

CSF2600505 Sistem Operasi CSGE602055 Operating Systems Week 00: Overview 1

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<http://os.vlsm.org/>

Always check for the latest revision!

REV158 29-Aug-2018

Operating Systems 2018-2 (Room 3114)

R/M (Tu/Th 13-15) | I (Tu/Th 15-17) | E (Th 19-22)

Week	Schedule	Topic	OSC10
Week 00	04 Sep - 12 Sep 2018	Overview 1	Ch. 1, 18
Week 01	13 Sep - 19 Sep 2018	Overview 2 & Scripting	Ch. 1, 2
Week 02	20 Sep - 26 Sep 2018	Security, Protection, Privacy, & C-language	Ch. 16, 17
Week 03	27 Sep - 03 Oct 2018	File System & FUSE	Ch. 13, 14, 15
Week 04	04 Oct - 10 Oct 2018	Addressing, Shared Lib, & Pointer	Ch. 9
Week 05	11 Oct - 17 Oct 2018	Virtual Memory	Ch. 10
Reserved	18 Oct - 19 Oct 2018		
Mid-Term	20 Oct - 27 Oct 2018	MidTerm (UTS): TBA	
Week 06	30 Oct - 05 Nov 2018	Concurrency: Processes & Threads	Ch. 3, 4
Week 07	06 Nov - 12 Nov 2018	Synchronization & Deadlock	Ch. 6, 7, 8
Week 08	13 Nov - 21 Nov 2018	Scheduling	Ch. 5
Week 09	22 Nov - 28 Nov 2018	Disks, BIOS, Loader, & Systemd	Ch. 11
Week 10	29 Nov - 05 Dec 2018	I/O & Programming	Ch. 12
Reserved	06 Dec - 14 Dec 2018		
Final Extra	15 Dec - 22 Dec 2018 12 Jan 2019	Final (UAS): TBA Extra assignment	This schedule is subject to change.

The Weekly Check List

- ☐ **Resources:** <https://os.vlsm.org/>
 - ☐ **(THIS) Slides** — <https://github.com/UI-FASILKOM-OS/SistemOperasi/tree/master/pdf/>
 - ☐ **Demos** — <https://github.com/UI-FASILKOM-OS/SistemOperasi/tree/master/demos/>
 - ☐ **Extra** — BADAK.cs.ui.ac.id:///extra/
 - ☐ **Problems** — rms46.vlsm.org/2/195.pdf, [196.pdf](http://rms46.vlsm.org/2/196.pdf), ..., [205.pdf](http://rms46.vlsm.org/2/205.pdf)
- ☐ **Text Book:** any recent/decent OS book. Eg. **(OSC10)** Silberschatz et. al.: **Operating System Concepts**, 10th Edition, 2018.
- ☐ Encode your **QRC** with image size of approximately 250x250 pixels:
"OS182 CLASS ID SSO-ACCOUNT Your-Full-Name"
Special for **Week 00**, mail your **embedded** QRC to:
operatingsystems@vlsm.org
With Subject: OS182 CLASS ID SSO-ACCOUNT Your-Full-Name
- ☐ Write your Memo (with QRC) **every week**.
- ☐ Login to badak.cs.ui.ac.id via kawung.cs.ui.ac.id for at least **10 minutes** every week. Copy the weekly demo files to your own home directory.
Eg. (Week00): `cp -r /extra/Week00/W00-demos/ W00-demos/`

Agenda

- 1 Start
- 2 Schedule
- 3 Agenda
- 4 How to contact the Lecturer
- 5 Highlights
- 6 Week 00
- 7 Week 01
- 8 Week 02
- 9 Week 03
- 10 Week 04
- 11 Week 05
- 12 Week 06
- 13 Week 07
- 14 Week 08
- 15 Week 09

Agenda (2)

- 16 Week 10
- 17 Assessment
- 18 Week 00: Review
- 19 Assignment (W00) #1
- 20 TIPS
- 21 Week 00: Summary
- 22 Week 00: Check List
- 23 The End

How to contact the Lecturer²

- For Q & A, use WhatsApp Group **OperatingSystems**
(info +62-881-456-XXXX)
Email (Subject:[**HELP**]) operatingsystems@vlsm.org



Figure: Never ever whine and pretend like this¹!

¹"Puss in Boot" is a DreamWorks/Paramount Picture character.

