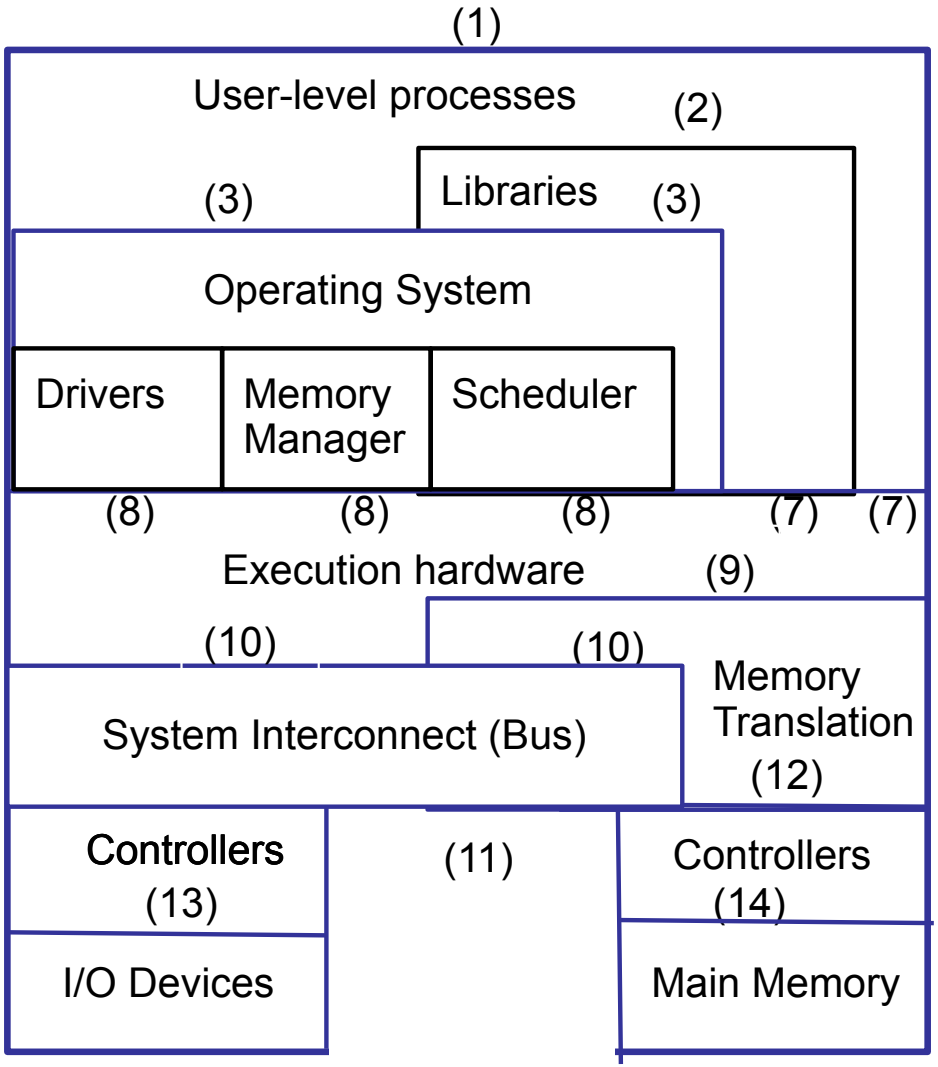
Operating Systems
Course Overview

Instructor: Kartik Gopalan

Class website:
http://oscourse.github.io

Interfaces in a Computer System



User ISA : 7
System ISA : 8
Syscalls : 3
ABI : 3, 7
API : 2,7

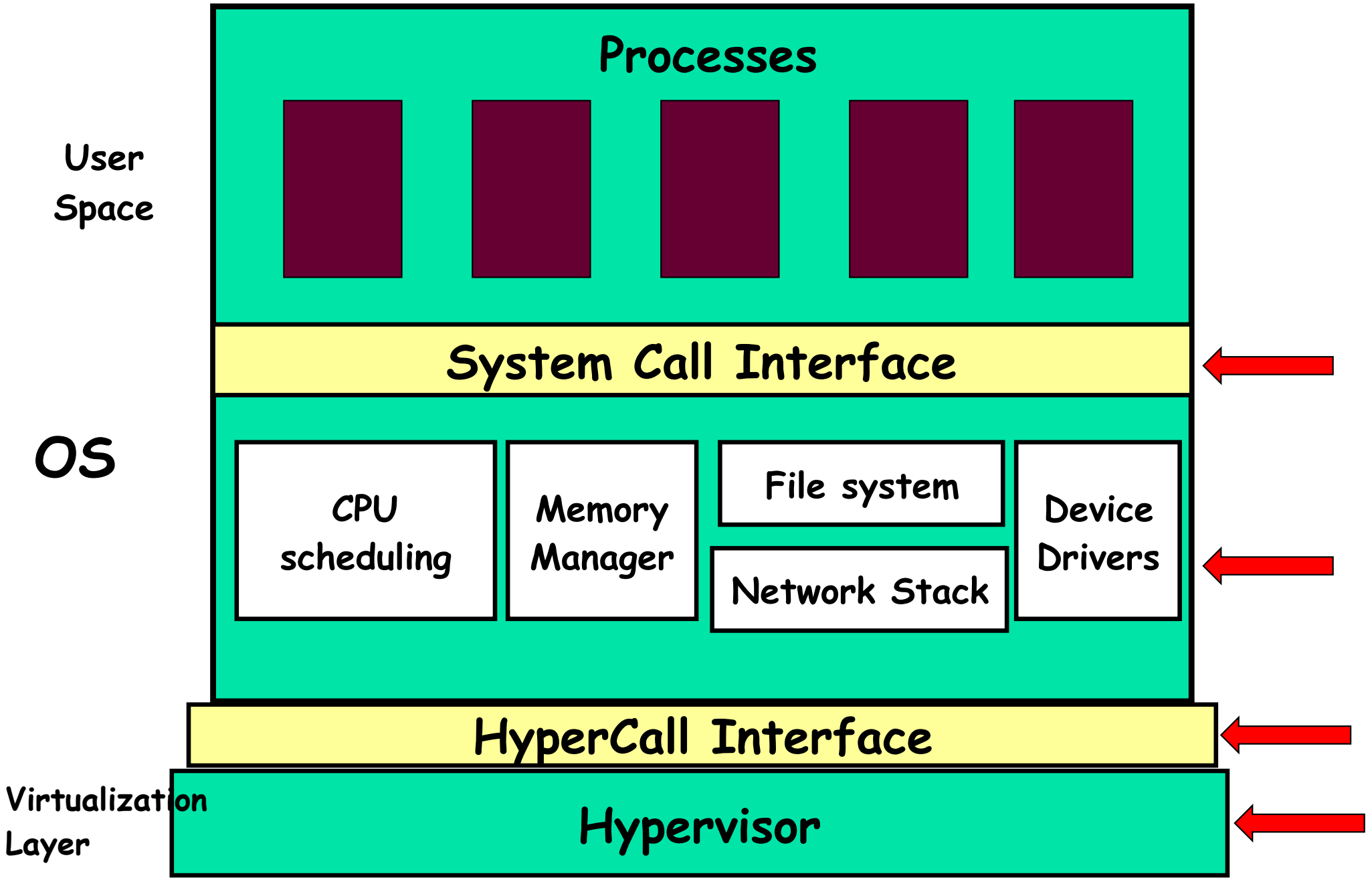
ISA = Instruction Set Architecture
ABI = Application Binary Interface
API = Application Programming Interface

What is an OS?

What is an OS?

- A bunch of software and data residing somewhere in memory.
  - But its not just *any* software.
- OS is the *most privileged* software in a computer.
  - *Privileged* means that OS can do special things, like write to disk, talk over the network, control memory and CPU usage, etc.
- OS manages all system resources
  - CPU, Memory, and I/O devices

Layers of Software



But when does the OS “run”?

