


Introduction To CPSC 203 And To Computer Science

You will learn what is “Computer Science” and what are some areas of study

James Tam

Administrative (James Tam)

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(If I’m not in my office try looking for me in ICT 102)
 - Email: (any time)
 - Appointment: email, phone or call
 - Drop by for urgent requests (but no guarantee that I will be in if it’s outside of my office hours!)



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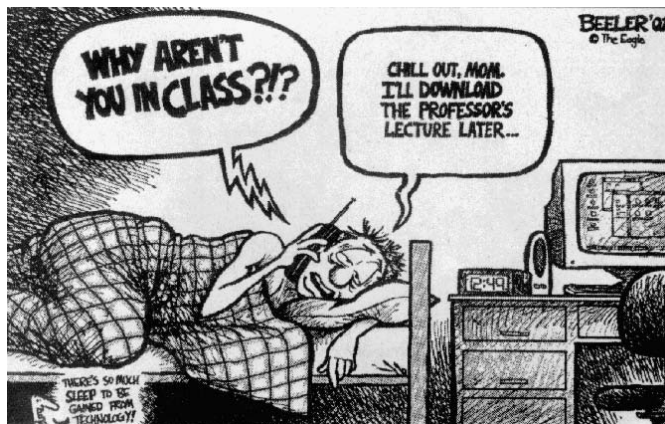
Course Resources

- Course website: <http://pages.cpsc.ucalgary.ca/~tamj/203>
- Course textbook:
 - “*Technology in Action with TAIT*”. Alan Evens, Kendall Martin, Mary Anne Poasty (Prentice Hall)

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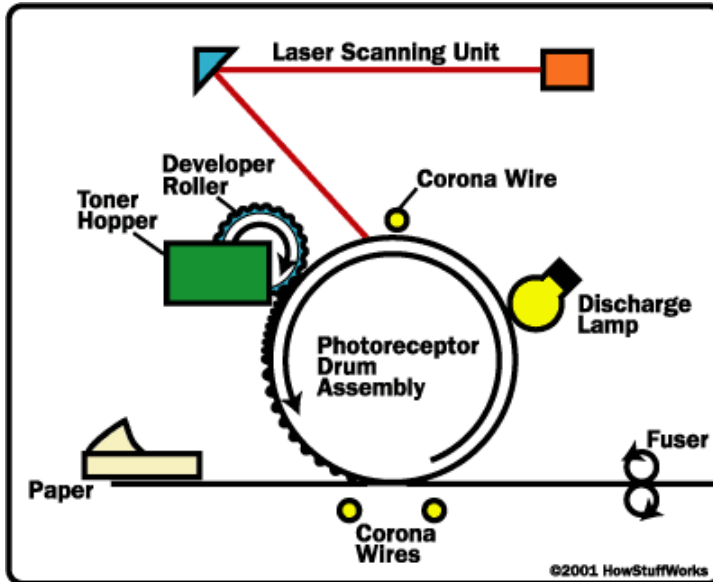
How To Use The Course Resources

- They are provided to support and supplement this class.
- Neither the course notes nor the text book are meant as a substitute for regular class attendance.



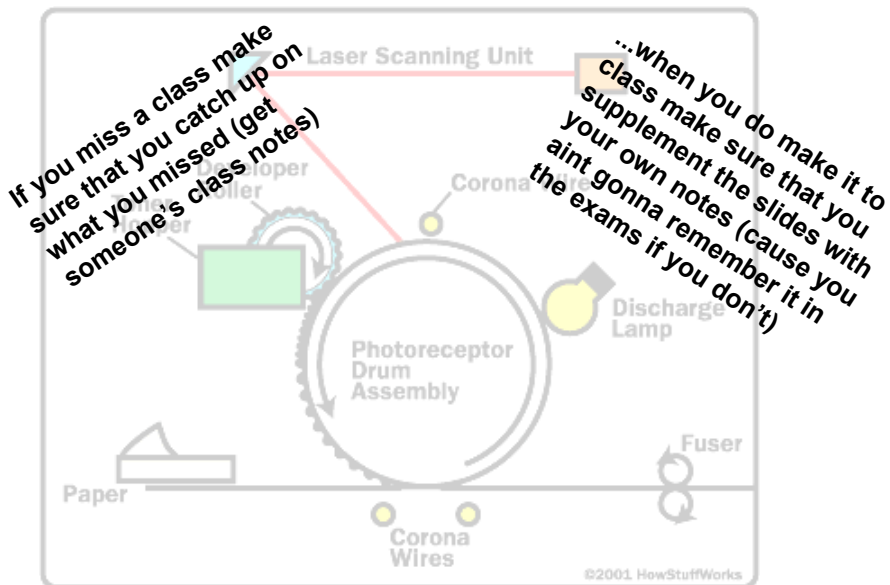
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How To Use The Course Resources (2)



