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LECTURE 1. INTRODUCTION

Welcome!

- Introduction
- Admin Issues
- Course Overview

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Acknowledgement of Country

We acknowledge and pay our respects to the Kaurna people, the traditional custodians whose ancestral lands we gather on. We acknowledge the deep feelings of attachment and relationship of the Kaurna people to country and we respect and value their past, present and ongoing connection to the land and cultural beliefs.

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LECTURE 1. INTRODUCTION

Imagine ...

- ... you had to count all the documents that contained a particular word
 - ... and you had about 1 billion documents to look through

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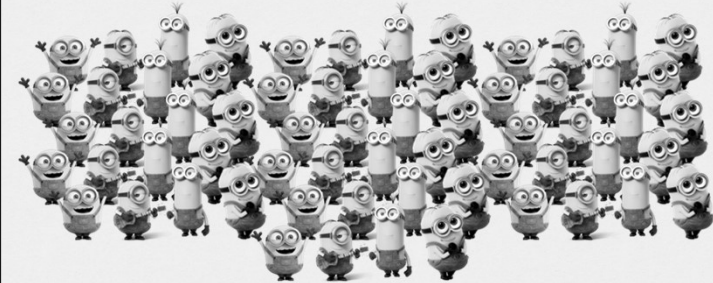
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Further imagine ...



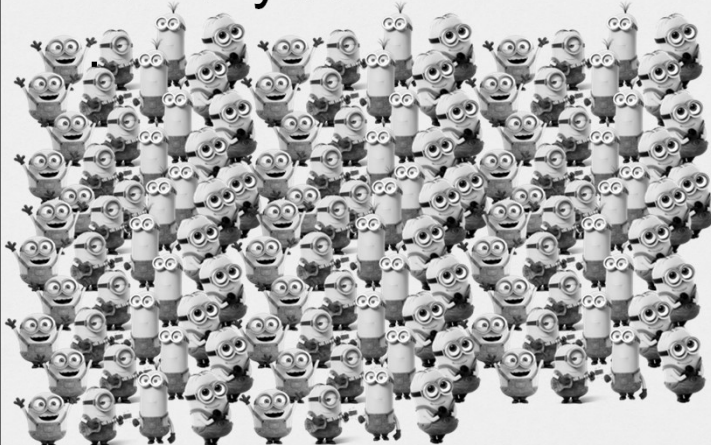
- Minion would load the document, see if the word was there, and increase counter if needed
- It would take the minion about 2 seconds/document or 2 billion seconds (~64 years) for all documents

Imagine ...

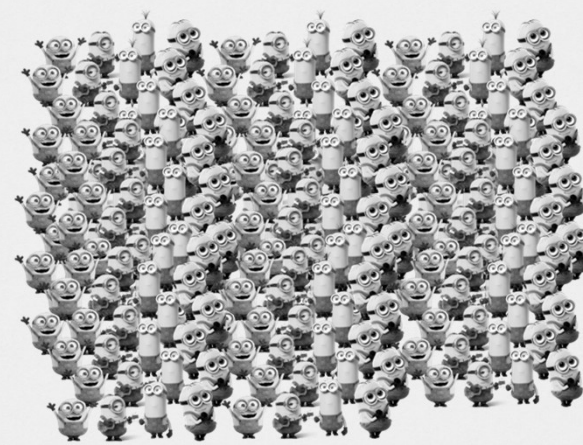


- Your 64-fold army of minions would reduce the time to under one year

Half a year



3 months ...



Parallel computation

- Many calculations are carried out simultaneously
- Principle: large problems can often be divided into smaller ones, which are then solved at the same time.
- A problem is broken into discrete parts that can be solved concurrently
 - Each part is further broken down to a series of instructions
 - Instructions from each part execute simultaneously on different processors
 - An overall control/coordination mechanism is employed

Motivation: Speedup

- One major motivation for using parallel processing: achieve a speedup:

$$speedup = \frac{T_1}{T_p}$$

T_1 : time for one minion

T_p : number of minions

Some Questions

- What can you do with one computer?
- What can you do with 1,000 computers?
- What can you do with a data centre?



