

COMP5111 – Fundamentals of Software Testing and Analysis

Introduction



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Computer Science & Engineering

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What is this course for?

- If your answers are 'yes'
 - ❑ I want my implementation to be less buggy
 - ❑ I am spending a lot of time in debugging my implementation
 - ❑ I want to validate my implementation automatically when I have revised it
 - ❑ I want to understand the automated techniques/tools to build reliable software
 - ❑ I want to learn more about software engineering research

What do you need for this course?



If you want to master something ...



Practice it!

- **Eclipse**
- **JUnit 4/5**
- **Soot**
- **EclEmma**
- **SpotBugs**
- **Randoop**
- **Evosuite**
- **Gzoltar**
- **BOA**
- **...**

Ariane 5 rocket incident



- Self-destructed 37 seconds after launch.
- Lost: Over US\$1 billion

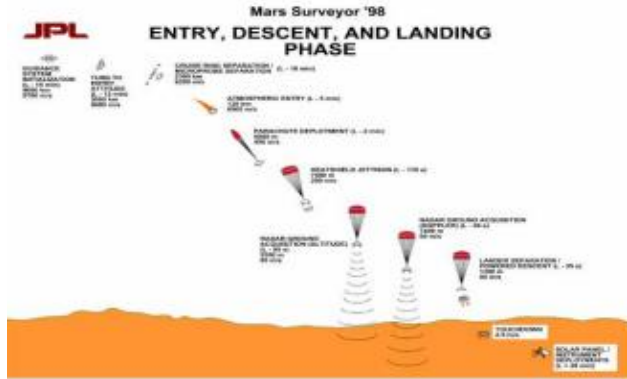
<http://www.cs.washington.edu/education/courses/403/09sp/calendar403.html>

Cause: An undetected control software



- ❑ Conversion from 64-bit floating point value larger than 32767 to 16-bit signed integer value caused an exception.
- ❑ Efficiency considerations led to the disabling of exception handler.
- ❑ Program crashed → rocket crashed

Mars Polar Lander



- Sensor signal falsely indicated that the craft had touched down when it was 130-feet above the surface
 - So, the descent engines shut down prematurely
- The error was traced to a line of faulty code

<http://www.cs.washington.edu/education/courses/403/09sp/calendar403.html>



How serious are coding mistakes in real life?

Phone users in the UK and other countries experienced major 3G/4G network disruption on 6 Dec 2018



- 30+ million O2 users in the UK lost data services after a **software issue** crashing 3G/4G networks for over 24 hours.
- The outage was caused by a software glitch in equipment supplied by Ericsson.
- The glitch also affected phone users on the SoftBank network in Japan. Other network operators around the world are said to experience similar problems.

Security flaws at NFT marketplace OpenSea left users' crypto wallets open to attack

The flaws, discovered by Check Point Software researchers, were promptly fixed.



S. Dent

@stevetdent

October 13th, 2021



Toyota recalls 625,000 hybrids: Software bug kills engines dead with THERMAL OVERLOAD

Prius owners look less smug

By Iain Thomson in San Francisco 15 Jul 2015 at 19:21

34  SHARE



Toyota has become the third car manufacturer in two weeks to recall its cars because of software problems, with over 625,000 Prius hybrids needing an upgrade to stop the engine suddenly cutting out.

On Tuesday Jaguar Land Rover recalled 65,000 of its Range Rover models over a software glitch that caused the cars to spontaneously unlock their doors. Last week it was Ford's turn, with 433,000 2015 Focus, C-MAX, and Escape cars called in because **owners couldn't switch them off, even if they removed the key ...**

https://www.theregister.co.uk/2015/07/15/toyota_recalls_625000_hybrids_over_enginekilling_software_glitch/

A problem has been detected and windows has been shut down to prevent damage to your computer.

DRIVER_IRQL_NOT_LESS_OR_EQUAL

If this is the first time you've seen this stop error screen, restart your computer. If this screen appears again, follow these steps:

Check to make sure any new hardware or software is properly installed. If this is a new installation, ask your hardware or software manufacturer for any windows updates you might need.