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How To Use The Course Resources (2)



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But Once You've Made An Attempt To Catch Up

- Ask for help if you need it
- There are no dumb questions



Images from "The Simpsons" © Fox

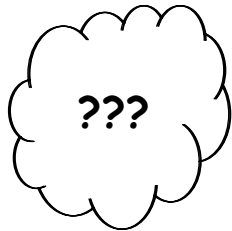
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Is This The Course The One For You?

- First year introductory courses
 - CPSC 203
 - CPSC 217
 - CPSC 231
- CPSC 203
 - The focus is on **how to use** computer programs
 - One important objective is to learn how computers and technology works *from the user's perspective*
 - Issues related to how computers work are largely introduced in the context of using applications.
 - E.g., Why is my computer so slow when I'm editing my movies?
 - E.g., Why did that computer game look and sound so much better on the store computer than on my machine at home?
- CPSC 217, 231
 - The focus is on **how to write** computer programs

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Feedback



Dilbert © United Features Syndicate

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Introduction To Computer Science

- What is Computer Science?



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Introduction To Computer Science

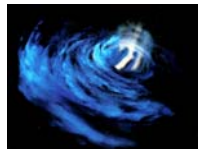
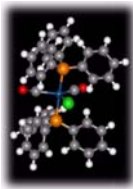
- What is Computer Science?



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Introduction To Computer Science

- Computer Science is about problem solving

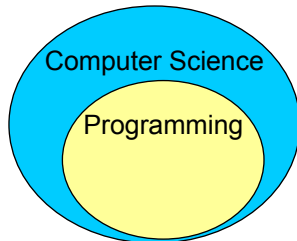


Some of the picture sources include: Star Trek: Deep space 9 © Paramount & the international space station

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Computer Science Is Not The Same As Computer Programming

- Computer Science does require the creation of computer programs ('programming')



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Some Areas Of Study And Research In Computer Science

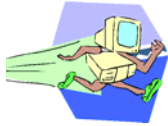
- Human-Computer Interaction
- Computer Graphics
- Information Visualization
- Databases
- Computer theory
- Computer networking and distributed systems
- Computer Simulations
- Artificial Intelligence
- Computer Vision
- Software Engineering
- Games programming

This list provides only a brief introduction to the different areas of Computer Science and is far from comprehensive:
For a more updated list: <http://www.cpsc.ucalgary.ca/Research/>

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Human-Computer Interaction (HCI)

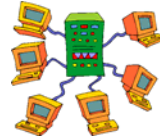
- Most of Computer Science deals with the ‘technical’ side of computers.



Run computers faster!



Make computers store more information!!



Increase the networking capabilities of computers!!!

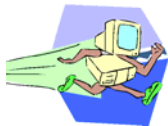
- These technical issues (and others) are all very important but something is still missing...

For more information: <http://grouplab.cpsc.ualgary.ca/> or <http://pages.cpsc.ualgary.ca/~ehud/Research.html>

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Human-Computer Interaction

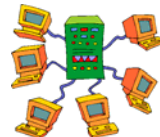
- Most of Computer Science deals with the ‘technical’ side of computers.



Run computers faster!



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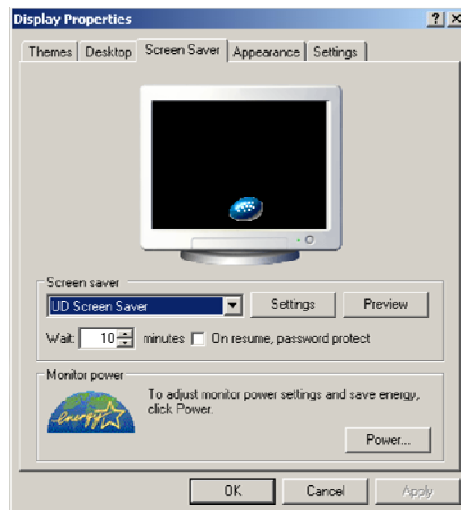
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Human-Computer Interaction

- ...but don't forget about the other side of the relationship.
- No matter how powerful the computer and how well written is the software, if the user of the program can't figure out how it works then the system is useless.
- Software should be written to make it as easy as possible for the user to complete their task. (Don't make it any harder than it has to be).
- This is just common sense and should/is always taken into account when writing software?