²FYI: King Goerge II founded the University of Goettingen in 1734.

Highlights

Coverage

This is an introduction to a modern operating systems course. It will cover general overview, computer architecture review, operating system overview, GNU/Linux CLI, scripting, C language overview, protection, security, privacy, systemd, I/O, addressing and pointers, memory management, processes and threads, virtual memory, synchronization, mutual exclusion, deadlock, CPU scheduling algorithms, file systems, and I/O programing.

Student-Centered

This course is student-centered where responsibility is in the hands of the students. Students are expected to be prepared for the class meeting.

GNU/Linux

Students will have a thorough understanding of how GNU/Linux provides services by using a Command Line Interface.

Week 00 Overview I: Topics¹

- Role and purpose of the operating system
- Functionality of a typical operating system
- Mechanisms to support client-server models, hand-held devices
- Design issues (efficiency, robustness, flexibility, portability, security, compatibility)
- Influences of security, networking, multimedia, windowing systems
- Structuring methods (monolithic, layered, modular, micro-kernel models)
- Abstractions, processes, and resources
- Concepts of application program interfaces (APIs)
- The evolution of hardware/software techniques and application needs
- Device organization
- Interrupts: methods and implementations
- Concept of user/system state and protection, transition to kernel mode

¹Source: ACM IEEE CS Curricula 2013

Week 00 Overview I: Learning Outcomes (1)¹

- Explain the objectives and functions of modern operating systems [Familiarity]
- Analyze the tradeoffs inherent in operating system design [Usage]
- Describe the functions of a contemporary operating system with respect to convenience, efficiency, and the ability to evolve. [Familiarity]
- Discuss networked, client-server, distributed operating systems and how they differ from single user operating systems. [Familiarity]
- Identify potential threats to operating systems and the security features design to guard against them. [Familiarity]
- Explain the concept of a logical layer. [Familiarity]

¹Source: ACM IEEE CS Curricula 2013

Week 00 Overview I: Learning Outcomes (2)¹

- Explain the benefits of building abstract layers in hierarchical fashion. [Familiarity]
- Describe the value of APIs and middleware. [Assessment]
- Describe how computing resources are used by application software and managed by system software. [Familiarity]
- Contrast kernel and user mode in an operating system. [Usage]
- Discuss the advantages and disadvantages of using interrupt processing. [Familiarity]
- Explain the use of a device list and driver I/O queue. [Familiarity]

¹Source: ACM IEEE CS Curricula 2013

Week 01 Overview II: Topics¹

- Types of virtualization (including Hardware/Software, OS, Server, Service, Network)
- Paging and virtual memory
- Virtual file systems
- Hypervisors
- Portable and cost of virtualization; emulation vs. isolation
- Cloud services: IAAS, PAAS and Platform APIs, SAAS

¹Source: ACM IEEE CS Curricula 2013

Week 01 Overview II: Learning Outcomes¹

- Explain the concept of virtual memory and how it is realized in hardware and software. [Familiarity]
- Discuss hypervisors and the need for them in conjunction with different types of hypervisors. [Usage]
- Differentiate emulation and isolation. [Familiarity]
- Evaluate virtualization trade-offs. [Assessment]
- Discuss the importance of elasticity and resource management in cloud computing. [Familiarity]
- Explain the advantages and disadvantages of using virtualized infrastructure. [Familiarity]

¹Source: ACM IEEE CS Curricula 2013

Week 02 Security & Protection: Topics¹

- Overview of system security
- Policy/mechanism separation
- Security methods and devices
- Protection, access control, and authentication
- Backups

¹Source: ACM IEEE CS Curricula 2013

Week 02 Security & Protection: Learning Outcomes¹

- Articulate the need for protection and security in an OS (cross-reference IAS/Security Architecture and Systems Administration/Investigating Operating Systems Security for various systems). [Assessment]
- Summarize the features and limitations of an operating system used to provide protection and security [Familiarity]
- Explain the mechanisms available in an OS to control access to resources [Familiarity]
- Carry out simple system administration tasks according to a security policy, for example creating accounts, setting permissions, applying patches, and arranging for regular backups [Usage]

