Postgraduate School Welcome

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Considering the current advances in AGI...

...is it still sensible to embark on a Master of Information Technology?

ChatGPT	DeepSeek
offers new opportunities	can provide you with
continue to be crucial	positions you to
more important than ever	not yet at a stage
rest assured	

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What about the Master of Information Technology at UNSW?

ChatGPT	DeepSeek
can provide you with	a solid pathway
can be a great choice	a compelling option
would help you	strong reputation
excellent program	excellent choice

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Once upon a time...

Some knew everything in one or more fields

- Aristotle
- Leonardo da Vinci
- Isaac Newton
- Carl Friedrich Gauss
- Henri Poincaré

ChatPGT, What is the volume of data you have been trained on?
To give you an idea: hundreds of billions of words

DeepSeek, What is the volume of data you have been trained on?
To give you an idea: hundreds of billions to trillions of tokens (words, phrases, or other units of text)

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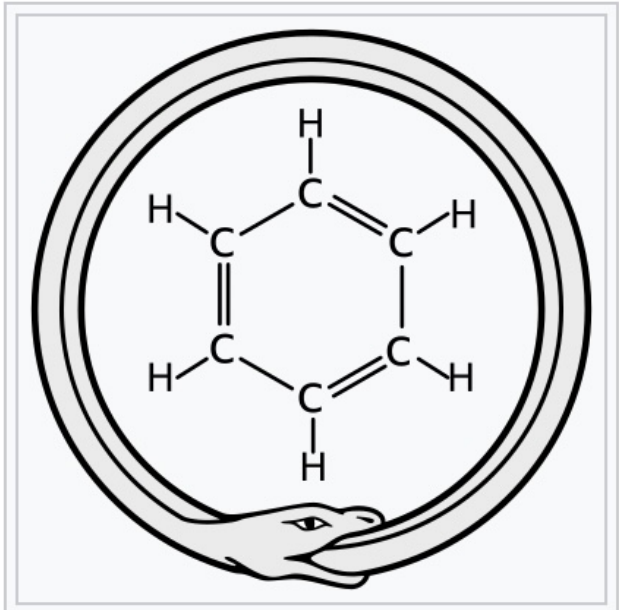
Just compute?

Penrose: Consciousness Does Not Compute

Friedrich August Kekule von Stradonitz, dozing by the fireplace



With 100% probability, a function from $\mathbb{N}$ to $\mathbb{N}$ is not computable, so there is hope, maybe...

UNSW Terminology (1)

You are enrolled in a **program**, such as:

- Program 7546: Graduate Certificate in Information Technology
- Program 5546: Graduate Diploma in Information Technology
- Program 8543: Master of Information Technology.

Programs take a number of **sessions**, namely, **trimesters**, to complete and award you a **degree**.

Programs are refined into **specialisations**, or **streams**:

- The Graduate Certificate has no specialisation.
- Both the Graduate Diploma and the Master have the same specialisations, one of which is the "default specialisation", equivalent to no specialisation.

Up to two (nondefault) specialisations can be acknowledged on your **testamur**.

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UNSW Terminology (2)

Each session, you will enrol in a number of **courses** (neither "subjects" nor "papers") such as COMP9020 Foundations of Computer Science.

With **full load**, you complete 8 courses per year, so you can enrol in 2 courses only in one trimester, taking 3 courses in the other 2 trimesters. Carefully consider when it is best to enrol in 2 courses only, unless you decide to always enrol in 3 courses except for your last session, when there is only one course left. That is your only option if you are an international student, unless a case can be made to **reduce study load**, which needs approval.
You can apply for **overload** if you are in your last session and have 4 courses left to complete your degree, but even if it is approved, that is most likely a bad decision followed by detrimental consequences.

Being enrolled in 2 or 3 courses per trimester, you are a **full-time student**. Being enrolled in 1 course per trimester, you are a **part-time student**.