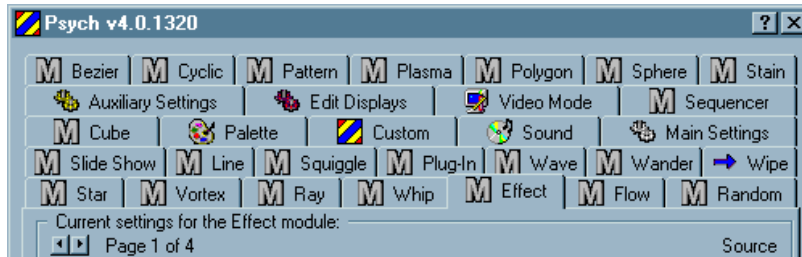
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Human-Computer Interaction: Not Just Common Sense Information



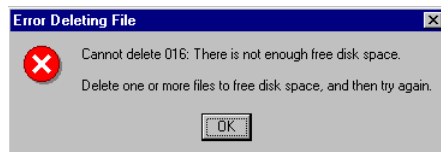
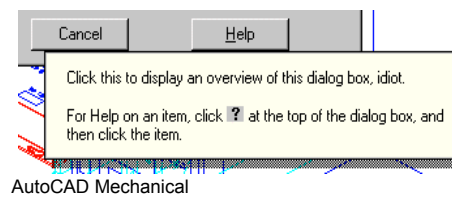
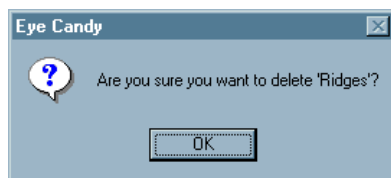
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Human-Computer Interaction: Not Just Common Sense Information (2)



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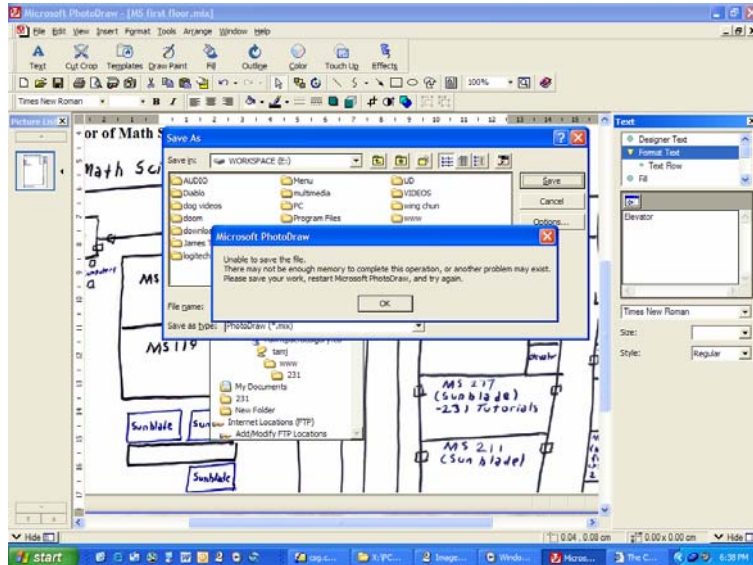
Human-Computer Interaction: Not Just Common Sense Information (3)



Windows 95

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Human-Computer Interaction: Not Just Common Sense Information (4)



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Computer Graphics

- Concerned with producing images on the computer.