¹Source: ACM IEEE CS Curricula 2013

Week 03 File System & FUSE: Topics¹

- Files: data, metadata, operations, organization, buffering, sequential, nonsequential
- Directories: contents and structure
- File systems: partitioning, mount/unmount, virtual file systems
- Standard implementation techniques
- Memory-mapped files
- Special-purpose file systems
- Naming, searching, access, backups
- Journaling and log-structured file systems

¹Source: ACM IEEE CS Curricula 2013

Week 03 File System & FUSE: Learning Outcomes¹

- Describe the choices to be made in designing file systems. [Familiarity]
- Compare and contrast different approaches to file organization, recognizing the strengths and weaknesses of each. [Usage]
- Summarize how hardware developments have led to changes in the priorities for the design and the management of file systems. [Familiarity]
- Summarize the use of journaling and how log-structured file systems enhance fault tolerance. [Familiarity]

¹Source: ACM IEEE CS Curricula 2013

Week 04 Addressing: Topics¹

- Bits, bytes, and words
- Numeric data representation and number bases
- Representation of records and arrays

¹Source: ACM IEEE CS Curricula 2013

Week 04 Addressing: Learning Outcomes¹

- Explain why everything is data, including instructions, in computers. [Familiarity]
- Explain the reasons for using alternative formats to represent numerical data. [Familiarity]
- Describe the internal representation of non-numeric data, such as characters, strings, records, and arrays. [Familiarity]

¹Source: ACM IEEE CS Curricula 2013

Week 05 Virtual Memory: Topics¹

- Review of physical memory and memory management hardware
- Virtual Memory
- Caching
- Memory Allocation
- Memory Performance
- Working sets and thrashing

¹Source: ACM IEEE CS Curricula 2013

Week 05 Virtual Memory: Learning Outcomes¹

- Explain memory hierarchy and cost-performance trade-offs. [Familiarity]
- Summarize the principles of virtual memory as applied to caching and paging. [Familiarity]
- Describe the reason for and use of cache memory (performance and proximity, different dimension of how caches complicate isolation and VM abstraction). [Familiarity]
- Defend the different ways of allocating memory to tasks, citing the relative merits of each. [Assessment]
- Evaluate the trade-offs in terms of memory size (main memory, cache memory, auxiliary memory) and processor speed. [Assessment]
- Discuss the concept of thrashing, both in terms of the reasons it occurs and the techniques used to recognize and manage the problem. [Familiarity]

¹Source: ACM IEEE CS Curricula 2013

Week 06 Concurrency: Topics¹

- States and state diagrams
- Structures (ready list, process control blocks, and so forth)
- Dispatching and context switching
- The role of interrupts
- Managing atomic access to OS objects
- Implementing synchronization primitives
- Multiprocessor issues (spin-locks, reentrancy)

¹Source: ACM IEEE CS Curricula 2013

Week 06 Concurrency: Learning Outcomes (1)¹

- Describe the need for concurrency within the framework of an operating system. [Familiarity]
- Demonstrate the potential run-time problems arising from the concurrent operation of many separate tasks. [Usage]
- Summarize the range of mechanisms that can be employed at the operating system level to realize concurrent systems and describe the benefits of each. [Familiarity]
- Explain the different states that a task may pass through and the data structures needed to support the management of many tasks. [Familiarity]

¹Source: ACM IEEE CS Curricula 2013

Week 06 Concurrency: Learning Outcomes (2)¹

- Summarize techniques for achieving synchronization in an operating system (e.g., describe how to implement a semaphore using OS primitives). [Familiarity]
- Describe reasons for using interrupts, dispatching, and context switching to support concurrency in an operating system. [Familiarity]
- Create state and transition diagrams for simple problem domains. [Usage]

¹Source: ACM IEEE CS Curricula 2013

Week 07 Synchronization & Deadlock: Topics¹

- Shared Memory and Critical Section
- Consistency, and its role in programming language guarantees for data-race-free programs
- Message passing: PtPo vs Multicast, Blocking vs non-blocking, buffering.