If problems continue, disable or remove any newly installed hardware or software. Disable BIOS memory options such as caching or shadowing. If you need to use Safe Mode to remove or disable components, restart your computer, press F8 to select Advanced Startup Options, and then select Safe Mode.

Technical information:

*** STOP: 0x000000D1 (0x0000000C,0x00000002,0x00000000,0xF86B5A89)

*** gv3.sys - Address F86B5A89 base at F86B5000, DateStamp 3dd991eb

Beginning dump of physical memory

Physical memory dump complete.

Contact your system administrator or technical support group for further assistance.



Would it be a surprise to you?



FIVE CRITICAL ANDROID BUGS GET PATCHED IN OCTOBER UPDATE

by **Tom Spring**

October 3, 2017 , 4:42 pm

Five critical vulnerabilities were reported by Google Monday as part of its October Android Security Bulletin. In all, 14 patches were issued for corresponding vulnerabilities, ranging from critical to high.



Date Bug in iOS 11.1.2 Causing Crash Loop on iPhones as December 2 Hits [Updated]

Friday December 1, 2017 9:53 pm PST by Juli Clover

A date-related bug in iOS 11.1.2 appears to be causing iPhones and iPads to continually crash or respring when time-based local notifications are received after 12:15 a.m. on December 2, according to reports on [Twitter](#) and [reddit](#).



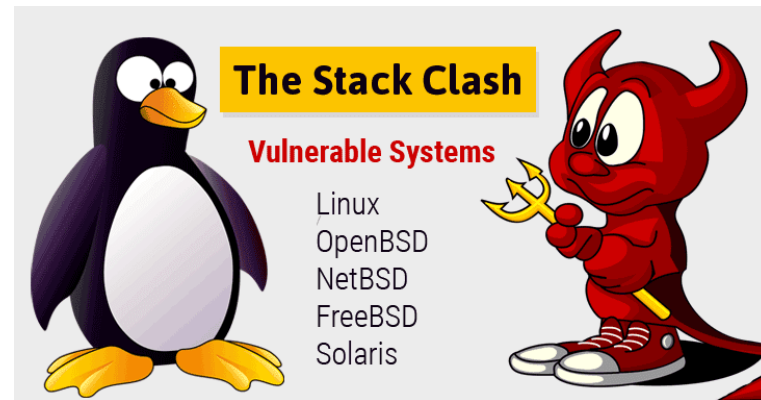
The problem seems to be tied to local notifications received from apps that offer daily or repeat reminders. For example, meditation app Headspace, one of the affected apps, sends daily reminders to users to encourage them to take some time to meditate. Any

BIZ & IT —

“Most serious” Linux privilege-escalation bug ever is under active exploit (updated)

Lurking in the kernel for nine years, flaw gives untrusted users unfettered root access.

DAN GOODIN - 10/21/2016, 4:20 AM



Facebook privacy bug 'affects 14 million users'



Facebook CEO Mark Zuckerberg at a joint senate commerce/judiciary hearing in June 2018

- Facebook found a software bug that caused millions of status updates intended to be posted privately among friends to be public.
- As many as 14 million users between May 18 and 27 in 2018 were affected.



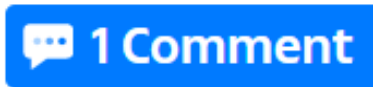
Source:

<https://www.thesun.co.uk/money/10772948/whatsapp-down-app-not-working-2/>

APP MELTDOWN WHATsApp down as thousands of users say the app isn't working

Alice Grahns, Digital Consumer Reporter

19 Jan 2020, 12:41 | Updated: 19 Jan 2020, 13:35



WHATSAPP users around the world are reporting issues with the popular messaging app.