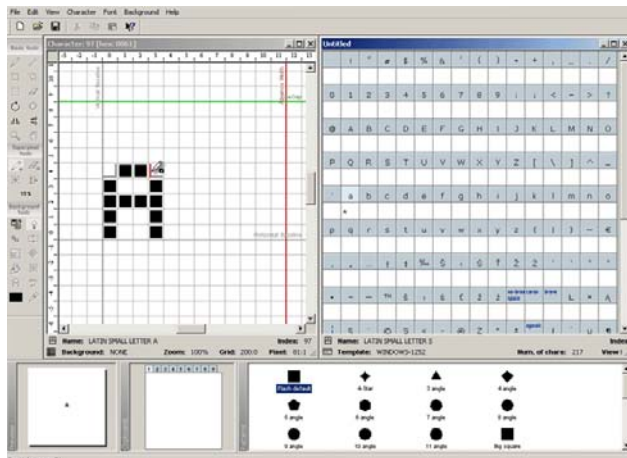
Gran Turismo 5 Prologue © Sony

For more information: <http://jungle.cpsc.ucalgary.ca/>

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Computer Graphics (2)

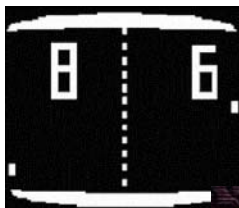
- 'Images' include everything visual on the computer: pictures, text, animations etc.
- Images can be produced with a collection of pixels



<http://www.simplefont.com/>

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Computer Graphics Have Come A Long Way!



Pong (Atari)



Eye of the Beholder (SSI)



Gran Turismo 5 (Sony)

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Computer Graphics: Issues

- How to make the images look “real”?



From <http://klamath.stanford.edu/~aaa/>

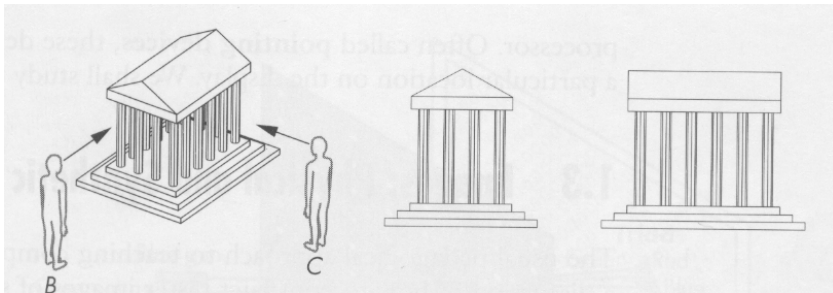


Final Fantasy: The spirits within © 2001 - Columbia Pictures

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Computer Graphics: Highly Mathematical

- Realistic images and effects are produced using complex calculations.



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Computer Graphics: Still A Long Way To Go

- “Even though modeling and rendering in computer graphics have been improved tremendously in the past 35 years, we are still not at the point where we can model automatically, a tiger swimming in the river in all it’s glorious details.”¹



¹ From “The Tiger Experience” by Alain Fournier at the University of British Columbia

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Computer Graphics: Something Just For Fun

- [Original video](#)
- [Bloopers version](#)

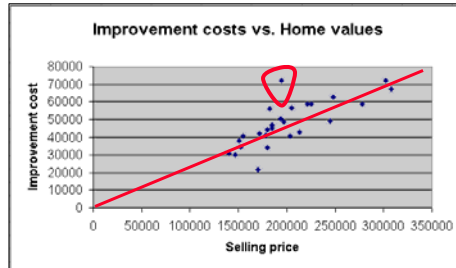
Videos by Brian Wyvill

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Information Visualization

- Finding ways of representing information in a way that amplifies cognition.

	A	B
1	Market value (\$)	Improvement cost (\$)
2	140000	31120
3	147000	29980
4	151000	38120
5	152000	34360
6	156000	40710
7	170000	21620
8	172000	42100
9	178000	41070
10	180000	34210
11	180000	44090
12	182000	55960
13	185000	45170
14	185000	46820
15	193400	50200
16	194500	71860
17	197000	48460
18	203000	40720
19	205000	56600
20	213000	42780
21	221000	58770
22	225000	58960
23	245000	48910
24	248000	62620
25	278000	58580
26	302500	72200
27	308000	67320

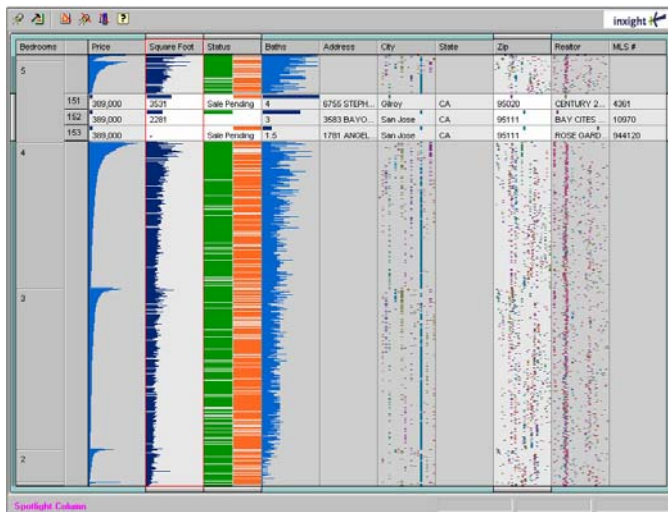


For more information: <http://innovis.cpsc.ucalgary.ca/>

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Information Visualization: Issues

- What is the “best” way of representing the information?