¹Source: ACM IEEE CS Curricula 2013

Week 07 Synchronization & Deadlock: Learning Outcomes¹

- Use mutual exclusion to avoid a given race condition. [Usage]
- Give an example of an ordering of accesses among concurrent activities (e.g., program with a data race) that is not sequentially consistent. [Familiarity]
- Use semaphores to block threads [Usage]

¹Source: ACM IEEE CS Curricula 2013

Week 08 Scheduling: Topics¹

- Preemptive and non-preemptive scheduling
- Schedulers and policies
- Processes and threads
- Deadlines and real-time issues

¹Source: ACM IEEE CS Curricula 2013

Week 08 Scheduling: Learning Outcomes¹

- Compare and contrast the common algorithms used for both preemptive and non-preemptive scheduling of tasks in operating systems, such as priority, performance comparison, and fair-share schemes. [Usage]
- Describe relationships between scheduling algorithms and application domains. [Familiarity]
- Discuss the types of processor scheduling such as short-term, medium-term, long-term, and I/O. [Familiarity]
- Describe the difference between processes and threads. [Usage]
- Compare and contrast static and dynamic approaches to real-time scheduling. [Usage]
- Discuss the need for preemption and deadline scheduling. [Familiarity]
- Identify ways that the logic embodied in scheduling algorithms are applicable to other domains, such as disk I/O, network scheduling, project scheduling, and problems beyond computing. [Usage]

¹Source: ACM IEEE CS Curricula 2013

- Characteristics of serial and parallel devices
- Abstracting device differences
- Buffering strategies
- Direct memory access
- Recovery from failures

¹Source: ACM IEEE CS Curricula 2013

Week 09 I/O: Learning Outcomes¹

- Explain the key difference between serial and parallel devices and identify the conditions in which each is appropriate. [Familiarity]
- Identify the relationship between the physical hardware and the virtual devices maintained by the operating system. [Usage]
- Explain buffering and describe strategies for implementing it. [Familiarity]
- Differentiate the mechanisms used in interfacing a range of devices (including hand-held devices, networks, multimedia) to a computer and explain the implications of these for the design of an operating system. [Usage]
- Describe the advantages and disadvantages of direct memory access and discuss the circumstances in which its use is warranted. [Usage]
- Identify the requirements for failure recovery. [Familiarity]
- Implement a simple device driver for a range of possible devices. [Usage]

¹Source: ACM IEEE CS Curricula 2013

Week 10 I/O & N/W Programming: Topics¹

- I/O Programming
- Network Programming

¹Source: TBA

Week 10 I/O & N/W Programming: Learning Outcomes¹

- I/O Programming [Usage]
- Network Programming [Usage]

¹Source: TBA

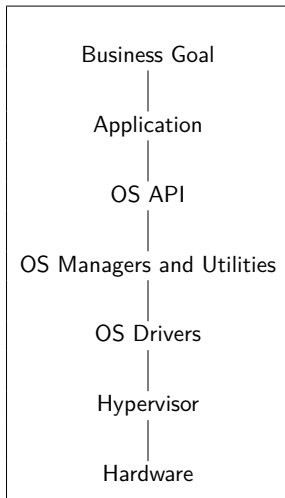
85 - ... = A	80 - 85 = A-	75 - 80 = B+	70 - 75 = B
65 - 70 = B-	60 - 65 = C+	55 - 60 = C	50 - 55 = D or C ¹
40 - 50 = D	30 - 40 = E	20 - 30 = E	00 - 20 = E

- **4 SKS** (Units) = 12 hours per week!
- **No Lab — No Task — No Pop Quiz – No Teaching Assistant.**
- **Active Preparation / Participation / Q&A Only.**
 - Pre-Midterm (UTS): 6 weeks @ 3 points (=18%).
 - Post-Midterm: 5 weeks @ 3 points (=15%).
 - Points for answering questions, trying demos, and writings memos.
 - Deductions for **NOT** answering questions: individually or collectively.
- **MidTerm+Final:** (6 + 5) set problems @ 6 points (= 36% + 30%).
- **Extra Rounding:** 1 point¹ or **C-2C:** upto 5 points¹.
- Check your points regularly at <https://academic.ui.ac.id/> and **DO NOT COMPLAIN** weeks after!

¹Terms and Conditions apply. Void where prohibited by law.

Week 00: Review

- What is an Operating System?
- Why taking an Operating System class?



