Welcome to OS @ UNSW

COMP3231/9201/3891/9283
(Extended) Operating Systems
Dr. Kevin Elphinstone

1

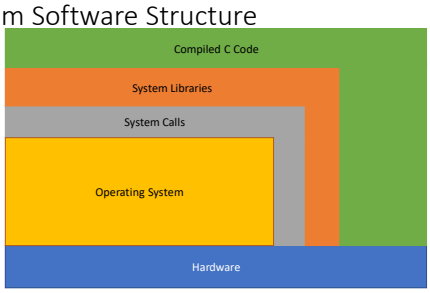
ns

- Ask any questions you have in the course forum before the first lecture.
- I'll answer either on the forum or in the first lecture.

2

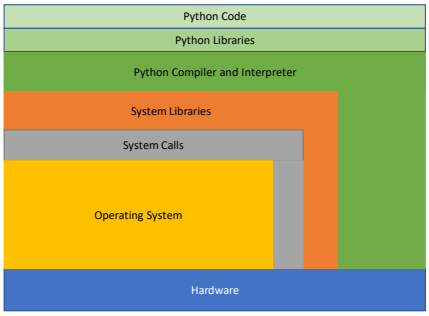
2

System Software Structure



3

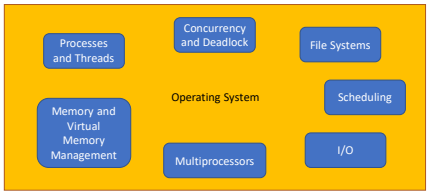
3



4

4

Major OS Topics

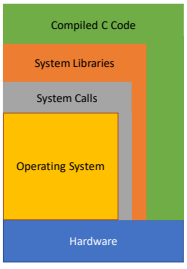


5

5

Why Learn Operating Systems?

- Understand the whole software stack
- Develop OS code
- Develop concurrent code
- Application performance
  - Understand operating system behaviour and how best to interface with it.
  - Diagnose system performance issues.



6

6

Lectures
- Introduce OS theory and case studies

Tutorials
- Re-enforce theory
- Provide guidance on the assignments

Assignments
- Opportunity to write real OS code
  - OS/161 is a simplified UNIX-clone intended for teaching
- Consist of the following
  - Warm-up exercise
  - Concurrency and synchronisation
  - OS Structure involving system calls and file system
  - Memory management

7

7

Intended schedule*

- Lectures
  - Weeks 1-5, 7-9
- Tutorials
  - Weeks 2-5, 7-10
- Assignments Due
  - ASST0 – Week 2
  - ASST1 – Week 4
  - ASST2 – Week 7
  - ASST3 – Week 10

* Subject to change

8

8

Overview of Course Outline

9

9

Prerequisites

- Data structures and algorithms
  - COMP2521, COMP9024 or COMP1927
  - Stacks, queues, hash tables, lists, trees, heaps,….
- Computer systems
  - COMP1521, DPST1092, COMP2121, COMP9032 or ELEC2142
  - Computer systems architecture
  - Assembly programming
  - Mapping of high-level procedural language to assembly language
  - Interrupts

10

10

Assumed Knowledge

- Computing Theory and Background
  - Basic computer architecture
    - CPUs, memory, buses, registers, machine instructions, interrupts/exceptions.
  - Common CS algorithms and data structures
    - Links lists, arrays, hashing, trees, sorting, searching…
  - Ability to read assembly language
  - Exposure to programming using low-level systems calls (e.g. reading and writing files)
- Practical computing background
  - Capable UNIX command line users
  - Familiar with the git revision control system
  - Competent C programmers
    - Understand pointers, pointer arithmetic, function pointers, memory allocation (malloc())
    - The dominant language for OS (and embedded systems) implementation.
  - Comfortable navigating around a large-ish existing code base.
  - Able to debug an implementation.

11

11

Why does this fail?

```
void set(int *x)
{
        *x = 1;
}
void thingy()
{
        int *a;
        set(a);
        printf("%d\n",*a);
}
```

Operating System Coding

12

12

Why does this fail?

```
void set(int *x)
{
        *x = 1;
}
void thingy()
{
        int a;
        set(&a);
        printf("%d\n",a);
}
```

