Issues in Computing

Ethical, Legal, Economic and Social
7 Mar 2025

Main Topics

1. Code of Conduct for Computing Professional (Topic 1, Case Study 1)
2. Legal Issues
   - Personal Data Protection Act (Topic 2 , Case Study 2A, Case Study 2B)
   - Intellectual Properties
     - Copyright, Topic 3A, Case Study 3A
     - License, Topic 3B, case Study 3B
3. Impact of Technology on lifestyle and workplace for social and economic developments.(Topic 4)

Why do we need Ethics in Computing ?

- It has a Direct Impact to the World
- It is Malleable
- It creates Policy Vacuums

Code of Conduct for Computing Professionals

- Code of Conduct Reference
  - ACM, Association of Computer Manufacturer Code of Ethics
  - BCS, British Computer Society Code of Conduct

Principles

1 PUBLIC - Software engineers shall act consistently with the public interest.
2 CLIENT AND EMPLOYER - Software engineers shall act in a manner that is in the best interests of their client and employer consistent with the public interest.
3 PRODUCT - Software engineers shall ensure that their products and related modifications meet the highest professional standards possible.
4 JUDGMENT - Software engineers shall maintain integrity and independence in their professional judgment.
5 MANAGEMENT - Software engineering managers and leaders shall subscribe to and promote an ethical approach to the management of software development and maintenance.
6 PROFESSION - Software engineers shall advance the integrity and reputation of the profession consistent with the public interest.
7 COLLEAGUES - Software engineers shall be fair to and supportive of their colleagues.
8 SELF - Software engineers shall participate in lifelong learning regarding the practice of their profession and shall promote an ethical approach to the practice of the profession.

Data Protection under PDPA

- Personal data refers to data, whether true or not, about an individual who can be identified from that data; or from that data and other information to which the organisation has or is likely to have access.
  - Direct link to a particular person, Eg NRIC, fingerprint, contact number
  - Different pieces of information, which collected together can lead to the identification of a particular person, example the IP Address used when accessing the Web
- Personal Data Protection Act (SGP)
  - The PDPA governs the **collection, use** and **disclosure** of **individuals'** personal data by organisations in a manner that recognises both the **right of individuals to protect their personal data** and the **need of organisations to collect, use and disclose personal data** for purposes that a reasonable person would consider appropriate in the circumstances.

Which of the followings is/are considered as Personal Data

- NRIC
- Contact Number
- Images, Comments that you post on social media
- GPS records of your activity
- TraceTogether Logs
- Your vote in the General Election
- CCTV captured images
- Research papers that you published
- Homework assignments that you have submitted
- Program code that you write for a company
- Websites that you have accessed from you browsers

Obligations of Organisations Managing your Personal Data

1. Consent
2. Purpose
3. Notification
4. Access and Correction
5. Accuracy
6. Protection
7. Retention Limit
8. Transfer Limitation
9. Accountability

Managing your own Personal Data

- Always think about who you are giving your personal data to and why.
- Carefully consider how much personal data you choose to post or share online
- Read website privacy notices
- Control your browser settings and decide how you want to be tracked, if at all.

Data Privacy == Data Security ?

- Deals with how Personal Data is handled (collect, use, disclose, protected and stored) in compliance with regulations
- Ensures that only authenticated and authorised users can access the Data

Intellectual Property

Intellectual property
Creations of the mind that have value but can exist purely as data with no physical form

Copyright
The legal right of owners to control the use and distribution of their intellectual property

Licence
Official description of activities that are authorised or forbidden by the owner of intellectual property

Nature of Copyright

1. Exclusive and assignable *legal right of an author* of works
2. These rights enable a copyright owner to control the commercial exploitation of his work.
3. Main legislation in Singapore: Copyright Act
   - Unlike registered designs and patents, copyright is not a monopoly.
   - Essentially copyright is a negative right to prevent others from copying.
     - So if two identical or similar works were in fact produced independently of each another, there is no infringement of copyright by one of the other

Copyright only protects way in which ideas are expressed (not the idea itself)

1. No copyright in ideas
   - Copyright only protects the way in which ideas/concepts are expressed.
2. Copyright protects the skill, labour, judgment used in creating that expressed form (eg when the ideas are written down)
   - Copyright subsists in literary, dramatic, musical and artistic works such as novels, plays, musical compositions, paintings, sculptures and compilations, & in subject-matter other than the works, such as sound recordings, films, broadcasts, cable programmes and published editions of works.
   - Copyright protection is available for live performances and rights management information, eg information identifying the author of a work and the terms and conditions relating to the use of the work.