Computer Organization Review

- You should understand:
 - von Neumann Model.
 - Buses, Bridges, Transfer Rate, Clock.
 - Memory: DDR, DDR-2, DDR-3 ...
 - Cache, Buffer, Spool, & Pipelining.
 - Direct Memory Access (DMA).
 - Port & Memory Mapped I/O.
 - CPU: (privilege/kernel/supervisor mode) vs. (user mode).
 - Physical (Hardware) Limitation.
 - Priority: Read vs Write.
 - Interrupts: Polling & Vectored.
 - Multiprocessors: Symmetric vs. Asymmetric.
 - Multicore & Multithreading.
 - Clustered Systems.
 - Numbers: base 2, base 8, base 10, base 16.
 - Base 2: 110010101010_2
 - Base 8: $01234567_8 = 000\ 001\ 010\ 011\ 100\ 101\ 110\ 111_2$
 - Base 10: $012\ 345\ 679$
 - Base 16: $9AB\ CDEF_{16} = 1001\ 1010\ 1011\ 1100\ 1101\ 1110\ 1111_2$

Block Diagram

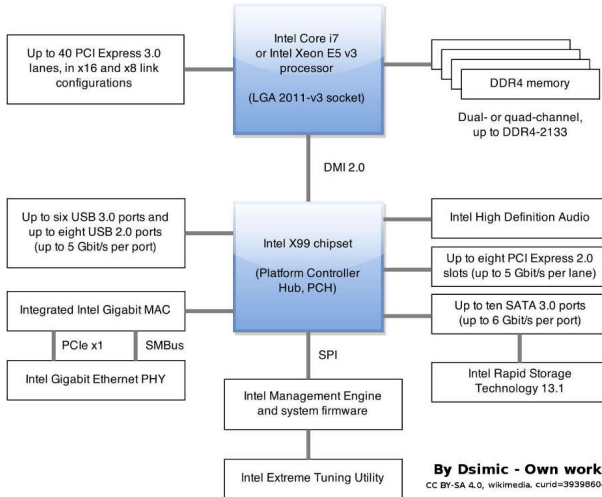


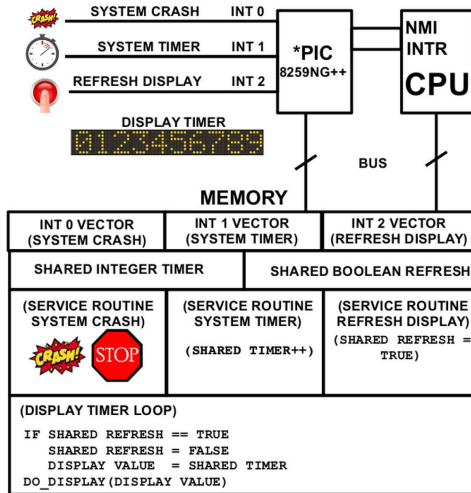
Figure: Block Diagram

APIC (Advanced Programmable Interrupt Controller)



Figure: APIC (Advanced Programmable Interrupt Controller)

Interrupt Handling



(c) 2017 VauLSMorg – This is a free picture

Figure: Interrupt Handling with PIC (Programmable Interrupt Controller)