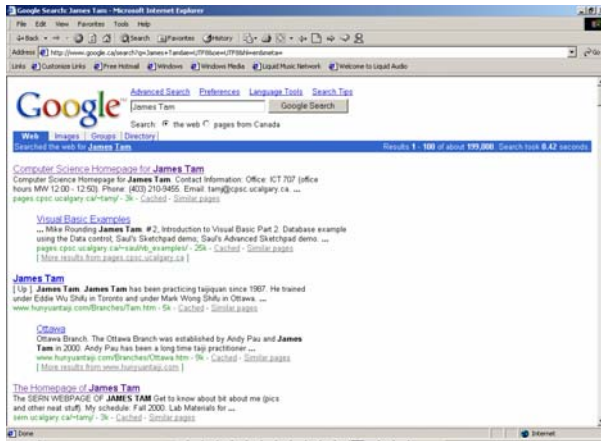


The Table Lens: Ramana R. and Stuart K. Card Xerox Palo Alto Research Center

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Databases

- Concerned with the efficient storage, retrieval and distribution of information
- It can be a difficult challenge!



For more information: <http://www.adsa.cpsc.ucalgary.ca/>

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Databases (2)

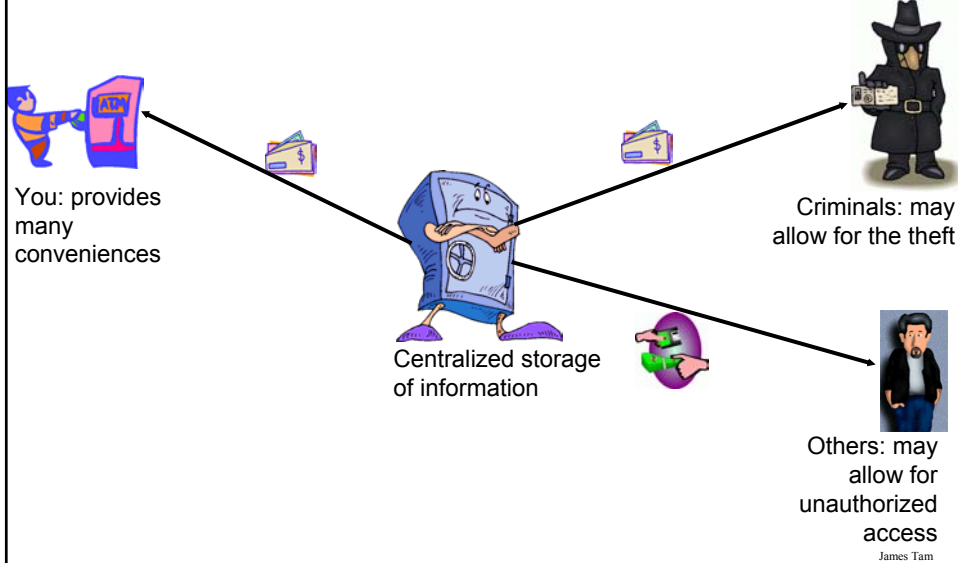
- Concerned with the efficient storage, retrieval and distribution of information
- It can be a difficult challenge!

Results 1 - 100 of about 199,000. Search took 0.42 seconds.

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Databases: Issues

- Having so much information stored has benefits and drawbacks.



Computer Theory

- Computer theory: studies problems that are mathematical but are to be solved with a computer.
- Some areas of Computer Theory
 - Cryptography
 - Algorithm analysis
 - Distributed computing

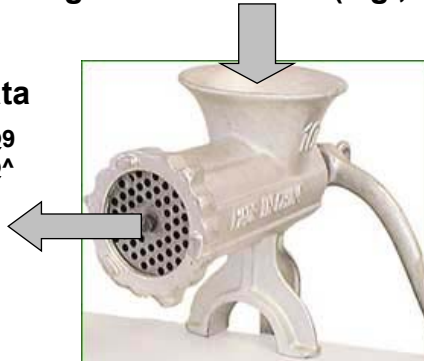
Computer Theory: Cryptography

- Computer security has become increasingly important since the advent of the Internet.
- One aspect of computer security is cryptography.