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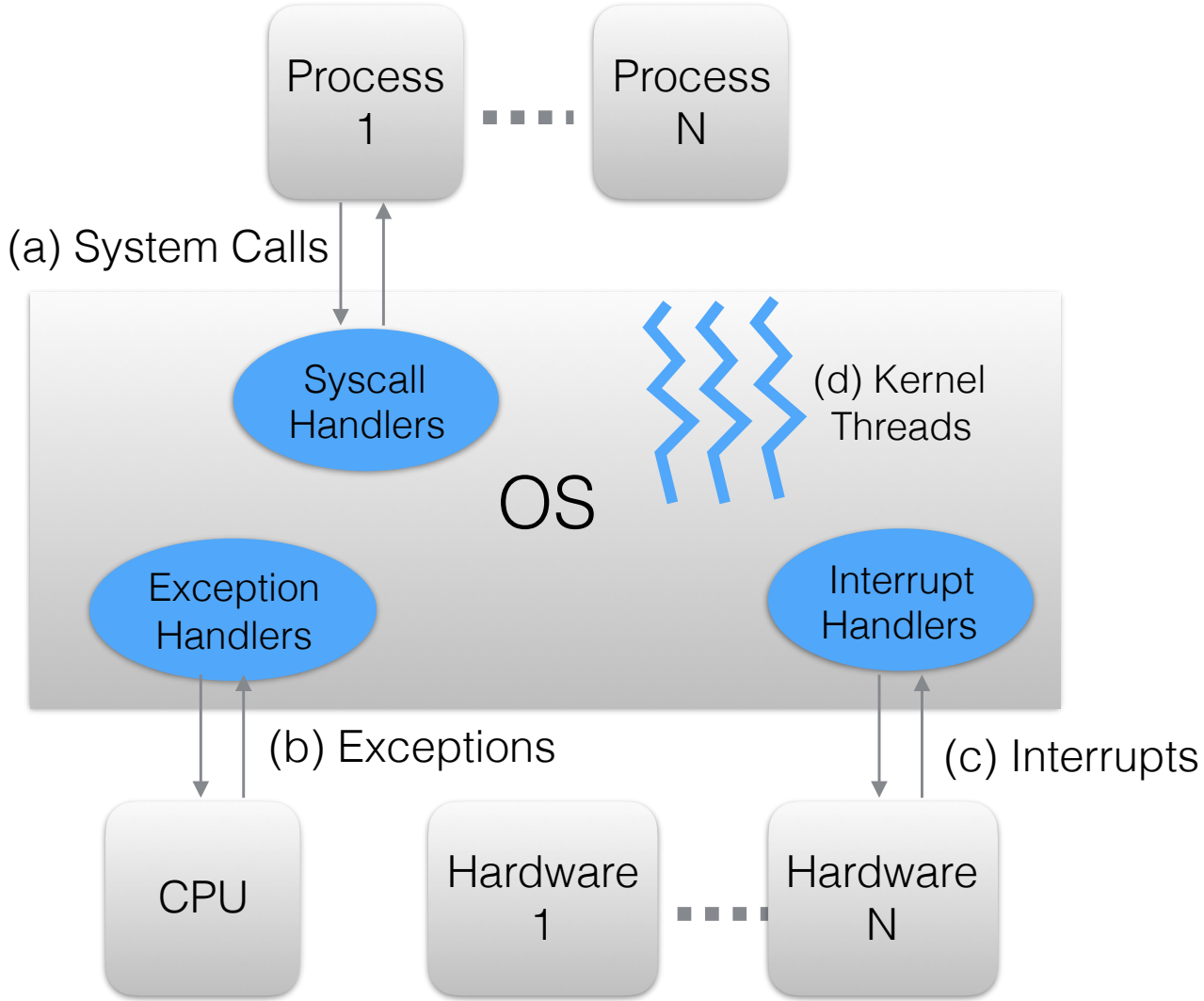
Four ways to invoke OS code



Three major tasks of OS

1. Virtualization
2. Concurrency
3. Persistence

Virtualization

- Making a physical resource look like something else (virtual).
- Why virtualize?
  - To make the computer easier to use and program.
- Examples
  - Make one physical CPU look like multiple virtual CPUs
    - One or more virtual CPUs per process
  - Make physical memory (RAM) and look like multiple virtual memory spaces
    - One or more virtual memory spaces per process
  - Make physical disk look like a file system
    - Physical disk = raw bytes.
    - File system = user's view of data on disk.