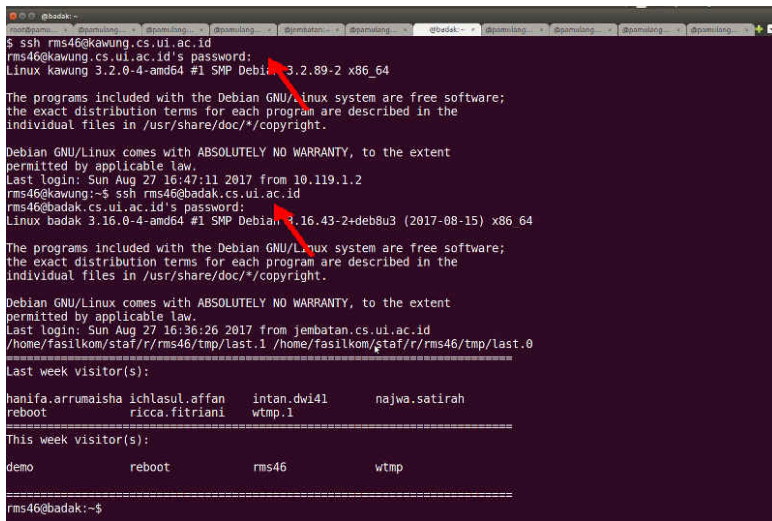
Managers Set

- Process:
 - Creating/Deleting; Suspending/Resuming; Synchronization; Communication; Scheduling
- Memory:
 - Tracking; Move In/Move Out; Allocating/Deallocating.
- Storage/File System:
 - Create/Delete; Open/Close; Read/Write.
- Mass Storage:
 - Scheduling; Allocating; Free Space.
- I/O:
 - Buffering; Caching; Spooling.
 - Interfacing (driving).
- Protecting & Security:
 - Protecting.
 - Security.

```
@rmsbase: ~
@rmsbase: ~
dummy1> $ echo "$USER --- $HOME --- `hostname`"
dummy1 --- /home/dummy1 --- badak
dummy1> $ ls -F
dummy1> $ echo "ATTN: /extra is not /extra/"
ATTN: /extra is not /extra/
dummy1> $ ls -F /extra
/extra@
dummy1> $ ls -F /extra/
Week00/ Week02/ Week04/ Week06/ Week08/ Week10/
Week01/ Week03/ Week05/ Week07/ Week09/
dummy1> $ echo "Copy /extra/ to localdir"
Copy /extra/ to localdir
dummy1> $ cp -r /extra/ localdir/
dummy1> $ ls -F localdir/
Week00/ Week02/ Week04/ Week06/ Week08/ Week10/
Week01/ Week03/ Week05/ Week07/ Week09/
dummy1> $ ls -F localdir/Week00/
W00-demos/ W00-OSC9-ch01.pdf W00-UTS-195.pdf W00-UXS-94.pdf
W00-os00-181.pdf W00-OSC9-ch16.pdf W00-UXS-183.pdf
dummy1> $ ls -F localdir/Week00/W00-demos/
c-program-example.c Makefile QR-Code.docx QR-Code.pdf
dummy1> $ cd localdir/Week00/W00-demos/
dummy1> $ make
gcc -o c-program-example c-program-example.c
dummy1> $ ./c-program-example
This is program #1
dummy1> $
```

Figure: BADAK.cs.ui.ac.id:///extra/

Login: Badak via Kawung



```
@badak: ~  
$ ssh rms46@kawang.cs.ui.ac.id  
rms46@kawang.cs.ui.ac.id's password:  
Linux kawung 3.2.0-4-amd64 #1 SMP Debian 3.2.89-2 x86_64  
  
The programs included with the Debian GNU/Linux system are free software;  
the exact distribution terms for each program are described in the  
individual files in /usr/share/doc/*/copyright.  
  
Debian GNU/Linux comes with ABSOLUTELY NO WARRANTY, to the extent  
permitted by applicable law.  
Last login: Sun Aug 27 16:47:11 2017 from 10.119.1.2  
rms46@kawang:~$ ssh rms46@badak.cs.ui.ac.id  
rms46@badak.cs.ui.ac.id's password:  
Linux badak 3.16.0-4-amd64 #1 SMP Debian 3.16.43-2+deb8u3 (2017-08-15) x86_64  
  
The programs included with the Debian GNU/Linux system are free software;  
the exact distribution terms for each program are described in the  
individual files in /usr/share/doc/*/copyright.  
  
Debian GNU/Linux comes with ABSOLUTELY NO WARRANTY, to the extent  
permitted by applicable law.  
Last login: Sun Aug 27 16:36:26 2017 from jembatan.cs.ui.ac.id  
/home/fasilkom/staf/r/rms46/tmp/last.1 /home/fasilkom/staf/r/rms46/tmp/last.0  
Last week visitor(s):  
hanifa.arrumaisha  ichlasul.affan      intan.dwi41        najwa.satirah  
reboot             ricca.fitriani      wtmp.1  
=====
```

This week visitor(s):			
demo	reboot	rms46	wtmp

```
=====
```

```
rms46@badak:~$
```

Figure: Login: Badak via Kawung

Program Example (Week 00)

```
$ cat c-program-example.c
/* (c) 2016-2017 Rahmat M. Samik-Ibrhaim
 * REV01 Sun Aug 20 15:01:12 WIB 2017
 * START Fri Jan 01 00:00:00 WIB 2016
 * This is a free software.
 * To compile:
 * $ gcc -o c-program-example c-program-example.c
 * To execute:
 * $ ./c-program-example
 */
```

```
#include <stdio.h>
```

```
void main() {
    printf("This is program #1\n");
}
```

