

# Topics in Computer Science



## Unit 4: Topics in Computer Science

- Environmental Stewardship and sustainability
- Exploring Computer Science
- Post secondary Opportunities

# Negative Effects of computer use on Environment

- First of all, sometimes people (especially in businesses) print unnecessary large amounts of files, emails or things from the internet which wastes paper and harms trees. People who use computers never really turn off the device which wastes electricity that could have been saved and reduce the amount of burning of fossil fuel.



- Secondly, computers are made of heavy metals and dangerous chemicals. Heavy metals including:
- Lead: Can be found in the Cathode Ray Tube, the glass of the monitor and the solder in the circuit board of the CPU. A CRT monitor can have up to 2.2kg of lead based on the glass used. Lead poisoning can happen through fumes, food contamination, skin absorption. Lead is particularly harmful to children because it interferes with development of the nervous system. It is a neurotoxin that can harm the kidneys and reproductive systems. Even low levels of lead can be harmful to a child's mental development.
- Mercury: Can be found in the circuit boards and internal switches. Mercury poisoning can include symptoms itching/burning skin, skin discoloration, shedding of the skin. It is linked to brain and kidney damage and harmful to developing fetus. It can be passed to an infant via breast milk.
- Brominated Flame Retardants: may cause thyroid damage and harm fetal development.
- Beryllium: it is a carcinogen that can cause lung disease
- Cadmium: Can be found in a coating on monitor glass, batteries, chip resistors and cables/wires. Cadmium can damage kidneys and bones.
- PCV: which emits highly toxic dioxin when incinerated.



These metals and chemicals contribute to global warming because from these discarded computers it causes water contamination and air pollution. E-waste is sent to developing countries which are placed in landfills where people there extract materials from these electronics such as gold, silver, and copper. They extract them by burning the substances and that process releases hazardous smoke into the air. Toxins from the air also touch the water which also gets polluted and causes health risks. People drink this water and also use it for cleaning their clothes.

The people present around the e-waste gain diseases such as skin cancer, brain damage, lung cancer, kidney disease and abortion.



- Some major negative effect of technology is obesity, according to The Center Of Disease Control and Prevention in a study in 2004, 16% of children (over 9 million) that are between ages 6-19 years old are overweight or obese, spending too much technology is not good to our health if we were not concerned about the negative effects it may develop some problems to our body like Type II Diabetes, asthma, sleep apnea, high cholesterol and or blood pressure. Also according to a Stanford University of Medicine study, elementary students consume 20% of their daily calories intake while watching television, which usually includes unhealthy snacks, largely due to advertisement for junk food and boredom. Kids are not burning off any of these calories while they plopped in front of the television.
- Another area of focus is that children who spend too much time in front of the television or playing video games tend to have worse grades than those students who are active and involved in extracurricular activities. Studies have shown that since they are using multi-tasking they have trouble focusing all of their attention on schoolwork. Studies performed by Dr. Rosen at Cal state showed that 16-18 olds perform 7 tasks, on average, at one time like texting on their cell phone, sending instant message while checking Facebook with the television on. and also it causes poor eye sight which the human eye is exposed too much on screen and other technologies.

Although computers can be used as a tool to spread awareness about problems in the environment, they cause a lot of environmental problems themselves. Pollution caused by the production of computer hardware, as well as from the cleaning agents used to clean computers, is a great hazard to the environment and the people that live in it.

People leave their computers on non stop resulting in a lot of energy consumption and enormous amounts of paper are being used daily to print out electronically stored data. It causes health problems as well as economic problems and is in urgent need of treatment. Use computer only when needed.



# Ways to reduce the impact of computers on the environment

There are ways to reduce the negative impact this has on the environment, like computer recycling, laptop recycling, and computer donating services. Next, computer use produces a large amount of paper waste, that destroys our environment. We must recycle the paper that can be reused, as well, we must try to decrease the amount of paper that we print in order to protect the environment. Lastly, the issue of power consumption, we have to try to reduce the amount of power a computer uses by only using a computer when needed and to remember to always turn the computer off when you are not using it. As well, there are many more smaller ways to save energy on the computer, like adjusting the computer brightness, setting, and using LCD monitors instead of CRT. These are just some of the ways that we are able to reduce the negative effects a computer has on the environment.