Software Failures That Testing Could Have Prevented

As businesses continue to migrate to digital platforms, it becomes absolutely critical to conduct rigorous software testing before launching of a product.



by Hiren Tanna – Jan. 02, 17 – Performance Zone

<https://dzone.com/articles/13-software-failures-of-2016-that-testing-could-have-prevented>

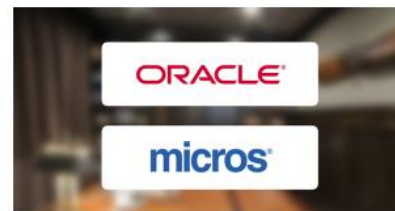
Yahoo! Data Theft



Mark Zuckerberg Hack



Oracle MICROS Hack



Many more incidents ...

- <http://outfresh.com/knowledge-base/6-famous-software-disasters-due-lack-testing/>
- <http://www.cigniti.com/blog/software-failures-2016-testing-prevented/>
- <http://www.cse.psu.edu/~gxt29/bug/softwarebug.html>
- <http://www.zdnet.com/article/40-it-failures-caused-by-software-bugs/>

Facts?



By Dalibor Siroky
30 October 2017, 14:02 p.m. comment

Categories

Data Loss, Data Management, Software, Vulnerabilities



Severe Market Competition. Almost 1 in every 2 apps is uninstalled within 30 days. 80% of apps are deleted after one use.

Chrome (Front-end): Four versions released in 2021-01
https://en.wikipedia.org/wiki/Google_Chrome_version_history

Hadoop (Back-end): Four stable versions released in 2020

https://en.wikipedia.org/wiki/Apache_Hadoop

PyTorch (Framework/Library): Six versions released in 2020

<https://www.wikidata.org/wiki/Q47509047>

Source: <https://www.softwaretestingnews.co.uk/the-real-cost-of-software-bugs/>

Facts?



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Severe Market Competition. Almost 1 in every 2 apps is uninstalled within 30 days. 80% of apps are deleted after one use.

Software is complex. On average, software developers make 100 to 150 errors for every thousand lines of code.

Bugs are frequent and expensive.

Software glitches happen every day. Recent research by CISQ revealed that software failures in the US cost the economy \$2.8 trillion in assets in 2018.

Source: <https://www.softwaretestingnews.co.uk/the-real-cost-of-software-bugs/>



Are there tools that help detect / mine / locate / repair bugs automatically?



Microsoft expands bug bounty program to cover any Windows flaw

Now every part of Windows is covered by a bug bounty scheme.

PETER BRIGHT - 7/27/2017, 4:28 AM



Some bugs aren't worth very much cash.

58

Microsoft today announced a new bug bounty scheme that would see anyone finding a security flaw in Windows eligible for a payout of up to \$15,000.

Google Technology

Google to offer \$200,000 for reporting bugs in Android

By Delwyn Pinto - June 6, 2017

0



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Tweet on Twitter



Google Will Pay \$200,000 For Finding A Bug In Android

Apple offers up to \$200,000 reward for finding security bugs

The top prize will be given for finding bugs in Apple's 'secure boot' firmware for blocking unwanted programs when an iOS device powers up



Programmers are held accountable to buggy code

<https://www.youtube.com/watch?v=3dF-POFE30E> (4 mins)

https://hkustconnect-my.sharepoint.com/:v:/g/personal/sccheung_connect_ust_hk/EQYTulYwMmVAjoVd3xR4RMwBM6ruQYIACV-Hq8e181nYNQ?e=jN2XIR



What did earlier classmates say?

The topics covered, though challenging in difficulty, highlights important concepts to the area of software testing. - I love how there is a "why" session at the beginning of every topic. With relevant real-life examples, it explains why the topic we are learning is important.

I had a lot of fun working on the programming assignment! Also, I strongly think that the last lecture on research methodology is really help in my research career, even my research focus is not in software engineering.