Original information (e.g., Credit card #)

Encrypted data

J~:~>^@^@^@.^@9
^@^P^@^Y^G^@^
Z
^@^B^@^Y
^@^B^@^I
^@^B^@^I

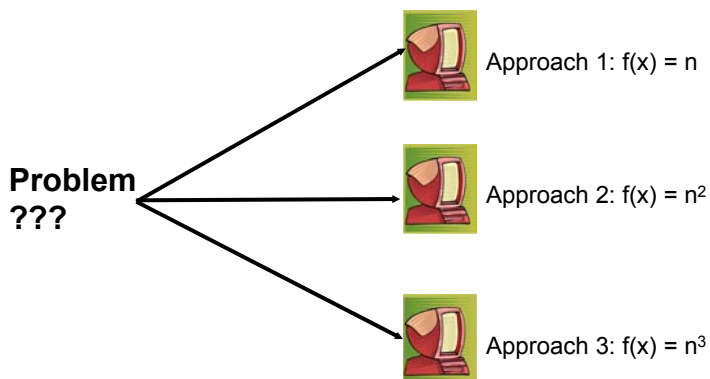


For more information: <http://www.cpsc.ucalgary.ca/Research/qcc.php/>

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Computer Theory: Algorithm Analysis

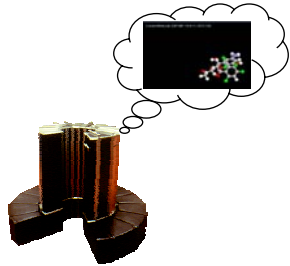
- A problem may be implemented many different ways with varying degrees of efficiency.
- Algorithm analysis: determining and proving the efficiency of a particular approach.



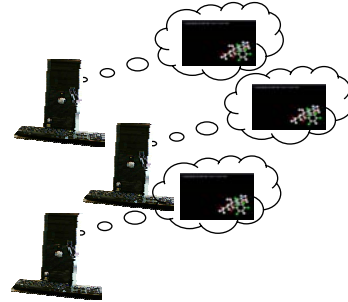
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Computer Theory: Distributed Computing

- Used for complex problems that require a great deal of computing power:
 - Medical research e.g., <http://www.computeagaincancer.org/>,
<http://www.stanford.edu/group/pandegroup/folding/>,
<http://fightaidsathome.scripps.edu/>...
 - Climate research: <http://www.climateprediction.net/index.php...>



Traditional Approach: use one powerful computer (Cray 1)

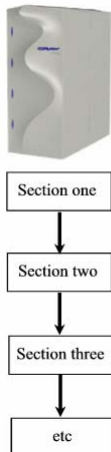


Approach using distributed computing: use several less powerful computers

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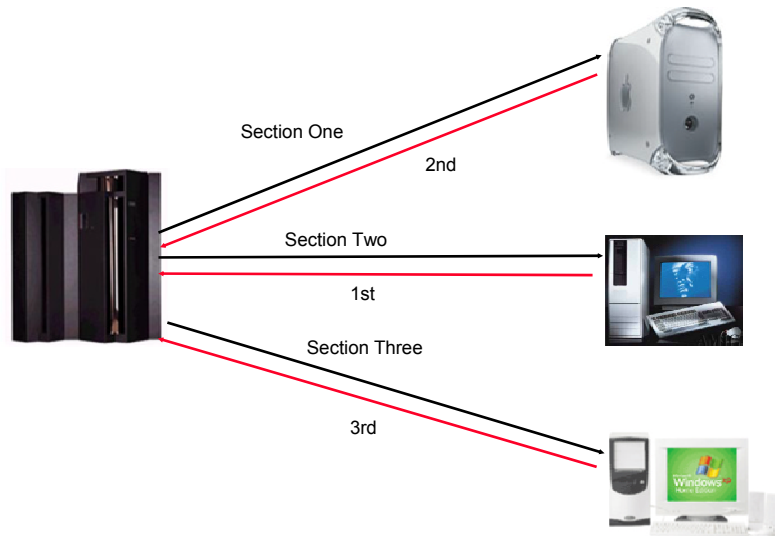
Computer Theory: Distributed Computing (2)

- One issue: Ensuring proper order



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Computer Theory: Distributed Computing (3)



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Computer Networking And Distributed Systems

- The advantages of working remotely (through a network or the Internet) are so obvious that it's now all taken for granted.



