2018		
Week 10	15 May - 21 May 2018	Network Sockets Programming & I/O Programming	
Reserved	22 May - 22 May 2018		
Final	31 May 2018	13:00 - 15:00 (UAS)	
Deadline	07 Jun 2018 16:00	Extra assignment **deadline**	

- The Check List (Operating Systems)
  - **Starting Point**: `http://rms46.vlsm.org/2/207.html`
  - **Text Book**: any recent/decent OS book but map it to **OSC9**.
  - Create **public** project "os181" on your `github.com` account.
    - Create file "`README.md`" and add an extra line every week. For e.g.[1]:

      ```
      ZCZC Sistem Operasi 2018 Awal (1)
      ZCZC W01 Have tried demo for week 01.
      ZCZC W02 Week 02 is done.
      ZCZC W03 Week 03 is done.
      ```

  - Encode your **QRC** with image size of approximately 250x250 pixels: **"OS181 CLASS ID GITHUB-ACCOUNT SSO-ACCOUNT SIAK-Full-Name"** Special for Week 00: Mail your **embedded** QRC to: `os181@vlsm.org` with Subject: [W00] CLASS ID SIAK-NAME.
  - Write your Memo (with QRC) **every week**.
  - Using your **SSO** account, login to `badak.cs.ui.ac.id` via `kawung.cs.ui.ac.id`.
    - Check folder `badak:///extra/Week00/`
    - Every week, copy the weekly demo files to your own home directory. Eg. for Week00:
      `cp -r /extra/Week00/W00-demos/ W00-demos/`

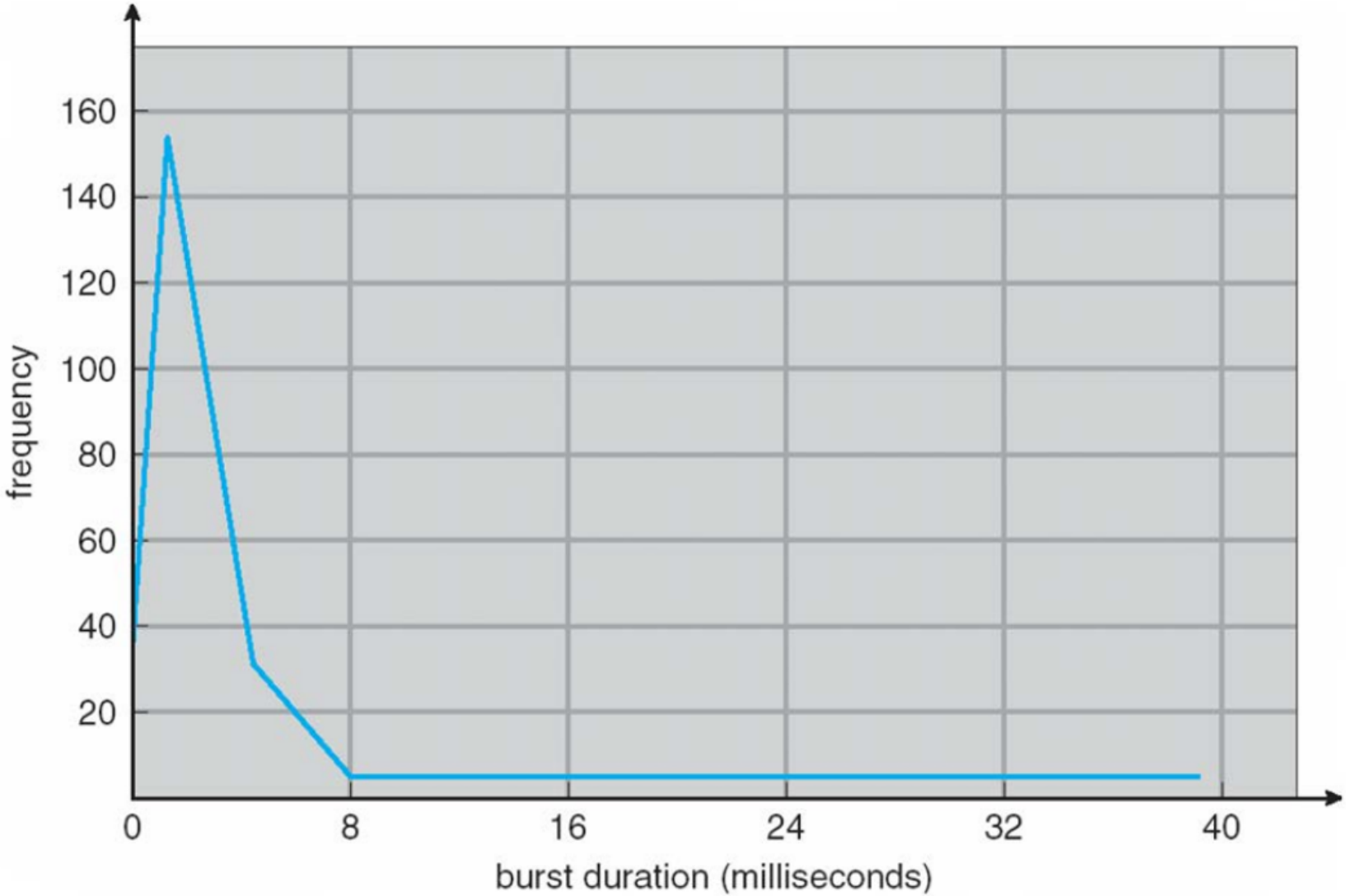
[1] Week 00 line is optional. The following "ZCZC WXX" weekly tags are mandatory.

Agenda

Week 08: Scheduling

- Reference: (OSC9-ch06 demo-w08)
- Scheduling
  - Basic Concepts
    - **WARNING:** It's just a BURST
    - IO Burst
    - CPU Burst
    - CPU Burst vs. Freq (See next slide)
  - Criteria: Utilization, throughput, {turnaround, waiting, response} time.
  - (Burst) Algorithm
    - FCFS, SJF, RR, Priority, Multilevel Queue.
  - Preemptive / Non-preemptive (Cooperative) Scheduling
  - I/O Bound / CPU Bound Processes
- Thread Scheduling
  - User-level $\rightarrow$ Process-Contention Scope (PCS): many to many/one.
  - Kernel-level $\rightarrow$ System-Contention Scope (SCS): one to one.
- Standard Linux Scheduling
  - Completely Fair Scheduler (CFS).
  - Real Time Scheduling.

CPU Burst: How Long (When)?



MultiProcessor Schedulling

- Asymmetric Multiprocessing vs. Symmetric Multiprocessing (SMP).
- Processor Affinity: soft vs. hard.
- NUMA: Non-Uniform Memory Access.
- Load Balancing
- Multicore Processors
- Real Time Schedulling: Soft vs. Hard.
- Big O Notation
  - O(1)
  - O(log N)
  - O(N)

The Two State Model

- CPU State – I/O State – CPU State – ...
  - n: processes in memory.
  - p: I/O time fraction.
  - p^n: probability n processes waiting for I/O.
  - $1 - p^n$: CPU utilization of n processes.
  - $\left[\frac{(1-p^n)}{n}\right]$: CPU utilization of ONE processes.
- Example: $p = 60\% \Rightarrow$ **CPU Utilization Per Process**: $\left[\frac{1-(60\%)^n}{n}\right]$

CPU Utilization	**Multiprogramming (%)**				
N	**1**	**2**	**3**	**4**	**5**
Per Process	40	32	26	21	18

  - For 5 concurrent processes:
    If total time is 100 seconds; for each processs, the CPU time will be 18 seconds.

The End

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