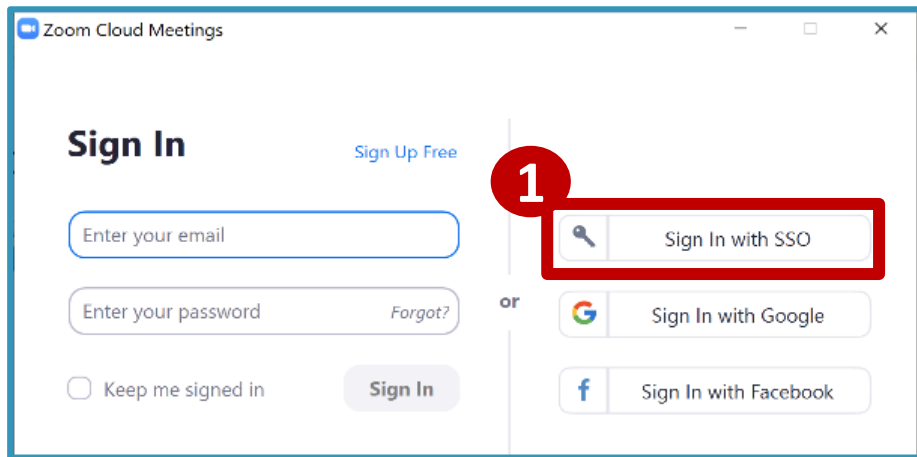
Always catch up with the latest research works in software engineering area. Teach us the up-to-date research methodology and technology.

I have learnt so many thing about software analysis deep and finished a project from zero to one hundred.

This course combines the knowledge of software analysis with the latest academic research. At the same time, the assignment is also very good to test the application of learning knowledge.

Student View: Only Authenticated Users

- You may want to give instructions to students to always sign-in to HKUST Zoom Meeting using SSO (single-sign on)



Zoom Cloud Meetings


Sign In [Sign Up Free](#)


Enter your email


Enter your password [Forgot?](#)

