Welcome to COMPSCI111/111G!

SEMESTER 1, 2017

Today’s class
Introduction to COMPSCI111/111G
◦ People
◦ Assessment
◦ Labs
◦ Test and exam

Introduction to computer hardware

Lecturers
Patrice Delmas
◦ Room: 418, Level 4, Building 303
◦ patrice@cs.auckland.ac.nz
◦ After lecture (or email for appointment)

Matthew Egbert
◦ Room: 483, Level 4, Building 303
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Yun Sing Koh
◦ Room: 485, Level 4, Building 303S
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Course coordinator and lab supervisor
Ann Cameron
◦ 303, Level 4, room 413
◦ a.cameron@auckland.ac.nz
◦ Open door policy, visit anytime or email for an appointment

Contact Ann if you have questions about the course or labs
Computer Science Support Network

Need to talk to someone?
We are here to listen and help!
Come and talk to us!

Test
Tuesday 11th April from 6:30pm–7:30pm
Location TBA
Test is worth 20% of your final grade

Marks for COMPSCI111/111G
Theory: exam and test
Practical: labs
Need to pass half of the theory and half of the practical in order to pass the course

Exam (60%)  Test (20%)  Labs (20%)

Labs
An opportunity to practise what you learn in lectures
- 1 compulsory 3-hour lab each week
- 9 labs together worth 20% of final mark
- 10% of each lab’s mark is given for arriving on time
- Hand in lab assignment sometime before start of next lab
- Definitely worth staying for the full 3 hours
Before labs start next Monday (13th March) please:
- Buy this semester’s lab manual from UBS.
- Find the First Floor Teaching Lab (FTL - 3035-175)
- Make sure you have a USB drive

- Paul Denny Room: 303.524 Ext: 87087 Email: paul@cs.auckland.ac.nz
- Angela Chang Room 303.414 Ext: 86620 Email: angela@cs.auckland.ac.nz
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Exam
Date and location will be announced by the Examinations Office

Places to find information
Canvas announcements
The course website:
www.cs.auckland.ac.nz/courses/compsci111s1c
You need to purchase a 2017 Semester 1 lab manual from UBS
Online course reference manual; available on the home page of the course website
The Computer Science student forum:
http://forums.cs.auckland.ac.nz
Any of the COMPSCI111/111G teaching staff ☺
  - Please use your University email account when emailing us

Class representative

Computer Hardware
LECTURE 1 – COMPSCI111/111G S1 2017
Today’s lecture

Identifying the key components in a computer
Understanding how these components work
Using this knowledge to understand computer specs

Overview of a computer

Input → Processing → Output

Storage

Communication

Computer hardware

“Those parts of the system that you can hit with a hammer (not advised) are called hardware”

Key design principle of modularity

Form factors

System units come in lots of different form factors

All-in-one PC

Tower

Desktop

SFF Small Form Factor

LFF Full Form Factor

(Ultra) Small Form Factor
Inside the system unit

- Power supply
- Fans
- CPU
- Expansion cards
- Motherboard
- Optical drive
- Hard disk drive

Power supply unit
Converts AC voltage to DC voltage for use within the computer

Inside a laptop

- CPU
- RAM
- Fans
- Optical drive
- Hard disk drive
- Motherboard
- Power supply (batteries)

Motherboard
The main circuit board to which all components are connected, allowing them to communicate with each other
Central processing unit (CPU)

The ‘brain’ of a computer. Processes data in a computer using its instruction set
Performance measured in instructions per second
Clock speed (measured in Hertz [Hz]) measures the speed at which electrical signals pass through the processor
CPUs must be kept cool, generally using a heatsink and fan

CPUs – Moore’s Law

Gordon Moore (Intel co-founder) stated in a 1965 paper: ‘The number of transistors on a single integrated circuit doubles approximately every 18 months, while the price remains the same.’
So...
- In 3 years, CPUs will be 4 times faster
- In 15 years, CPUs will be 1000 times faster

CPUs - transistors

Moore's Law has been an important guide for many parts of the tech industry, especially in CPU manufacturing
More difficult to keep up with Moore's Law as we reach the limits of CPU fabrication technology
CPUs – other measures