13

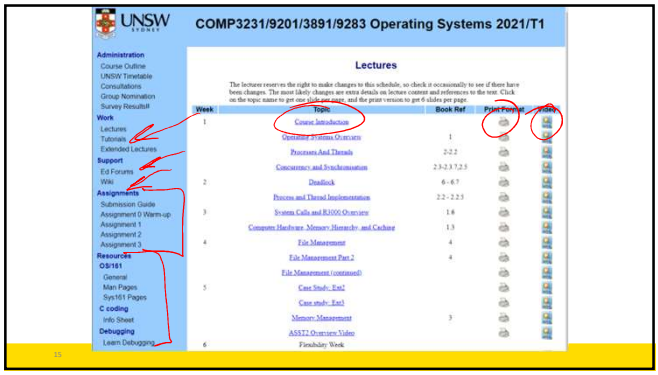
13

Lectures

- Common for all courses (3231/3891/9201/9283)
- 2 * 2 hrs each week
- The lecture slides will be available on the course web site
  - http://www.cse.unsw.edu.au/~cs3231
    - Available prior to lectures, when possible.
    - Slide numbers for note taking, when not.
- Lectures will be face-to-face and live streamed simultaneously
  - Uses Echo360
  - There is a live chat which will be monitored by a tutor (soon).
  - Recording will be available afterwards as per usual.

14

14



15

15

Extended OS Comp3891/9283

Starts in week 1

- A combination of:
  - Examination of topics in more depth
  - Looking at research in areas (past/present)
  - OS/161 internals in more depth
- Separate Assessment
  - 80%-ish of final exam common with base course
  - 20%-ish targeted to extended students
  - ~~Advanced assignment components part of the assessment~~
- Assumes the tutorials are not challenging enough
  - Effectively replaces the tutorial with extra interactive lecture.

16

16

Tutorials

- Start in week 2
- A mix of online and f2f
  - Depends on tutorial you enrolled in
- Attendance is strongly recommended
  - but not marked.
- Tutorial questions cover a broad range of examples
  - Answers available online the week after.
  - Use the tutorial to focus where needed
    - There is intentionally more questions than can be covered
    - Review the questions beforehand

17

17

Assignments

- Assignments form a substantial component of your assessment.
- They are challenging!!!!
  - Because operating systems are challenging
- We will be using OS/161,
  - an educational operating system
  - developed by the Systems Group At Harvard
    - With local changes.
  - It contains roughly 20,000 lines of code and comments
    - Comments are part of the documentation

18

18

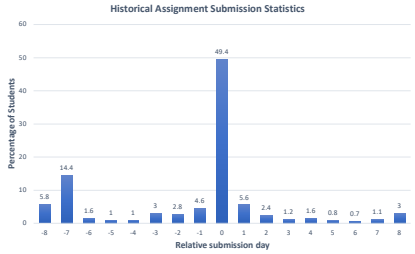
Assignments

- Don't underestimate the time needed to do the assignments.
  - 80% is understanding
  - 20% programming
- Avoid
  - 1% understanding
  - 9% programming
  - 90% debugging
- If you start a couple days before they are due, you will be late.
- To encourage you to start early,
  - Bonus 2% of awarded mark per day early, capped at 10%
  - See course outline for exact details
    - Read the fine print!!!!

19

16% late

Assignment Submission Times



20

Assignments

- Late penalty
  - 4% of total assignment value per day
    - Assignment is worth 20%
    - You get 18, and are 2 days late
    - Final mark = 18 – (20*0.04*2) = 16 (16.4)
- Assignments are only accepted up to one week late. >5 days = 0

21

Assignments

- Warmup assignment (ASST0)
  - Done individually
  - Available NOW!!!!
- ASST2 and ASST3 are in pairs
  - Info on how to pair up available soon
- Additionally, advanced versions of the assignment 2 & 3
  - Available bonus marks are small compared to amount of effort required.
  - Student s
  - Attempti or failure to complete

Assignment	Due
ASST0	Week 2
ASST1	Week 4
ASST2	Week 7
ASST3	Week 10

22

Assignment 0

- Warm-up exercise due in week 2
  - It's a warm-up to have you familiarize yourself with the environment and easy marks.
    - Practice with git revision control
    - Practice submitting a solution
    - Practice using code browser/editor
  - Do not use it as a gauge for judging the difficulty of the following assignments.

23

Assignments

```
Submission test failed. Continue with submission (y/n)? y
```

- Lazy/careless submitter penalty: 15%
- Submitted the wrong assignment version penalty: 15%
  - Assuming we can validly date the intended version

24

Assignments

- To help you with the assignments
  - We dedicate a tutorial per-assignment to discuss issues related to the assignment
  - Prepare for them!!!!!