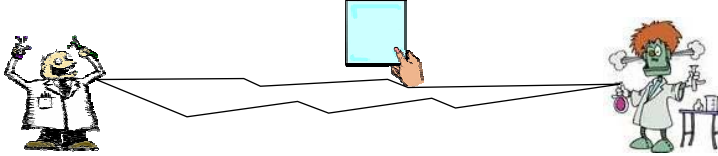
For more information: <http://grid.ualgary.ca/>, <http://www.westgrid.ca/> or <http://pages.cpsc.ualgary.ca/~mahanti/>

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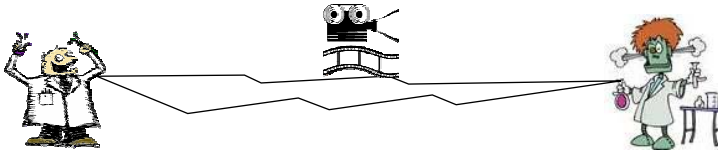
Computer Networking And Distributed Systems (2)

- This area of research focuses on ensuring the efficient transmission of electronic information while minimizing transmission problems.

10 page paper: Transmission rate: 2400 bits per second is okay



2 hour video: Transmission rate: 10,000,000 bits per second is still too slow



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Computer Networking And Distributed Systems (3)

- Speed isn't the only issue... minimizing transmission problems



Terminator 2: Judgment Day © Lions Gate Home Entertainment

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Computer Networking And Distributed Systems (3)

- Speed isn't the only issue... minimizing transmission problems



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Computer Networking And Distributed Systems (3)

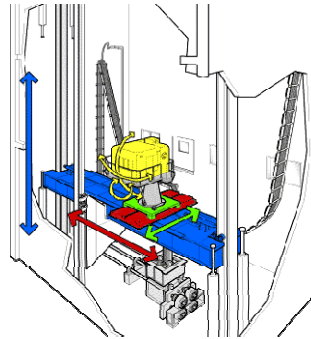
- Speed isn't the only issue... minimizing transmission problems



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Simulations

- Recreating behaviour by an analogous model or situation to gain information more conveniently or to train personnel.



Images from <http://www.simlabs.arc.nasa.gov/vs>.

For more information: <http://warp.cpsc.ualgary.ca/>

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Simulations (2)

- Why simulate?
 - Complex systems
 - Dangerous experiments
 - Controlled conditions
 - Cost savings

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Simulations: Some Issues

- What information should be included in the simulation?
- How confident are we in the results of the simulation?
- Speed of the simulation.

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Queuing Simulations

- A queue is a list that can take many forms: FIFO (First-in, First-out), LIFO (Last-in, First-out), Priority queue.
- Random functions are employed to simulate the occurrence and duration of events that are related to the queue.
- Example: How many cashiers should be employed at a store at particular times of day?
 - The two extreme approaches can be problematic.
 - A compromise must be made between financial considerations and having a reasonable wait time for customers.
 - The experiential approach may take too long to see any results.
 - An alternative is create and run a simulation which requires certain pieces of information to be known.

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Artificial Intelligence

- What makes a person smart?
- How do we build a smart machine?
 - How to make a machine think like a person?
 - How to make a machine behave like a person?

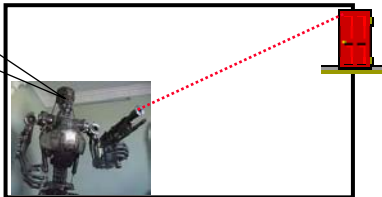
For more information: <http://pages.cpsc.ucalgary.ca/~jacob/AI/> or <http://pages.cpsc.ucalgary.ca/~denzinge/>

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Artificial Intelligence (2)

- Approaches:
 - 1) Trying to simulate a person (strong equivalence)

Hasta
la vista
baby!