- The computer also has many negative effects on our health as well. The main health concerns of a computer are vision problems, problems, and obesity. Firstly, it cause you to have vision problems. In order to reduce such side effects you may take a few minutes away from your computer, better yet your desk each hour, or lean back, close your eyes and relax. This will reduce the chance of vision problems. Lastly, to reduce the risk of obesity, it is good to quickly revive yourself with a few easy stretches and in between your day, go to the gym to get some exercise and this will also help revitalize your mind. These are just a few simply ways to reduce the negative impact computers have on our health.
- Although computers effect both the environment and our health, there are many ways in which we are able to reduce the negative impacts computers have. By either recycling computers or paper, or by doing a few stretches, this will go a long way into helping the environment and your health.

**Use Power Management** - Whether your computer is on hibernate, sleep, or standby, your personal computer has power management settings that enable it to automatically sleep after a period of inactivity. Enabling these options is easy and can save up to \$60 per year on your electricity bill.

**Turn off your Screensaver** - Screensavers are unnecessary eye-candy, on modern monitors and running one can increase energy consumption as it may prevent the monitor from dimming when not in use. By turning off your screensaver, your monitor can be shut off without wasting any electricity.

**When Not in Use** - Turn Off the power of your computer and its printers, speakers, etc. Your computer uses energy even when it's not in use or sleeping. So, once you have finished working on your computer for the day, be sure to switch everything off. If you desire to go a step further, unplug the computer and all output devices as they continue to use a small amount of energy even when switched off. Remember that computers and other electronic devices generate heat when on – and that can lead to extra spending on air conditioning!

**Buy Green** - When the time comes to buy a new computer, choose an Energy Star qualified product. If you're looking to buy hardware for your business, consider buying from a company such as Ricom that specializes in selling refurbished equipment. Buying used laptops or computers is a good factor for the environment.

**Recycle** - Instead of sending your old computer to landfill, recycle it. Charities such as the Little Geeks Foundation collect old computers and distribute them to children that are in need of it. Look to see what recycling options are available in your city. Don't just give it away, make money, and if you are considering giving your computer away, be sure to securely delete the data before doing so.

**Upgrade Your Computer** - Do you really need to throw out your computer? Maybe upgrading it would give it a new lease of life.

**Use an Eco-friendly search engine** - Some search engines, such as EcoSearch.org, they donate a portion of their profits to environmental causes. Try one, They're easy to use and you'll be helping a worthwhile cause.

Computational modeling is the use of mathematics, physics and computer science to study the behavior of complex systems by computer simulation. A computational model contains numerous variables that characterize the system being studied. Simulation is done by adjusting these variables and observing how the changes affect the outcomes predicted by the model. The results of model simulations help researchers make predictions about what will happen in the real system that is being studied in response to changing conditions. Modeling can expedite research by allowing scientists to conduct thousands of simulated experiments by computer in order to identify the actual physical experiments that are most likely to help the researcher find the solution to the problem being studied

Computational modeling is used to study a wide range of complex systems. Some examples include:

- ***Forecasting the weather.*** Weather forecasting uses computer models that analyze and make predictions based on numerous atmospheric factors. This is important for many reasons including protecting life, property, and crops, and helping utility companies plan for increases in power demand, especially when extreme climate shifts are expected.
- ***Building better airplanes.*** Flight simulators re-create aircraft flight using the complex equations that govern how aircraft fly and the reaction of the aircraft to external environmental factors such as turbulence, air density, and precipitation. In addition to being used to train pilots, flight simulators are used for the design of aircraft and research into how aircraft might be affected by different conditions.
- ***Studying earthquakes.*** Computational modeling is used in the study of earthquakes, with the goal of saving lives, buildings, and other types of infrastructure. Computer simulations model how the construction, composition, and motion of structures, and the surfaces on which they are built, interact to affect what happens during an earthquake.
- ***Household items.*** Computational models are used to develop many, if not most, of the items we use in our home. For example, packaging of household chemicals (e.g. for hygiene, laundry, cleaning) and food (e.g. coffee, potato chips, cookies), production of textiles (e.g. fabric, clothes) and even designing diapers utilize many complicated mathematical methods and modeling tools.



How can computational modeling improve medical care and/or biomedical research?