What Is Not Protected By Copyright?

Subject matter not protected by copyright includes:

1. Ideas (e.g. a new business idea that have not been documented or expressed in writing)
2. Concepts (eg. an idea for a new customer engagement apps that has not been written down ie not expressed in writing)
3. Procedures (eg. the steps involved to create a new cloud based legal services)
4. Methods (eg. the unique solution to a mathematical problem), and
5. Subject matter that has not been made in a tangible form in a recording or writing (e.g. a speech or a dance that has not been written down or recorded)

No registration required

1. An author automatically enjoys copyright protection as soon as he creates and expresses his work in a tangible form.
    - No need to file for registration to secure copyright protection.
2. Copyright arises immediately upon creation.
    - Copyright protected in a work as soon as it is expressed or fixed in a material form (e.g. paper, tape and film) from which it is capable of being reproduced.
    - In relation to literary, dramatic, musical and artistic works, there must also exist an identifiable author who is a natural person
    - What if an algorithm creates a musical as has happened in the UK?

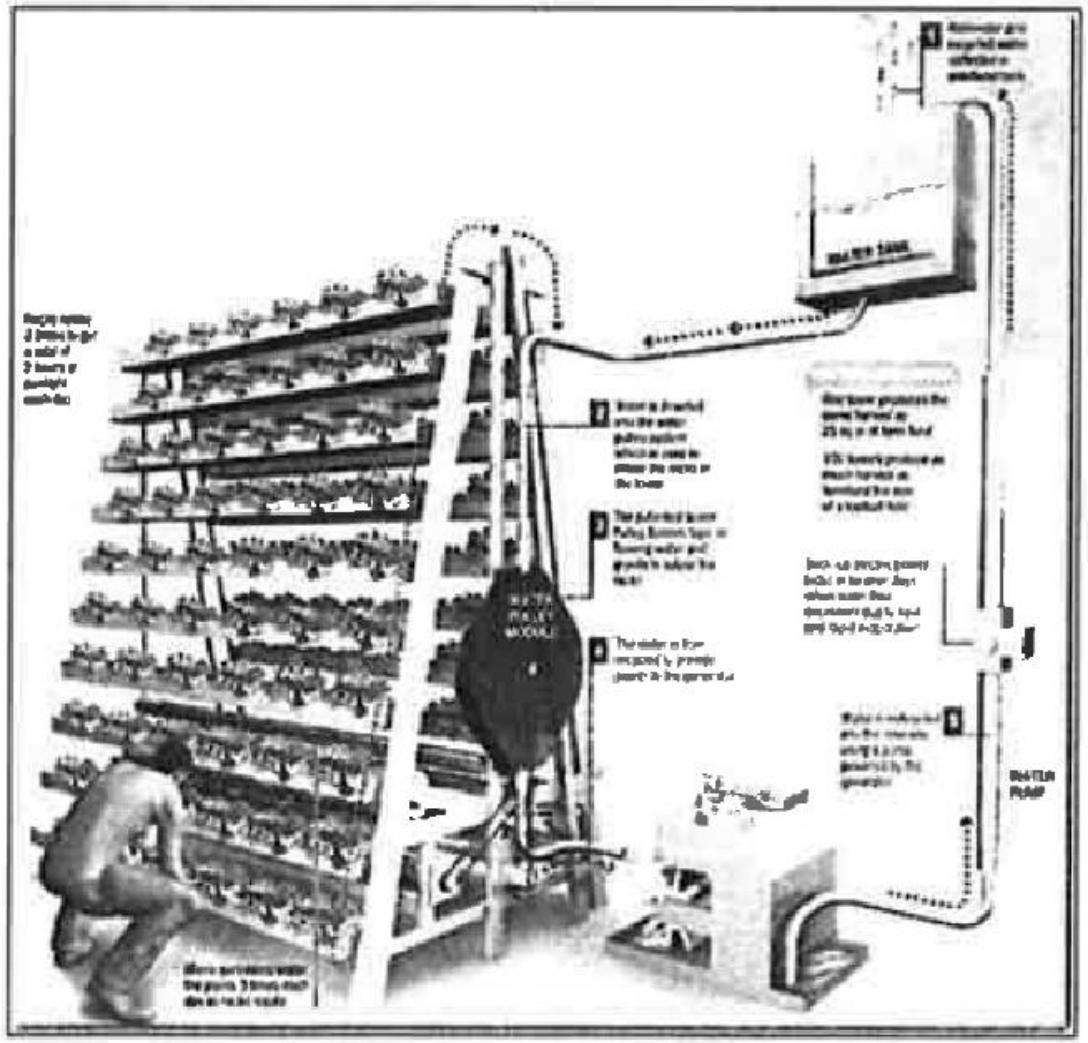
Trade Mark

1. Any sign (eg logo) capable of being represented and of distinguishing one's goods or services from those of others.
2. A passing off action involves
   a *deception* made by a person or a legal entity (such as a company) to sell his own goods or services as if they are the goods or services of another. Such unfair business practice affects the brand or goodwill of another.