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UNSW Terminology (3)

Each course is worth a number of **UOC**'s, aka **Units Of Credit**, a multiple of 6, equal to 6 for most courses.

Completing a degree means collecting enough UOC's, together with satisfying a number of extra conditions such as completing **core** courses, as opposed to **elective** courses.

The arithmetic mean of all marks (out of 100) that you scored in all courses you enrolled in up to the end of a trimester, including any course your failed, even if you took it again and passed it, is your **WAM** (Weighted Average Mark) for that session, and eventually for the degree. To some employers, for some jobs, WAM matters a lot, and makes your degree all the more valuable that it is higher.
Every course has its own way to compute the final mark, usually using the arithmetic mean, sometimes using the harmonic mean, sometimes imposing **hurdles** (individual assessments such as the final exam that you must pass).

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Census date: MARCH 13

Thursday of week 4

Deadline to drop a course without losing your fees for the course.

- Beware that if you are not meeting expectations by then, things are most likely to get WORSE.
- Beware of casual work. Dropping casual work might be an alternative. Most likely, casual work won't bring you enough money to offset the costs of having to study one extra session, having to pay again for any course you fail.

If things do not work as expected, it is important to ACKNOWLEDGE it, and THE EARLIER, the BETTER. If that is the case, the best time is by census date; better than end of first session; which is still better than end of second session; which is still "better" (rather, not as bad) as end of third session...

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You need two things

PASSION, or at least STRONG INTEREST

HARD, REGULAR WORK

The value of your degree, hence the quality of your first and possibly subsequent jobs, significantly depends on your academic results.

We want you to thrive, we hope you will thrive, we will help you to thrive. Just that IT studies, like any kind of studies, are for some people and not for others...

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Pieces of advice (1)

As far as delivering contents is concerned, we could have sessions that are 2 weeks long.

The bottleneck is not in teaching, but in learning, because we saturate, because there is only so much we can learn in one day.

So essential to:

- Know/Feel how much can be effectively learnt in one day.
- Make sure that much is learnt in one day, every day: study enough.
- Building confidence feeling that every day brings its own achievements, will have a strong positive effect.
- Do NOT study madly on some days and study nothing on others.
- Do NOT "prepare for the exams" a few days or weeks before they take place. Just master the material day by day.

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Pieces of advice (2)

You are at University to get SUPPORT.

Create, seize every opportunity you can to get support! In particular:

- Most courses have a **forum** or **messageboard**. Use it to post questions of interest to everyone and help other fellow students by answering questions they asked.
- Attend consultation, not only to get help with assessments, but also to get feedback on your work, clarify parts of the course material...

Try and MINIMISE USE OF EMAIL, really so for all matters that are of interest to other students where forum/messageboard are much more appropriate mediums of communication.

Also, first LOOK FOR INFORMATION (e.g., in course outlines) before you ask for it.

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Breadth and Depth

IT is a discipline with many fields.

- Professionally, it is good to have a decent understanding of the concepts and techniques developed in most major areas, of course together with more specific knowledge and skills in one or two specialised fields.
- Academically, it is good to EXPLORE, going for breadth, and having found out or confirmed that this or that area is best for you, go for depth.
- You cannot complete the degree without both significant breadth and significant depth. So be open enough, especially in the first half of your studies.

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MIT program constraints (1)

- 6 courses are core.
  - GSOE9820 Project Management
  - COMP9021 Principles of Programming
  - COMP9311 Database Systems
  - COMP9024 Data Structures & Algorithms
  - COMP9331 Computer Networks &Applications
    (co-requisite: COMP9024)
  - COMP9900 Info Tech Project + GSOE9010 or GSOE9011 Engineering Postgraduate Coursework Research Skills or one of the two pairs of research project courses:
    - COMP9991+COMP9992 Research Projects A+B (6 UOC+6UOC)
    - COMP9991+COMP9993 Research Projects A+C (6 UOC+12UOC)

  A WAM of 75 is required.
  They should be done in last trimester (COMP9900) or last 2 trimesters (COMP9991 + COMP9992/COMP9993)

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MIT program constraints (2)

Make sure you list the courses that are of potential interest to you as a graph that shows the dependencies (contraints of pre-reqs and co-reqs) to help planning.