Concurrency

- Juggling many tasks together
- Examples
  - One physical CPU runs many processes
  - One process runs many threads
  - One OS juggles process execution, system calls, interrupts, exceptions, CPU scheduling, memory management, etc.
- There's a LOT of concurrency in modern computer systems.
- And its the source of most of the system complexity.

Persistence

- Storing data “forever”
  - On hard disks, SSDs, CDs, floppy disks, tapes, phono discs, paper!
- But its not enough to just store raw bytes
- Users want to
  - Organize data (via file systems)
  - Share data (via network or cloud)
  - Access data easily
    - …and recover data when lost.
  - Protect data from being stolen.

History of OS

- 1950s and 1960s: Early operating systems were simple batch processing systems
  - Users provided their own "OS" as libraries.
- 1960s and1970s: Multi-programming on mainframes
  - Concurrency, memory protection, Kernel mode, system calls, hardware privilege levels, trap handling
  - Earliest Multics hardware and OS on IBM mainframes
  - Which led to the first UNIX OS which pioneered file systems, shell, pipes, and the C language.
- 1980s: Personal computing era
  - MacOS, IBM PC and its DOS, Windows, and so forth.
  - Unfortunately, many lessons from earlier multi-programming era were forgotten and had to be re-learned (painfully).
- 1980s also saw the fragmentation of UNIX
  - Each big company had its own version (IBM, Apple, HP, SUN, SGI, NCR, AT&T….)
  - LOT of legal wrangling over IP and copyrights
- 1990s: Then came BSD and Linux
  - Open source.
  - Led the way to modern OSes and cloud platforms
- 1990s also saw wider adoption of threads and parallelism
- 2000 and beyond: Mobile device OS and hypervisors
  - Android, iOS
  - VMWare ESX, Xen, Linux/KVM etc.

Class Logistics

Coverage of Topics

- Processes and Threads
- Concurrency
- Memory Management
- File and Storage Systems
- Input/Output
- Security
- Virtualization
- Basics of Programming in the Linux Kernel
- Other topics as appropriate

Course Material

- Lecture slides and papers posted on the class website
- Andrew Tanenbaum, Modern Operating Systems, 3rd or 4th edition

- Website will also have office hours, test dates, assignments, test samples etc.

Accounts you need

- CS LDAP Account
  - To log into machines in G-7, Q-22, and remote.cs.binghamton.edu
- A VM to work on
  - Details to follow.
- BU Email account
  - <yourid>@binghamton.edu
  - For communicating with me and TA
  - For receiving announcements
- Access to blackboard
  - For submitting your assignments and getting grades
  - http://mycourses.binghamton.edu

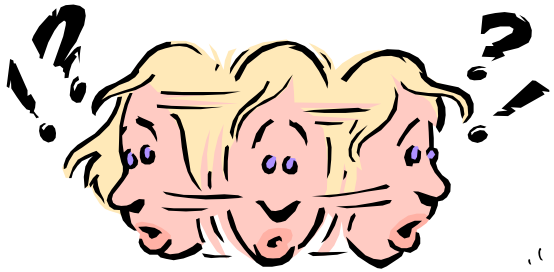
Students with disabilities

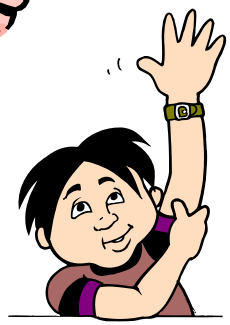
- Please contact me, preferably, within the first two weeks of class.
- Please contact the SSD office for any accommodations.
  - Bring me their letter listing the accommodations required.
- Don’t hesitate to tell me if some aspect of the class is not working for you.
  - We will promptly work with you and SSD to fix it.

To ask or not to ask?

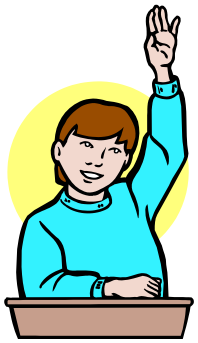
- Instructor and TAs are not a psychics!
  - If you don't ask, then we won't know that you need help.