Patent

A patent is a right granted to an *owner of an invention* that prevents others from copying or replicating the invention, using the invention, selling or licensing the invention & trading in that invention (eg importing or exporting)

In order for someone to do any of the above, permission or consent of the patent owner would be required.



Example of patented technology for vertical farming (SkyGreen, Singapore)

Copyright

- Establish Ownership of Work, DO NOT need to register
- Not Monopolise, someone else may have the same idea and created his/own work independently from each other
- I can read an algorithm from the same book as someone else and write my own program
- Expiry Period

Software is protected by Copyright law

Algorithm is NOT protected by Copyright law

Patent

- Right granted to owner of an Invention, need to Register
- Monopolise, prevent others from using the invention
- CANNOT be patented
  - Abstract Ideas
  - Laws of nature
  - Natural phenomena
- Expiry Period

Can an Algorithm be patented ?

How do you allow others to use your copyrighted software or patented invention ?

Types of Software Licences

(Refer to Handout Notes)

- Public Domain
  - Legal Protections have expired, surrendered or not applicable
  - Not protected by copyrights

- Open Source (Source Code)
  - Freedom to share, copy, study, modify
  - Example : GPL, BSD, MIT, Apache
  - Protected by copyright
  - Owner may require that source code must always be distributed, attribution be given to the author
  - Copyleft are open source licences that ensure that the software REMAINS open source. (eg GPL)

- Freeware and Shareware
  - Similar to proprietary software except that they are free
  - Trial or limited functionality

- Proprietary/ Commercial (Product)
  - Commercial software
  - Source code are kept secret
  - Illegal to copy, modify or distribute

- Dual or Hybrid license
  - Often incorporate an Open Source together with a commercial license
  - Uses Open Source license to let users add features to the software. Once a baseline set of features is there, it will be release as a commercial license with support (bug fixes)

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7.5 Impact of Technology on Everyday Life

Text Book Page 274 to 280

- Social Impact
  - How we interact with people
  - Positive or Negative impact in our life
- Economical Impact
  - Productivity, Employment
- Ethical Issues
  - Right or Wrong ?

Professor James H. Moor

Computers provide us with new capabilities and these in turn give us new choices for action. Often, either no policies for conduct in these situations exist or existing policies seem inadequate. A difficulty is that along with a policy vacuum there is often a conceptual vacuum. Although a problem in computer ethics may seem clear initially, a little reflection reveals a conceptual muddle.

Communication

Internet, Social Media, Mobile devices

Social impact

- On the positive side, the Internet has enabled diverse cultures to interact and share ideas with each other. Social networking sites have also allowed users to remain connected with friends, family and colleagues even over long distances.
- On the negative side, some people use the Internet to reinforce their existing opinions or to spread rumours and misinformation.

Economic impact

- The rise of smart phones has led to an increased focus on mobile devices and mobile applications in the computing industry.
- The rise of social media has led to the increased use of social media for marketing purposes and has helped businesses to better understand buying habits and consumer needs by analysing social media posts.
- Improvements in communications technology have also reduced business costs through the use of cheap and effective video conferencing calls in place of face-to-face meetings.

Ethical issues

- Should some kinds of false information on the Internet be blocked or would this be taking censorship too far?
- Is it right to collect and analyse social media posts in ways that the original authors may not have intended?

Education

Wikipedia

Just 16 years old

5.5M articles, 750 new articles per day, 10 edits per second

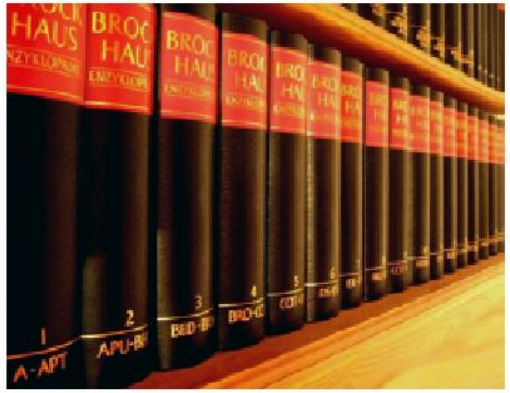
Not only a replacement to the encyclopaedia