Specialisations bring their own constraints. They are optional. For most of them, you will satisfy the requirements by just, after initial exploration, taking more courses in areas you are most interested and perform best in.

If you feel a course would be particularly interesting but you can't take it because you have to take another course and satisfy the requirements of a specialisation, consider forgetting about the specialisation.

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MIT program flexibility

Having to complete 16 courses, if you do not fail any course, you will have

- the last session with only 1 course,
- or two sessions with only 2 courses — probably best.

It is worth considering taking only 2 courses in first session, right now or at least by census date. The first session might be the most challenging:

- You need to understand "the rules of the game".
- You might need to adapt to a new education system, a variety of accents...
- You need to build confidence.
- You need all aspects of your life to be well organised, stable.
- If you are new to computing, building the foundations can be the most time consuming, before it becomes more of the same...

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Vlab

Vlab is software that gives you access to a CSE lab computer on your own desktop, laptop computer, tablet or smartphone.

A Google search with the keywords `CSE` + `vlab` returns as first link a page that lets you use the service, still not in the best, most stable way:

`https://vlabgateway.cse.unsw.edu.au`

A link takes you to a page that gives you instructions on how to connect to a VNC (Virtual Network Computing) client to connect in the best way.

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Mathematical tools

General (graphs theory, probability theory, logic, complexity classes, linear algebra):

COMP9020 Foundations of Computer Science

Of specific interest:

GSOE9210 Engineering Decision Structures

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Computability theory and algorithmics

A key result is the existence of a *universal* computable function, which allowed one to envision programmable devices to solve arbitrary (computable) problems, rather than devices dedicated to solving a unique (computable) problem.

COMP4141 Theory of computation

Some problems have a computable solution *in theory*, but not in any practical term. Complexity theory addresses these issues.
Algorithmic theory proposes practical computable solutions to many problems in a rather systematic way, considering families of (generic) problems and families of (generic) solutions, possibly only approximated.

COMP9101 Design and analysis of algorithms
COMP4121 Advanced algorithms
COMP6741 Algorithms for intractable problems

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Application: the computer

The computer is one of our main tools, similarly to the fact that a telescope is one of the main tools of an astronomer.
But whereas the latter is an application from optics, the former is an application of our very field (and others, such as electronics).

A computer has to be designed and built.

COMP9032 Microprocessors and interfacing
COMP9222 Digital circuits and systems
COMP9211 Computer architecture

It has to implement a universal computable function.

COMP9102 Programming languages and compilers

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Making it easier to speak to a computer

It needs high level programming languages to implement the solutions to specific problems. These languages can be classified into families and studied at an abstract level.

COMP9164 Concepts of programming languages

In practice, we will use particular instances of the former and program in some specific language.

COMP9021 Principles of programming
COMP9024 Data structures and algorithms
COMP6771 Advanced C++ programming
COMP6991 Solving modern programming problems with Rust
COMP6080 Web front-end Programming

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Making a computer do what you want

To organise all data and programs than can be run on a computer and execute programs efficiently, a special program, the **operating system**, needs to be designed and implemented.

COMP9201 Operating systems
COMP9242 Advanced operating systems

Operating systems must also be able to let many machines share the work

COMP9243 Distributed systems

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Managing the complexity of very large programs

Algorithmic theory is about coming up with very smart solutions to small, well defined problems. But many problems do not require so much clever solutions, but mainly a huge number of lines of code, with the assurance that the result meets the specifications, is robust, error-free, secure, etc. This leads to the field of **Software engineering**.