- 2) Trying to simulate what the person can do

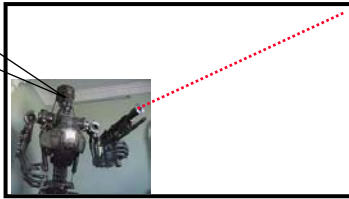
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Artificial Intelligence (2)

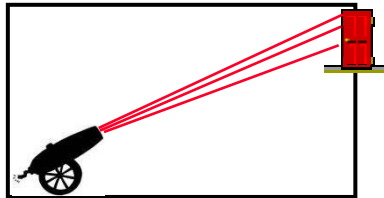
- Approaches:

- 1) Trying to simulate a person (strong equivalence)

Hasta
la vista
baby!



- 2) Trying to simulate what the person can do (weak equivalence)

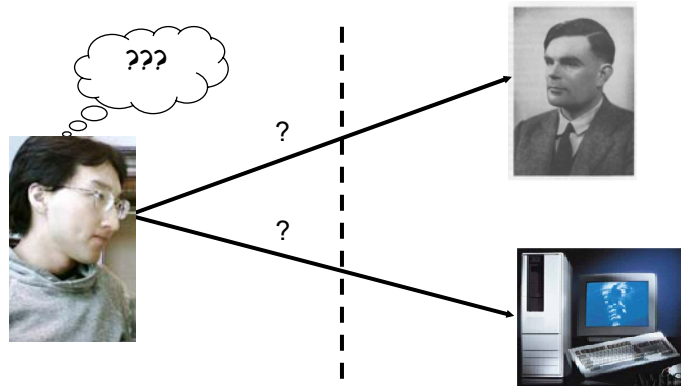


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Artificial Intelligence (3)

- How do we know we have a "smart machine"?

- The Turing test



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Artificial Intelligence (4)

- Much work still needs to be done



Photo from www.startrek.com © Paramount

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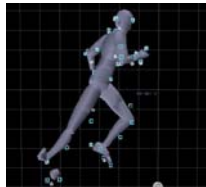
Computer Vision

- Identifying and analyzing visual information based on appearance

- Hand writing recognition: six?



- Analyzing digital video: studying running styles



For more information: <http://pages.cpsc.ucalgary.ca/~parker/DML/welcome.html> or
<http://vma.cpsc.ucalgary.ca/projects>

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Computer Vision (2)

- Some Issues:

- When is it okay and not okay to capture computer images and videos?



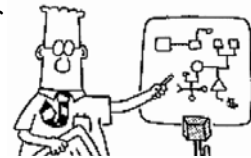
- What are the consequences of the computer misrecognizing something?



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Software Engineering

- Concerned with employing systematic ways of producing good software on time and within budget



Dilbert © United Features Syndicate

Approaches To Developing Software

1. Bottom up (Software Engineering is not employed)
2. Top down (employs some Software Engineering)

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Bottom Up Design

1. Start implementing all details of a solution without first developing a structure or a plan.

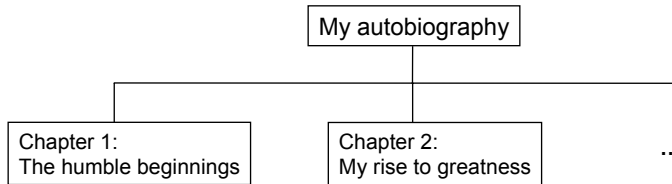
Here is the first of my many witty anecdotes, it took place in a "Tim Horton's" in Balzac..

- Potential problems:
 - (Generic problems): Redundancies and lack of coherence between sections.
 - (Programming specific problem): Trying to implement all the details of large problem all at once may prove to be overwhelming.

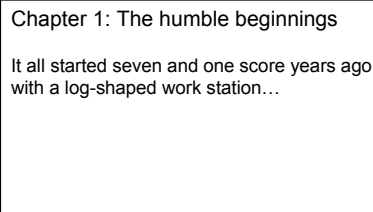
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Top Down Design

1. Start by outlining the major parts (structure).



2. Then implement the solution for each part making sure to check and test it first.



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Games Programming

- Pulls together many areas of Computer Science
- The University of Calgary was the first Canadian university to offer this area of study.

<< Warning!!! >>

Blatant advertisement

<< Warning!!! >>



"Scarface: The World is Yours" © Radical Entertainment

For more information: http://pages.cpsc.ucalgary.ca/~parker/cpsc585-radical/the_site_2/CPSC585.html

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You Should Now Know

- What is Computer Science and how it differs from computer programming.
- What are some of the areas of research and study in Computer Science and what is the main focus of each.