Crowdsourced, non-limiting, non-excludable, non-profit

Huge positive externalities — articles translated into other languages

Addictive way to learn, encourage curiosity, from really mundane articles to great content

Power of making knowledge free



Social impact

- On the positive side, technology has provided better videos, simulations and collaboration tools for lessons to be more engaging and relevant to students, both inside and outside the classroom. The open sharing of information on the Internet has made education accessible to all, even learners from disadvantaged backgrounds.
- On the negative side, technology has made it more challenging for educators as students' attention spans are getting shorter due to the technology and social media that they are used to today.

Education

Economic impact

- The rise of open courseware has led to a large number of for-profit and non-profit organisations that offer customised lessons on a variety of topics for self-study online.
- Many educational institutions have also invested heavily in the materials and infrastructure needed to conduct lessons over the Internet.
- Some traditional educators find that they need to retrain and pick up new skills to better utilise these new technologies for education.

Ethical issues

- Should students be allowed to use mobile phones in school?
- Can education technology ever be more effective than a good teacher?

Finance

Social impact

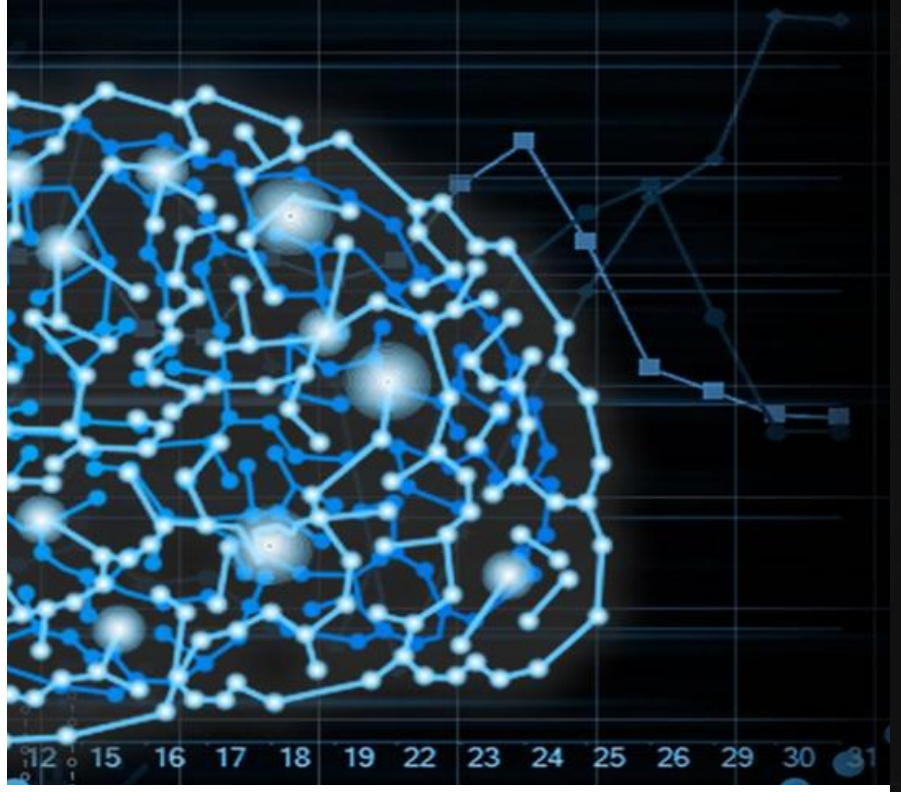
- On the positive side, the rise of financial technology has enabled consumers to spend, borrow, invest and save money through low-cost and easy-to-use mobile and web applications. There is no longer a need to perform such transactions in person. Individuals have also become better-educated on how to make smart financial decisions using information that is freely available on the Internet.
- On the negative side, cyberattacks and the ease of obtaining false information on the Internet has made some people more vulnerable to financial scams and other get-rich-quick schemes.