Makefile

```
$ cat Makefile
```

```
# (c) 2016-2017 Rahmat M. Samik-Ibrahim  
# REV01 Tue Aug 22 14:45:14 WIB 2017  
# START Fri Jan 01 00:00:00 WIB 2016  
# This is a free Makefile configuration.  
# Just run:  
# % make
```

```
ALL:  c-program-example
```

```
c-program-example: c-program-example.c  
    gcc -o c-program-example c-program-example.c
```

```
clean:  
    rm -f c-program-example
```

Week 00: Demo Directory

```
$ ls -al
total 44
drwxr-xr-x  3 rms46 rms46  4096 Aug 28 18:45 .
drwxr-xr-x 13 rms46 rms46  4096 Feb 28 18:50 ..
-rw-r--r--  1 rms46 rms46   334 Aug 23 20:17 c-program-example.c
-rw-r--r--  1 rms46 rms46   319 Aug 23 20:17 Makefile
-rw-r--r--  1 rms46 rms46 23606 Aug 28 18:26
                                           QuickResponseCode.docx
```

```
$ make
gcc -o c-program-example c-program-example.c
$ ./c-program-example
This is program #1
$ ls -al
total 56
.....
$ make clean
rm -f c-program-example
$
```

Assignment (W00) #1: Generate your QR Code

- What year and term? Eg. 2018 – 2 \rightarrow "0S182"
- What is your OS class? Regular (A, B, C, D)? Or, Extension (E)? Or, International (I)? Or Matrix (M)? Or, Other (X)? Eg. "X".
- What is your Student ID (NPM)? Eg. "1253755125".
- What is your SSO Account (for using badak.cs.ui.ac.id)? Eg. "demo".
- What is your Full Name (at SIAK)? Eg. "Demo Suremo".
- Generate your QR code:
0S182 X 1253755125 demo Demo Suremo



- **NOTE:** Your Student ID (NPM) is the most important information!

- (Eg.) Subject: OS182 X 1253755125 demo Demo Suremo
- Insert your QR Code (**embedded**). **DO NOT ATTACH!**
 - How to generate a QR Code: <http://goqr.me/>

1. Type text 2. Contents 3. Live preview

Text

OS182 X 1253755125 demo Demo Suremo

35 characters

<http://goqr.me/>

Download Embed

Add a logo!

Download QR Code

Error correction code: H

Foreground: 000000 Background: FFFFFFFF

Border: 10

Size: 400

Download QR Code as: SVG EPS PNG JPEG

Note: You can use the QR code completely free of charge (commercial and print usage allowed).

- Do not forget to **test** (SCAN) your QR Code!

Week 00 Memo Example

[OS182][WEEK. 00 01 02 03 04 05 06 07 08 09 10]

[CLASS: A B C D E I M (X)] [ID: 1253755125] [Name: Demo Suremo] [Rev: 07]

$$\begin{aligned} | \langle x, y \rangle | &\leq \|x\| \|y\| \\ \frac{d\vec{v}}{dt} &= \vec{a} \\ \frac{d\vec{x}}{dt} &= \vec{v} \\ d\vec{v} &= \vec{a} dt \\ \int d\vec{v} &= \int \vec{a} dt \\ \vec{v} &= \vec{v}_0 + \vec{a}t \\ \frac{d\vec{x}}{dt} &= (\vec{v}_0 + \vec{a}t) \\ d\vec{x} &= (\vec{v}_0 + \vec{a}t) dt \\ \int d\vec{x} &= \int (\vec{v}_0 + \vec{a}t) dt \\ \vec{x} &= \vec{x}_0 + \vec{v}_0 t + \frac{1}{2} \vec{a} t^2 \end{aligned}$$



$$\begin{aligned} \hat{H}|\psi_n(t)\rangle &= i\hbar \frac{\partial}{\partial t} |\psi_n(t)\rangle \\ \frac{1}{c^2} \frac{\partial^2 \phi_n}{\partial t^2} - \nabla^2 \phi_n + \left(\frac{mc}{\hbar}\right)^2 \phi_n &= 0 \\ \hbar \frac{\partial}{\partial t} s &= s / \hbar \frac{\partial}{\partial t} s = p_i \text{ or } s_i = 1, \dots, k. \\ f(Q_i) &= \sum_{d_i=1}^{\infty} \frac{(2d_i-1)!}{(d_i!)^2} Q_i^{d_i} \\ d(x, z) &\leq d(x, y) + d(y, z) \end{aligned}$$