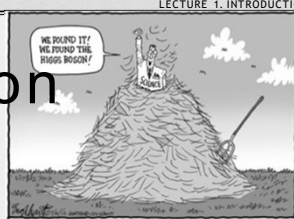
1. CGI



- Large number of frames of high quality animation
- Large number of characters



2. Higgs Boson



- Data produced by LHC estimated at 15 petabytes per year
- LHC Computing Grid, Open Science Grid, LHC@home
 - 200,000 processing cores and 150 petabytes of disk space, distributed across 34 countries
 - 300 GBytes/s of data

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3. Networking



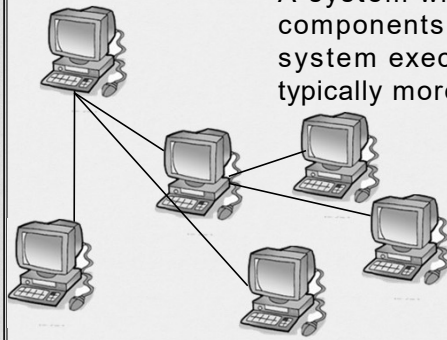
- Global scale network of computers for experiments with protocols etc. (PlanetLab)
- Speed up content delivery (Akamai)

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What is a Distributed System?

A system where the software components that make up the system execute on two (or typically more) computers.



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Quick question

- What is the difference between parallel and distributed computing?

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Online Resources

- All online resources for this course will be available on the course MyUni page:
 - <https://myuni.adelaide.edu.au/courses/85261>
- Here you can ask questions and discuss the course. (DO NOT SHARE ANY CODE!)
- All lecture notes, and assignments will be made available here.
- You should ensure that you check the course pages for updates regularly.

Books

- **Textbook:**
 - *An Introduction to Parallel Programming* - P. Pacheco, Elsevier 2011
 - Available in the bookshop
 - [E-book link on the course MyUni page](#)

Reference Books

- Designing and Building Parallel Programs, by Ian Foster – [online here](#).
- Other useful reference books:
 - Parallel Programming for Multicore and Cluster Systems - T. Rauber, G. Runger, Springer 2009 - available online through the University library
 - Principles of Parallel Programming - C. Lin, L. Snyder, Addison-Wesley, 2009 - available in the University library
 - The Art of Computer Systems Performance Analysis - R. Jain, 1997

Teaching Arrangements

- This course will be taught through:
 - 2 hour lectures every week
 - 5 tutorials (workshops)
- It is expected that for a 3-unit course, students devote 156 hours of time.

Learning Objectives

- Range of fundamental and applied techniques in building parallel and distributed applications
 - To develop and apply knowledge of parallel and distributed computing techniques and methodologies.
 - To gain experience in the design, development, and performance analysis of parallel and distributed applications.

Learning Objectives

- Range of fundamental and applied techniques in building parallel and distributed applications
 - To gain experience in the application of fundamental Computer Science methods and algorithms in the development of parallel applications.
 - To gain experience in the design, testing, and performance analysis of a software system, and to be able to **communicate** that design to others.

Prerequisites

- An advanced course in data structures
 - we look at data structures in different ways
 - need to understand fundamental properties
- Computer Systems is assumed knowledge

Topics

- Parallel and distributed systems. Overview and challenges. Why do it?
- Parallel hardware and software.
- Distributed memory programming with message passing and MPI.
- Shared memory programming: multi-threading, esp. OpenMP and Pthreads.
- Introduction to parallel programming models.
- Parallel algorithm design and program development.
- Aspects of parallel computer hardware.
- Performance Analysis.
- Using high performance computing facilities.
- Other issues in parallel and distributed computing.

At the end of the course you will be ...

- able to understand fundamental concepts and *trade-offs* behind parallel and distributed applications
- able to design and implement parallel and distributed applications
- able to design and implement scalable systems, with an in-depth understanding of their performance
- a better coder

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Who are we?