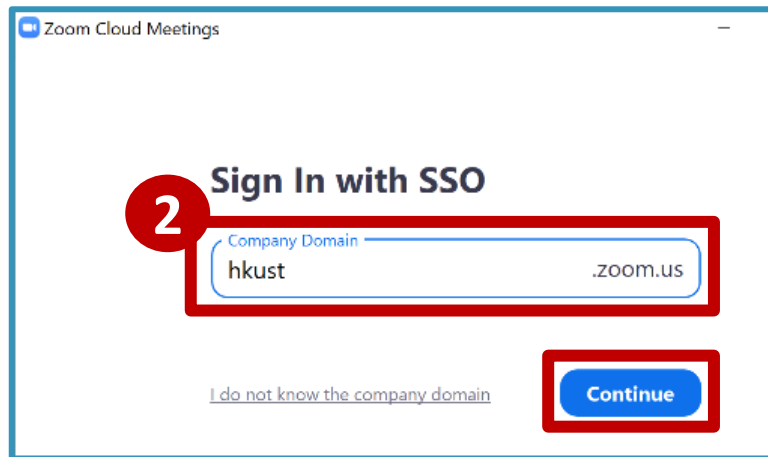
☐ Keep me signed in **Sign In**

or

1  **Sign In with SSO**

 Sign In with Google

 Sign In with Facebook



Zoom Cloud Meetings

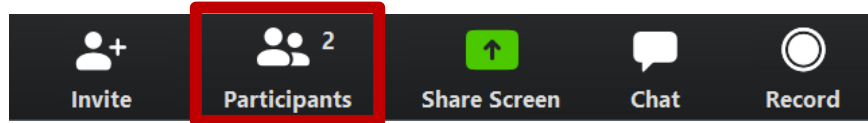
2 **Sign In with SSO**

Company Domain .zoom.us

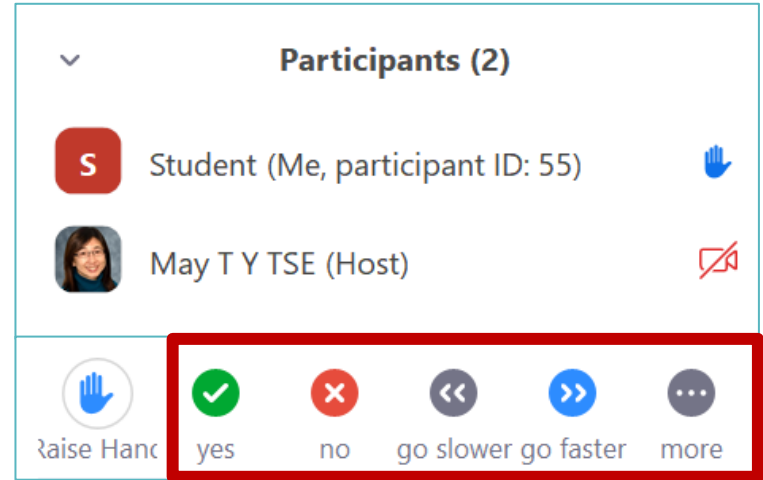
[I do not know the company domain](#) **Continue**

Remember how to respond with buttons?

Launch the
Participants
window



Student (Participant)

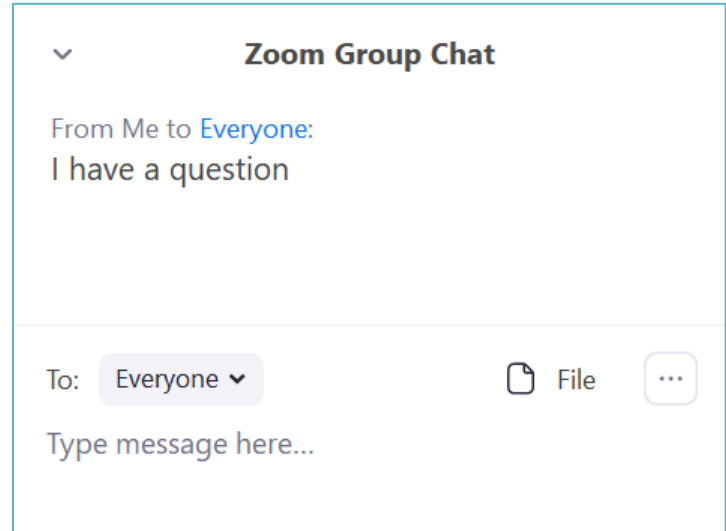


- Click to **YES** to respond
- Click **NO** to respond

Remember how to chat?

Click to
launch the
chat window

Student (Participant)



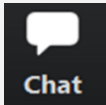
How can you help us manage this session?



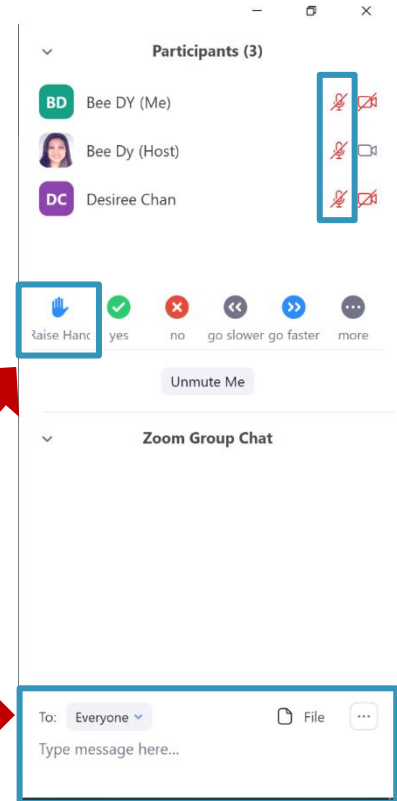
Muted: You are all muted to reduce background noise