- ***Treatment of heart disease.*** Researchers are developing models of the mechanics of blood vessels, blood flow, and heart valves. These models can then be used in a number of ways, including optimizing the design of implanted devices such as artificial heart valves and coronary artery stents. Researchers are also using computational models to develop decision tools for doctors that can provide guidance for the treatment of cardiovascular disease based on detailed analysis of specific characteristics of each patient.
- ***Vision surgery.*** With the increase in laser vision surgery, scientists are using computational modeling to improve the procedure and reduce the chance of poor results. Specifically, biomechanical models of the human cornea are being developed to simulate laser surgery and refine the technique. Another important use of these models is for virtual training of physicians in how to perform the procedure.
- ***Predicting drug side effects.*** Researchers are using computational modeling to predict potential side effects of drugs. This approach offers the possibility of choosing the design of a drug, early in the development process, that will be the safest for patients. This approach may also allow researchers to identify possible new uses for medications that are already on the market. Identifying which drugs are the least likely to have adverse side effects also has the potential to reduce the many years needed to bring a promising candidate drug from the experimental stage to an approved, safe medication for diseases and conditions that lack effective treatments

# Government Agencies and Community Partners that Provide Resources and Guidance for Environmental Stewardship

- Electronics and electrical products (e-waste), including batteries and accessories, are managed by product stewardship agencies in accordance with their stewardship plans approved under the Recycling Regulation. Government agencies that provide resources and guidance for environmental stewardship are as follows:
- INAC has worked with many partners over the years to develop unique made-in-the-North programs that focus on taking care of the environment in the NWT. The Environmental Stewardship Framework (ESF), previously known as the Cumulative Effects Assessment and Management Framework or CEAMF, is an overarching framework that links these and other environmental programs together. The ESF was created in 2000 to support responsible economic development within the context of sound environmental stewardship. cited from: A citizens guide to INAC's environmental stewardship roles in the Northwest Territories.
- A Rocha is committed to responsible environmental stewardship that passes on a legacy of hope and transformation to communities. cited from: A Rocha environmental stewardship

# Emerging areas of research in Computer science

**Cryptography** or **cryptology** is the practice and study of techniques for secure communication in the presence of third parties called adversaries. More generally, cryptography is about constructing and analyzing protocols that prevent third parties or the public from reading private messages; various aspects in information security such as data confidentiality, data integrity, authentication, and non-repudiation are central to modern cryptography. Modern cryptography exists at the intersection of the disciplines of mathematics, computer science, and electrical engineering. Applications of cryptography include ATM cards, computer passwords, and electronic commerce.

**Distributed computing** is a field of computer science that studies distributed systems. A *distributed system* is a system in which components located on networked computers communicate and coordinate their actions by passing messages. The components interact with each other in order to achieve a common goal. Three significant characteristics of distributed systems are: concurrency of components, lack of a global clock, and independent failure of components. Examples of distributed systems vary from SOA-based systems to massively multiplayer online games to peer-to-peer applications.

**Data mining** is an interdisciplinary subfield of computer science. It is the computational process of discovering patterns in large data sets involving methods at the intersection of artificial intelligence, machine learning, statistics, and database systems. The overall goal of the data mining process is to extract information from a data set and transform it into an understandable structure for further use.

**Artificial intelligence (AI)** is the intelligence exhibited by machines. In computer science, an ideal "intelligent" machine is a flexible rational agent that perceives its environment and takes actions that maximize its chance of success at an arbitrary goal. for example, optical character recognition is no longer perceived as an exemplar of "artificial intelligence" as it is nowadays a mundane routine technology. Modern examples of AI include computers that can beat professional players at Chess and Go, and self-driving cars that navigate crowded city streets.

**Robotics** is the branch of mechanical engineering, electrical engineering and computer science that deals with the design, construction, operation, and application of robots, as well as computer systems for their control, sensory feedback, and information processing.



A **geographic information system** or **geographical information system (GIS)** is a system designed to capture, store, manipulate, analyze, manage, and present all types of spatial or geographical data.

GIS is a broad term that can refer to a number of different technologies, processes, and methods. It is attached to many operations and has many applications related to engineering, planning, management, transport/logistics, insurance, telecommunications, and business. For that reason, GIS and location intelligence applications can be the foundation for many location-enabled services that rely on analysis and visualization.