Dealing with writing good software that is easy to read and maintain, and using techniques that make it secure and reliable:

COMP9181 Language-based software safety
COMP9153 Algorithmic verification

Dealing with writing large programs:

COMP9044 Software construction: techniques and tools

More generally, managing projects and teams (in general):

GSOE9820 Engineering Project Management

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Making computers user friendly

COMP9511 Human Computer Interaction
COMP4141 User interface design and construction

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Writing special kinds of programs

Programs that draw geometric or animated figures.

COMP9415 Computer graphics

Programs that fulfil the needs of businesses (which requires of course understanding these needs, hence programming is only one aspect of the following courses; in particular, designing appropriate systems is crucial).

COMP9321 Data services engineering

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The computer and the brain

Many believe that the brain is a computer; others believe that the brain can be simulated by a computer (anything the former can do, the latter can do as well). So let us try and let computers do what we do. This leads to the field of **Artificial intelligence**.

We can try and come up with a (simplified) model of the brain and write programs that simulate its activity.

COMP9444 Neural networks and deep learning

One can also completely ignore the workings of the brain and just focus on what we want the computer to achieve. Human beings are able to complete such a broad range of tasks.

COMP9414 Artificial intelligence
COMP9491 Applied artificial intelligence

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Focusing on particular tasks...

How can computers gain knowledge, how can we make them reason?

COMP4418 Knowledge Representation and Reasoning

How can computers prove theorems?

COMP4161 Advanced topics in software verification

How can computers build representations and analyse what they"see"?

COMP9517 Computer vision

How can computers understand natural language and interact verbally with users?

COMP6713 Natural language processing

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. . . and on more particular tasks

How can they make a robot move and execute a planned set of actions?

COMP9434 Robotic software architecture

How can they build a model of their environment, that evolves as the latter changes?

COMP9417 Machine learning and data mining
COMP9418 Advanced topics in statistical machine learning

How can they help consumers find the products they "want"?

COMP9727 Recommender systems

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Communicating information (1)

How do computers communicate information to each other or to or from other devices, and in particular, using the Internet and using wireless technology?

COMP9331 Computer networks and applications
COMP9332 Network routing and switching
COMP9333 Advanced computer networks
COMP9334 Capacity planning of computer systems and networks
COMP9335 Wireless mesh and sensor networks
COMP9336 Mobile data networking
COMP9337 Securing fixed and wireless networks
COMP6733 Internet of things experimental design studio

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Communicating information (2)

How do we schedule the exchange of information?

COMP9154 Foundations of concurrency
COMP6752 Modelling concurrent systems

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Communicating information (3)

How do we make sure that the exchange of information is secure?

COMP6441 Security engineering and cyber security
COMP6443 Web application security and safety
COMP9447 Security engineering workshop
COMP6451 Cryptocurrency and distributed ledger technologies
COMP6451 Cryptocurrency and distributed ledger technologies
COMP9301/2 Cybersecurity project
COMP6445 Digital forensics
COMP6447 System and software security assessment
COMP6448 Security engineering masterclass
COMP6452 Software architecture for blockchain applications
COMP6845 Extended digital forensics and incident response

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Storing and extracting information

How do we efficiently store, search for, retrieve, and perform fundamental operations on pieces of information, and in particular, pieces of information stored on the web?

COMP9311 Database systems
COMP9315 Database systems implementation

How can we compress the representation of a piece of information as much as possible and search from the compressed form?

COMP9319 Web data compression and search

How do we deal with and exploit massive amounts of data?

COMP9313 Big data management

And more particularly, data from social networks?

COMP9312 Data analytics for graphs

How do we make sure what we extract is relevant?

COMP6714 Information retrieval and web search

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And (possibly) turning some of that. . .

. . . into a successful business:

GSOE9220 Launching a start-Up

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Conclusion

- CSE courses are demanding, but ultimately rewarding.
- Work harder!
- Devote some time to every course at least every second day, and preferably every day.
- Do not think that you will catch up later, seek help whenever you need.

Have a great time as a CSE student!

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