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Course Coordinator Hung Nguyen
hung.nguyen@adelaide.edu.au

Lecturer Andrew Wendelborn
andrew.wendelborn@adelaide.edu.au

Tutors to be advised

(see course MyUni page for updated information)

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Now for the
serious stuff

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Assessment

- This course has 3 components:
 - Written examination 60%
 - Quizzes 10%
 - Practical assignments 30%
 - Assignment 1 10%
 - Assignment 2 10%
 - Assignment 3 10%
- You are expected to participate in all activities, attend lectures and submit your assignments on time.
- Hurdle: You need at least 40% of the mark of the written examination to pass this course.

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Minimum Performance

- On each component with a hurdle, you are required to achieve at least 40% of the marks allocated in the component.
- If your mark for any component with a hurdle is less than 40% of the allocated marks for that component, and your overall mark is greater than 45 F, your overall mark will be **reduced** to 45 F.
- To pass the course, you must obtain a passing mark overall and achieve at least 40% of the available marks in components with a hurdle.

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Late submission policy

- You should hand your coursework in on time.
- If you hand in your work late, your mark will be capped, based on how many days late it is.
 - up to 1 day late — mark reduced to 75%, marks below 75% not affected.
 - up to 2 days late — mark reduced to 50%, marks below 50% not affected.
 - up to 3 days late — mark reduced to 25%, marks below 25% not affected.
 - More than 3 days late — mark is reduced to 0.
- If you handed in something on time, and it is worth more than something that you handed in late, you will get the higher mark.
- Hand in early!

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Repeating Students

- Students who repeat a course are expected to attempt all of the aspects of the course again. This includes making fresh attempts at all coursework assessment items.
- You may apply to the course coordinator to have your previous work counted but this is not usually granted.
- Make sure that you attend all of the lectures, do all of the work and study hard for the exam – you don't want to get stuck repeating the same course over and over.

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Assignment Extensions

- A student may be eligible for assignment extensions based on medical, compassionate, extenuating circumstances
- A student will be ineligible if their Circumstances:
 - were avoidable and the student had reasonable opportunity to make alternative arrangements;
 - relate to balancing workloads from other units of study, disciplines or faculties;
 - were personal commitments or events such as international travel, holidays or weddings;
 - relate to temporary minor ailments such as colds, minor respiratory infections, headaches or minor gastric upsets;
 - relate to stress or anxiety normally associated with examinations, required assessment tasks or any aspect of course work;
 - are a result of misreading or misunderstanding the examination timetable.

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Assignment Extensions

- For extensions, please contact the course coordinator
- If you think your situation is exceptional, contact your course coordinator ASAP, who will then consult the Head of School.
- Students who deliberately submit false or fraudulent documentation may be referred to the Student Misconduct Tribunal.
- You will normally only receive an extension equivalent to the number of days covered by your documentation. Don't expect to get an extra week because you lost a day.

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Exam Information (including additional/replacement exams)

- University Examinations Site for information on Additional/Replacement exams:
 - <http://www.adelaide.edu.au/student/exams/>
- For the full policy on Modified Arrangements, see:
 - <https://www.adelaide.edu.au/policies/3303>

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Academic Integrity

- Useful link:
 - <https://www.adelaide.edu.au/student/success/academic-integrity-for-students>
- Academic integrity values
 - **Honesty** - being honest about where your ideas come from
 - **Respect** - giving credit when you use other people's ideas
 - **Responsibility** - taking ownership of your work
 - **Fairness** - treating other students and scholars fairly
 - **Trust** - doing the right thing, even when nobody is watching
 - **Courage** - standing up for what is right
- The University takes academic integrity **very seriously**. For the most serious types of misconduct students can be **suspended** or completely **excluded** from the University.

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Types of Academic Misconduct 1/2

- **Plagiarism**, where students present Work for assessment or publication that is not their own, without attribution or reference to the original source.
- **Collusion**, where students present Work as independent Work when it has in fact been produced in whole or in part with others (including persons external to the University) unless prior permission for joint or collaborative Work has been given by the Course coordinator, as specified in the Course Outline.
- **Copying**, where a student acts in such a way as to seek to gain unfair advantage or assist another student to do so.