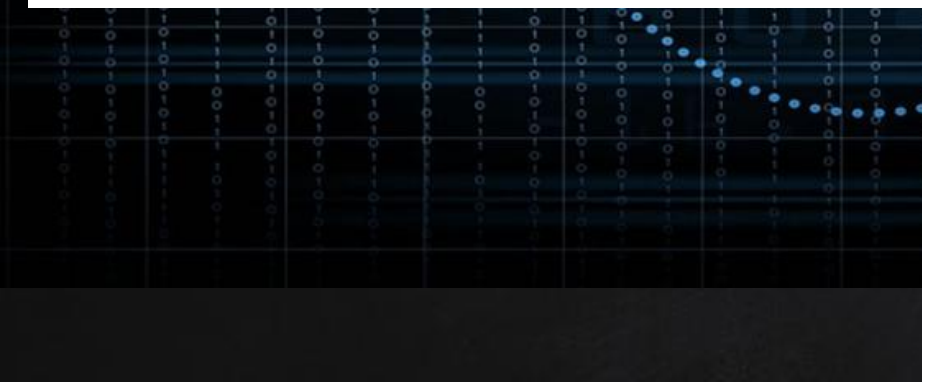
Cashless Society

Finance

Economic impact

- Financial technology is currently an area of growth in the financial industry. Numerous companies have been started to make financial services more efficient for both individuals and businesses. These companies typically use technology and software to reduce the time, cost and effort needed for payments, investments, fundraising, trading, and/or data analytics for both businesses and individuals.
- With the evolution of technology, the time needed to perform a financial trade has decreased from seconds down to mere microseconds. This has led to the rise of algorithmic trading, which is the study and refinement of algorithms, to make trading decisions at speeds not possible by a normal human being.





Ethical issues

- Should financial technology be limited to protect more vulnerable users?
- Is it safe or acceptable to have financial markets controlled by secret algorithms instead of humans?

Healthcare

Social impact

- On the positive side, technology has enabled telemedicine, which is the use of video conferencing and other technology, for doctors to provide medical consultations and diagnoses over the Internet. This gives patients who are located in remote places or have limited mobility better access to healthcare.
- On the negative side, some patients find the use of robots and other technology in healthcare impersonal and mistrust the ability of machines to provide proper healthcare. Other patients may misuse information from the Internet and make potentially dangerous decisions based on incorrect diagnoses.

http://www.aljazeera.com/news/2017/12/robots-changing-future-healthcare-171227082514530.html

Healthcare

Economic impact

- Technology has created new areas of growth in the healthcare industry, such as the provision of telemedicine solutions to existing healthcare businesses. In particular, many of these solutions provide a way for patients to securely transfer potentially sensitive medical information over the Internet.
- There is also an increased focus in automating healthcare processes through the use of robots to dispense medicine and other more menial tasks. This may in turn cause such jobs to disappear from the job market.
- The rise of 3D-printing technology has also opened up new opportunities in the building and customisation of prosthetic limbs, hearing aids and dental fixtures.

Ethical issues

- Is it acceptable for robots to replace humans in providing certain kinds of healthcare?
- Is it acceptable to transfer private medical information over the Internet?

Transportation

Social impact

- On the positive side, transport has become less stressful and more predictable for travellers due to the availability of detailed maps as well as real-time information on bus frequencies, traffic congestion levels and street-level photographs of neighbourhoods around the world. All this information is also available at low cost through popular mobile devices.
- On the negative side, some people are uncomfortable with how pictures and information about themselves or their home may be used by mapping companies without their permission in order to build more accurate maps for travellers.

Transportation

Economic impact

- The rise of self-driving vehicles is likely to open new areas of growth in the travel industry. Singapore is one of the first countries where self-driving cars are being tested, and if successful, the technology will likely revolutionise the motor industry.
- There are also multiple new companies that offer on-demand rides via mobile applications. These developments have led to sweeping changes in the taxi service industry as well as employment opportunities for taxi drivers.
- Mapping technology is also another area of growth with an increased focus on making 3D maps and geospatial data more accessible and useful to travellers.

Ethical issues

- Is it acceptable for mapping companies to drive through neighbourhoods and take pictures to put them online?

Entertainment

Social impact

- On the positive side, technology has enabled more exciting and engaging forms of entertainment. Many computer games have active online communities and mobile games have even managed to bring participants together in the real world through in-game incentives to meet or team up.
- On the negative side, some people may be addicted to computer games or social networking sites. There is an increasing concern that such technology is causing people to become deficient in real-life social skills or abandon their responsibilities.

Entertainment

Economic impact

- Games, animation and media are areas of strong growth in the entertainment industry with new opportunities being opened up by the rise of high quality virtual reality, augmented reality and motion-tracking technology.
- Many businesses are also using monitoring technology and strategies from game design to provide rewards and incentives for work-related achievements.

Ethical issues

- Is it right for game companies to make money off addicted players?
- Is it right for businesses to use technology to monitor employees more extensively?

Logistics

- Kiva Robots