25

25

Group Work Policy

- Groups of two
- Group members do not have to be in the same tutorial
- Group assignments will be marked as a group
  - Including 'groups' of one.
- Group members are expected to contribute equally to each assignment.
  - No "I'll do the 2nd if you do the 3rd assignment"
  - We accept statements of unequal contributions and do adjust marks of the lessor contributor down.
- Submissions are required to have significant contributions attributable to individual group members.
  - E.g. verifiable using the git revision control system

26

26

Plagiarism

- We take cheating seriously!!!
- We systematically check for plagiarised code
  - Penalties are generally enough to make it difficult to pass
- We can google as easy as you can
  - Some solutions are wrong
  - Some are greater scope than required at UNSW
    - You do more than required
    - Makes your assignment stick out as a potential plagiarism case
  - We do vary UNSW requirements

27

27

Exams

- There is NO mid-session
- The final written exam is 2 hours
- Supplementary exam are available according to UNSW & school policy, not as a second chance.
  - Medical or other special consideration only

28

28

Assessment*

- Exam Mark Component
  - Max mark of 100
- Based solely on the final exam
- Class Mark Component
  - Max mark of 100
- 100% Assignments

* Course outline is authoritative.

29

29

Assessment

- The final assessment is a weighted geometric mean of 60% exam (E) and 40% class (C) component.

$$M = e^{\frac{60 \ln E + 40 \ln}{100}}$$

- Additionally, minimum of 40 required in exam (E) and class (C) components to pass.

30

30

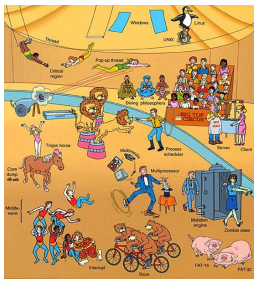
Assessment

- You need to perform reasonably consistently in both exam and class components.
- Geometric mean only has significant effect with significant variation.
- Reserve the right to moderate marks, and moderate courses individually if required.
  - Warning: We have moderated marks only once in the past

31

Textbook

- Andrew Tanenbaum, *Modern Operating Systems,* 3rd/4th Edition, Prentice Hall



32

References

- A. Silberschatz and P.B. Galvin, *Operating System Concepts*, 5th, 6th, or 7th edition, Addison Wesley
- William Stallings, *Operating Systems: Internals and Design Principles,* 4th or 5th edition, Prentice Hall.
- A. Tannenbaum, A. Woodhull, *Operating Systems--Design and Implementation*, 2nd edition Prentice Hall
- John O'Gorman, *Operating Systems*, MacMillan, 2000
- Uresh Vahalla, *UNIX Internals: The New Frontiers*, Prentice Hall, 1996
- McKusick et al., *The Design and Implementation of the 4.4 BSD Operating System*, Addison Wesley, 1996

33

Ed Forums

- Where announcements are posted!!
- Forum for Q/A about assignments and course
  - Ask questions there for the benefit of everybody
  - Share your knowledge for the benefit of your peers
  - Look there before asking
- https://edstem.org/
  - Longer link on class web page
    - You will have received an invite from them to your UNSW email address.
      - z8888888@unsw.edu.au
  - You need to join to follow the course.

34

Search first!

- You are probably not the first to experience the problem, so see if the question is answered before asking again.

Add to an existing post if directly related

- If you are experiencing a variant of the same issue, add to an existing post.

Start a new post for a separate issue

- Try to have an accurate title
- Avoid adding an unrelated question to a hot topic because you just happen to be there when you had the thought. It makes it hard to find for others.

Avoid bitmaps (screenshots)

- Bitmaps are not searchable so you limit the chances of fellow students finding your post, and indirectly make us less enthusiastic about providing a detailed answer to your non-searchable post.

Provide some context

- Cut-n-paste the error if appropriate, and include the preceding output to provide a chance for others to understand what is going on. Mention the OS/machine/environment your using if it's not clear from the cut-n-paste.

Mark questions resolved if they are!

- Don't leave follow-ups unresolved if you have fixed your issue.

Leave questions unresolved if they are!

- I filter using `unresolved` to find outstanding issues, I won't find them unless they are marked unresolved.

You're very welcome to post if you know the answer to an issue.

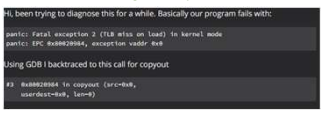
- The course staff do not have a monopoly on answers, nor do we monitor the forum 24hrs a day. A quick answer can make somebody's day (or at least avoid wasting it). A responsive forum can be an awesome resource for the entire course.

35

Enforcing standards

- Don't be offended if we reject your post
  - Simply post again following the guidelines

A good example



A bad example

36

Consultations/Questions

- Questions should be directed to the forum.
- Admin and Personal queries can be directed to the class account cs3231@cse.unsw.edu.au
  - Don't post private threads in Ed
- We reserve the right to ignore email sent directly to us (including tutors) if it should have been directed to the forum.
- Consultation Times
  - See course web site.
  - Must email (cs3231@cse) at least an hour in advance and show up on time.
    - If we get at least one email, we'll run the consult.

37

37

What next?

https://wiki.c

38

38