$$\begin{aligned} \frac{d\vec{v}}{dt} &= \vec{a} \\ \frac{d\vec{x}}{dt} &= \vec{v} \\ d\vec{v} &= \vec{a} dt \\ \int d\vec{v} &= \int \vec{a} dt \\ \vec{v} &= \vec{v}_0 + \vec{a}t \\ \frac{d\vec{x}}{dt} &= (\vec{v}_0 + \vec{a}t) \\ d\vec{x} &= (\vec{v}_0 + \vec{a}t) dt \\ \int d\vec{x} &= \int (\vec{v}_0 + \vec{a}t) dt \\ \vec{x} &= \vec{x}_0 + \vec{v}_0 t + \frac{1}{2} \vec{a} t^2 \end{aligned}$$

Figure: Memo: OS182 X 1253755125 demo Demo Suremo

Week 00: Problem Example (from OSC2e)

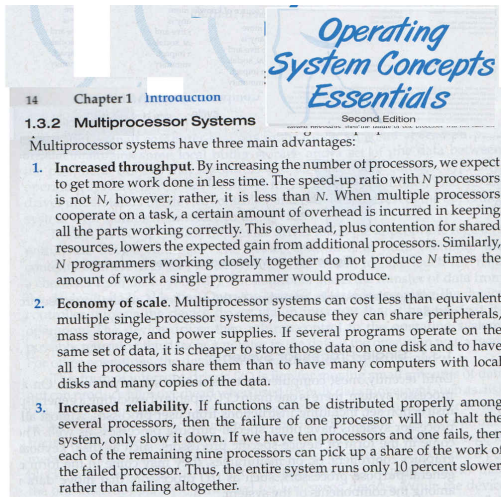


Figure: T / F The advantages of a multiprocessor system include: increased throughput, economy of scale, and increased reliability (Week00 2016-1).

TIPS (1)

- For any administrative issues, contact SEKRE at building B, 2nd floor – especially for absences, illness, sick letters, follow-up exams, etc. Please do not contact the **Lecturer** (RMS).
- Please complete the follow-up / paper work within 6 working days (RMS).
- Prepare the weekly MEMO as completely as possible. You should have mastered the material at the beginning of the week (RMS).
- You should understand every single problem of the past examinations. Write down all hints in your "**MEMO**" (MHP).
- You are allowed to bring up to (max) 6 sheets of MEMOs for the midterm (UTS) and up to 5 (max) sheets of MEMOs for the final term (UAS) (RMS).
- You should understand every single line of the "**DEMOS**" (MHP).
- You should ask **the lecturer** or anyone, anything you do not understand (TA).

TIPS (2)

- TBA.

Special Thanks

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See also <https://rms46.vlsm.org/2/221.pdf>.

Week 00: Summary

- Reference: (OSC10 chapter 1 + chapter 18)
- What is an Operating Systems?
 - Definition: Resource Allocator & Control Program.
 - Why taking an Operating System class?
- Computer Organization Review
- The Manager Set
 - Process Manager, Memory Manager, I/O Manager, Storage Manager.
- Security and Protection
- Virtualization
 - Hypervisor type 0, 1, 2
 - Paravirtualization, Emulators, Containers.
 - VCPU: Virtual CPU
 - Virtualization Implementation:
 - Trap-and-Emulate mode
 - Binary Translation mode

Week 00: Check List

- ☐ Starting **Week 01**: TABULA RASA is not accepted anymore!
- ☐ Find/copy this document from <http://os.vlsm.org/>
- ☐ Find/read a recent/decent OS Book and map it to **OSC10**.
- ☐ Using your **SSO** account, login to `badak.cs.ui.ac.id` via `kawung.cs.ui.ac.id`.
- ☐ Check folder `badak:///extra/Week00/`
 - ☐ Try to copy and compile `c-program-example.c`.
- ☐ QR Code: (Eg) "0S182 X 1253755125 demo Demo Suremo"
- ☐ Mailto: `operatingsystems@vlsm.org`
(Eg.) Subject: 0S182 X 1253755125 demo Demo Suremo
- ☐ Write "Memo Week00" + your QRC.
- ☐ **How to improve this document?**

The End

- ☐ This is the end of the presentation.
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 - This is the end of the presentation.