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Types of Academic Misconduct 2/2

- **Cheating in Examinations** means engaging in dishonest practice or breaching the rules during or in relation to Examinations
- **Contract Cheating**, where a student submits completed or partially completed Work that a third party has completed for them, regardless of the relationship between the student and the third party or whether the third party is paid or unpaid. This includes the submission of work completed by an AI agent, without the explicit consent of your course coordinator.
- **Misrepresentation**, where a student presents untrue information with the intention of deceiving or misleading the assessor.
- **Solicitation**, where a student offers or gives money or any item or service to a University staff member or any other person to gain academic advantage for the student or another person.

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Case 1 (based on real past incidents from UoA)

- Ami (not her real name) is sitting her online and open resource exam. The exam asks for a definition of a key term. Ami knows that the correct definition is in her course notes so she opens the notes and cuts and pastes the definition into her exam. She doesn't acknowledge the course notes. She thinks: "If the question is asking for a definition, it is best to use the proper definition given in the course materials – I don't want to risk losing marks by paraphrasing or changing the definition in any way".
- Sam (not his real name) is also sitting the same exam. When tackling the same question Sam does a quick internet search and copies the answer directly from a website into his exam. He thinks: "This is an online exam so I don't need to reference. Referencing is just for assignments"

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- Students who had copied the lecture notes had not breached the policy. So Ami was found not to have committed a breach of the policy. No entry was made in the Academic Integrity Register.
- Students who copied from the internet were found to have committed a breach (plagiarism) but this was considered to be as a result of a genuine misunderstanding of the policy. So Sam was found to have committed a breach as a result of a genuine misunderstanding of the policy. Sam lost a few marks from his exam as a penalty. This outcome was recorded on the University's Academic Integrity Register and will be considered if Sam is ever suspected of breaching the policy again in the future.

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Case 2

- Ali, Sasha, Kiki, Kahn, John and Lizzie (not their real names) are enrolled in the same course and need to submit a research proposal.
- The friends decide to work together to maximise their chances of finishing the proposal correctly. They get together to discuss their proposals and research ideas and methods. Kiki has done research proposals before and finishes hers first. She shares her proposal with the others.
- The course coordinator suspected that one proposal may have been used by the others to frame and base their own proposals (Turnitin similarity report of **22%**). The students said that they didn't understand that it isn't ok to work together.
- Given the circumstances, the academic integrity officer decided that the students had breached the policy (collusion) but through a genuine misunderstanding. The students were allowed to resubmit the assessment. Each student's name was recorded in the Academic Integrity Register.

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Case 4

- Molly and Kane (not their real names) are taking an online exam.
- After Molly has finished the exam Molly gets a text from Kane. He says he's finished the exam too but wants Molly to share her completed exam with him so he can compare their answers.
- Kane actually hasn't finished the exam. He contacted Molly because he didn't know the answers.
- Molly was upset that she was deceived by Kane. Kane was very apologetic.
- So Molly was found to have breach of the policy (cheating in exams) but as a result of genuine misunderstanding and was penalised with a loss of 10% of the marks for the assessment.
- Kane was found to have a second breach (with no genuine misunderstanding) and received 0% for the assessment.

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How to avoid plagiarism/collusion

- If you get stuck, seek help from the lecturer, tutor or prac demonstrator rather than copying from someone else.
- Starting your work early will help you to avoid getting stuck at the last minute.

When in doubt, ask your lecturer.

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Your Responsibilities

- Attend Lectures
 - Ensure that you are informed of any announcements made.
- Assignments
 - Do all practical assignments.
 - Good planning can help keep the time you spend under control.
- Problems
 - If there is a problem affecting your work on this course, ask for help.

Help must be sought quickly. **ASK FOR HELP**
- Exams
 - Make sure that you can attend both the main and supplementary examinations.
 - Extra supplementary exam sessions are not offered

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