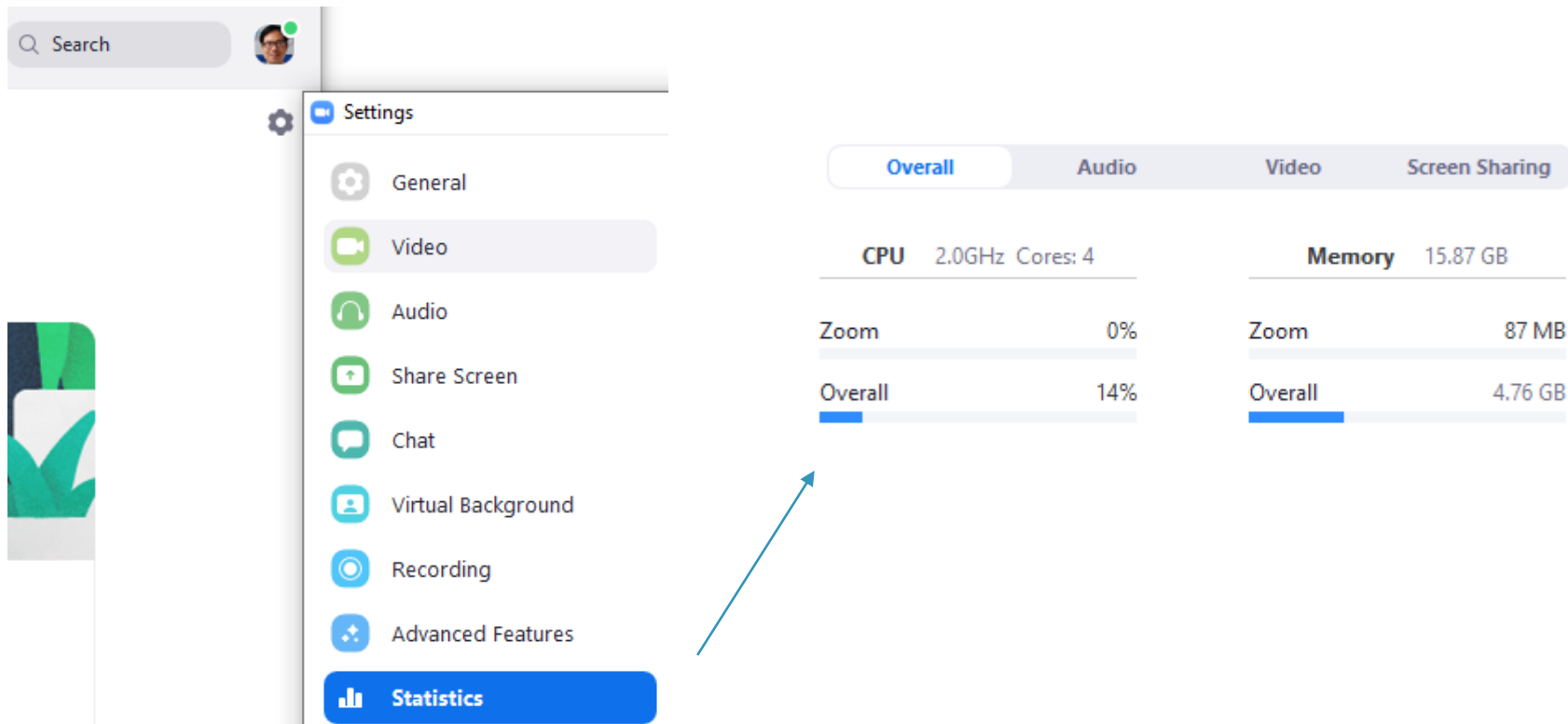
Raise Hand: Please Raise your hand if you would like to speak and lower it if you no longer want to speak (open 'Participants' window)



Chat: For quicker response, you may post your questions in the chat so that other classmates can help answer.



Do I have a good Zoom connection?



Do I have a good Zoom connection?

Overall

Audio

Video

Screen Sharing

Item name	Send	Receive
Frequency	24 KHz	32 KHz
Latency	13 ms	12 ms
Jitter	5 ms	3 ms
Packet loss - Avg(Max)	0.0% (0.0%)	1.9% (3.3%)

Overall

Audio

Video

Screen Sharing

Item name	Send	Receive
Latency	-	11 ms
Jitter	-	1 ms
Packet loss - Avg(Max)	-	1.6% (6.1%)
Resolution	-	926x720
Frame Per Second	-	26 fps