- Please let us know if…
  - You are lost
  - You don't understand something
  - You don't have the background
  - Class can be improved in certain ways





- Ask for help early
  - Don't wait till the last minute
- Feel free to give feedback
  - Especially in the middle of the semester
  - Direct feedback is always welcome.



Asking Questions

- Make Google your friend!
  - Can’t beat the response time!
- Email me and TAs
  - oscourse@binghamton.edu
- Stop by during office hours
  - After class or by appointment

Stressed?

- Keep the perspective
- If you are overwhelmed with this course, talk to us.
- If you are depressed or panicking for any other reason.
  - Seek professional counseling.
  - http://counseling.binghamton.edu/

Academic Integrity

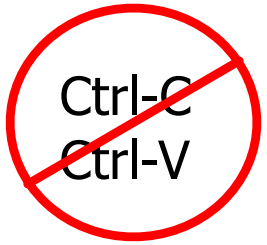
·Means
- Do your own work. Don't do others' work.
- Don't ask/give solutions, including code.
- Don't get code from the Internet.
- Protect your code

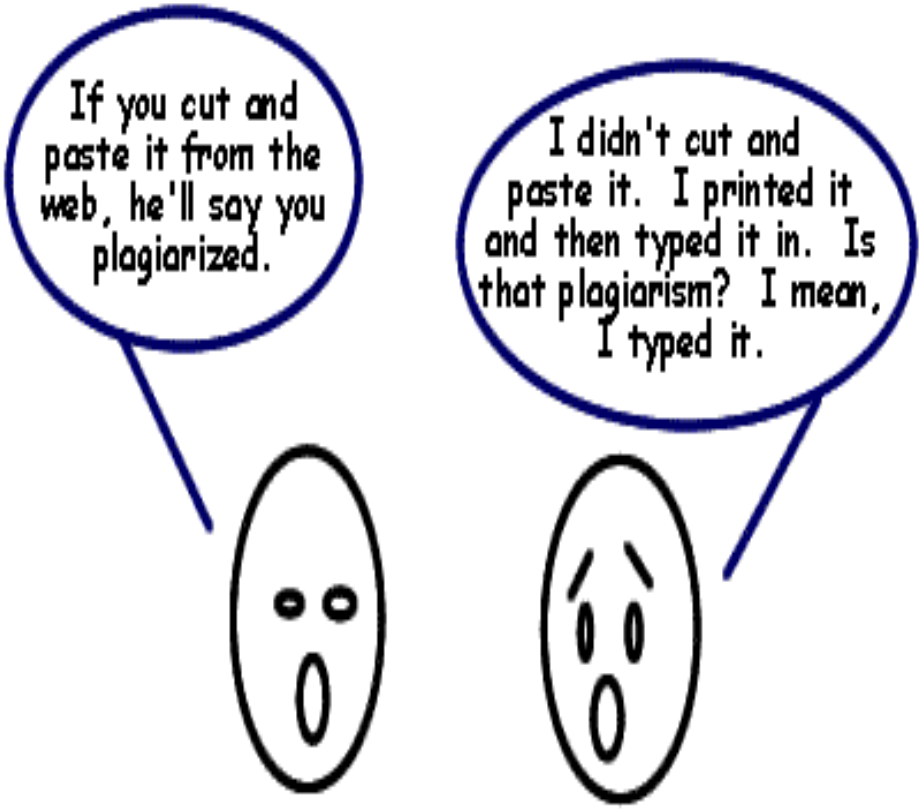
·Moss: A tool for detecting software plagiarism will be used.

·Please read the policies on course web page
·http://oscourse.github.io/policies.html

·Dishonesty ➔
- You can get an F grade
- Be referred to the Dean's office

·Its better to submit your own imperfect own than to submit a perfect copied one.
·You get partial grades for incomplete work.
·But you'll get F for copied work.





http://library.kcc.hawaii.edu/main/instruction_info/plagiarism1.html

Missed Exams/Assignments

- Generally, no makeup exams/assignments.
  - Except for medical emergencies or jury duty when accompanied with valid documentation.

- Please plan your other commitments (travel, interviews, etc) around deadlines.

That’s it! Have a great semester!