# CAREERS IN COMPUTER ENGINEERING

## CS CAREERS ON THE RISE



Computer  
Engineering Careers



Information Technology  
(IT) Careers



Software  
Engineering Careers

## NETWORK & COMPUTER SYSTEM ADMINS



# 12%

May 2012 Employment: 366,400

2022 Jobs Forecast: 409,400

Job Growth Forecast: 42,900

## SOFTWARE DEVELOPERS, APPLICATIONS



# 23%

May 2012 Employment: 613,000

2022 Jobs Forecast: 752,900

Job Growth Forecast: 139,900

## COMPUTER NETWORK SUPPORT SPECIALISTS



# 7%

May 2012 Employment: 174,600

2022 Jobs Forecast: 186,800

Job Growth Forecast: 12,100

## COMPUTER NETWORK ARCHITECTS



# 15%

May 2012 Employment: 143,400

2022 Jobs Forecast: 164,300

Job Growth Forecast: 20,900

## COMPUTER HARDWARE ENGINEERS



# 7%

May 2012 Employment: 83,300

2022 Jobs Forecast: 89,400

Job Growth Forecast: 6,200

## SOFTWARE DEVELOPERS, SYSTEMS SOFTWARE



# 20%

May 2012 Employment: 405,000

2022 Jobs Forecast: 487,800

Job Growth Forecast: 82,800

# Experiential Learning

**Experiential learning** is the process of **learning** through experience, and is more specifically defined as "**learning** through reflection on doing". Hands-on **learning** is a form of **experiential learning** but does not necessarily involve students reflecting on their product.

## What is CO-OP?

Co-op education is a structured way of learning that combines in-class learning with periods of actual work. This working experience is called a co-op placement. While on placement, you get to network with employers, gain valuable work experience in your chosen field, and earn academic credits that count toward your degree or diploma.

### Benefits of co-op education

- **You get to put what you've learned into action.**

Co-op placements give you the chance to apply the latest theories and approaches you've learned in the classroom, giving you real work experience in your particular discipline.

- **You can make money.**

Co-op placements are usually paid positions, unless you're doing a co-op through your high school. This paid work experience can be a really great opportunity to learn how to manage your money, not to mention pay for your school-related costs.

- **You could edge out the competition.**

Co-op placements provide you with excellent work experience in your field of study, and this can give you an edge when you're done school and competing for jobs. It shows employers that you not only have the academic training and knowledge, you can also do the job!



**Job shadowing** (or **work shadowing**) is a popular on-the-job learning, career development, and leadership development intervention. Essentially, job shadowing involves working with another employee who might have a different job in hand, might have something to teach, or can help the person shadowing him or her to learn new aspects related to the job, organization, certain behaviors or competencies. Organizations have been using this as a very effective tool for learning. Some of the applications of job shadowing are the following:

- **New job training:** Consider an individual planning to take up a different role in the same organization. The individual may be asked to shadow the current incumbent for a couple of days to months to get a better idea of his or her role, as well as understand the particulars of the same without the commitment of the responsibility. This helps the individual to be more confident, aware, and also better prepared to take up the role. For the organization it reduces the chances of failure and reduces the time required for the individual to be fully productive.
- **Career development:** With multiple options available for somebody to grow in an organization, job shadowing can help to get a better sense of options available and the required competencies for the same. An employee may shadow senior employees in various positions/functions to appreciate and get a better idea about what it takes to build a career there.
- **Developing expertise:** At the core of job shadowing is its ability to transmit knowledge and expertise to another person. By doing a planned work, job shadowing can support knowledge management and ensuring that deep expertise and knowledge are not lost.
- **Leadership development:** Many organizations use job shadowing as an effective tool for leadership development. Aspiring leaders are given opportunities to shadow senior leaders and learn from them. It effectively complements classroom learning and aspiring leaders get to experience first hand what it takes to be a leader.
- **Job shadowing helps both parties to learn and exchange ideas.** It helps in networking, exploring opportunities, giving/receiving feedback, and collaboration with different departments.

Meet a variety of employers in an exhibition-like setting to learn more about their employment opportunities. Employers exhibiting at this year's fair are recruiting students and new grads for: full-time jobs, part-time jobs, internships and summer jobs.

<http://www.skills.edu.gov.on.ca/OSP2Web/EDU/DisplayEssentialSkills.xhtml>