Power efficiency and heat are just as important as clock speed

Modern CPUs have multiple cores, increasing their processing capacity

New kinds of processors, such as system on chip (SoC) are commonly used in mobile and embedded devices

Primary memory

Used to store data for quick access by CPU

Main form of primary memory is Random Access Memory (RAM)

RAM is volatile memory

More RAM improves a computer’s speed by providing more quick access memory

Capacity is measured in bytes, clock speed measured in Hz

Many types of RAM; common type is DDR3 SDRAM

Secondary memory

 Used to store files for repeated access over time

Also known as non-volatile storage; the storage medium retains its contents without needing a supply of electricity

Many forms of secondary storage:

- Hard disk drive (HDD)
- Solid state drive (SSD)
- CDs, DVDs, Blu-ray
- USB drives, external HDDs

Hard Disk Drive (HDD)

Stores data on spinning magnetic disks. Data is read and written by moving heads

Advantages:

- Cheap storage medium
- Widely used and supported
- Can have very large capacity drives
- Long operating life

Disadvantages:

- Noisy operation
- Can consume more power than SSDs
- Fragile, needs to be handled carefully
Solid State Drive (SSD)
Stores data on flash memory, the same technology used by USB drives
Advantages:
- Silent operation
- Higher read/write speeds when compared to HDDs
- Low power usage
- More durable
- Use less space
Disadvantages:
- Costlier than HDDs
- Can wear out faster than HDDs

Memory capacity
Measured in bytes
Plain Text (approx.)
- 1 byte
- 1 KB
- 1 MB
- 1 GB
1 character - using ASCII standard for encoding
13 lines/1000 characters in our course notes
300 pages
175 phone books
Music (approx.)
- 1 GB
DVD (approx.)
- 1 GB
2 hours
20 minutes

Memory hierarchy
- CPU caches
- Primary memory (RAM)
- Secondary memory (HDD, SSD)
- Faster access time
- Lower cost and higher capacity

Expansion cards
Additional circuit board that provides extra functionality
Examples: sound card, graphics card, network card
Plugged into motherboard using slots that follow certain standards:
- ISA
- PCI-E
- AGP
Graphics card

Used to perform graphics processing and run the computer’s monitors

Consists of:
- GPU (either part of CPU or separate graphics card)
- Video memory
- Heatsink and fan
- Ports

Redundant Array of Independent Disks (RAID)

RAID pools HDDs/SSDs together to form a larger, more reliable data storage mechanism

Each RAID configuration has its own strengths and drawbacks

RAID is commonly used in servers

RAID configurations

Numerous configurations, we’re focusing on two:
- RAID 0 – data stripes used to increase speed
- RAID 1 – data redundancy used to increase reliability

RAID 10 combines RAID 0 and RAID 1 together

Input devices

Peripherals that allow the computer to receive input from the outside world, mainly from the user

Common input devices:
- Keyboard
- Mouse
- Webcam

Other input devices:
- Voice recognition
- Biometric scanners
- RFID tags
Output devices

Peripherals that present information processed by the computer to the user

Output devices include:
- Computer monitor
- Printer
- Speakers
- Touchscreens

New forms of output include:
- Virtual reality

Connectors and buses

All peripherals are connected to the motherboard via ports

Ports form part of a bus

Wired connections:
- USB (Universal Serial Bus)
- Thunderbolt high speed connector
- Ethernet
- VGA, DVI and HDMI for monitors

Wireless connections:
- Wi-Fi
- Bluetooth

Computer specs

How much primary memory does this computer have?
- 32GB of DDR4 RAM

How many cores does the processor have?
- Quad = 4 cores

Does this computer have a motherboard?
- Yes, all computers have a motherboard which connects everything together

What kind of graphics card does this computer have?
- Discrete NVIDIA graphics card
Supercomputer
A computer at the frontline of contemporary processing capacity – particularly the number of calculations.

Supercomputers play an important role in the field of computational science. They are used for a wide range of computationally intensive tasks.

They use many microprocessors in parallel.

Performance of a supercomputer is measured in floating-point operations per second (FLOPS).

Summary
Computers process input from the user and other sources and provide output.

Computer systems are designed using the principle of modularity.

System units are made up of a number of components working together:
- Power supply
- Motherboard
- CPU
- Primary and secondary memory
- Connectors and buses