Instructor: Holger Hoos
Welcome!

**Learning Goals for the Course (I)**

• **understand** how data structures, interfaces and processes on computers are designed;
• **design** your own digital artifacts using computer applications and programs, by applying your understanding of data, interfaces, and processes and using other resources available to you;
• **connect** your computing knowledge with your knowledge and interest in other disciplines;

**CPSC 101**
[cs.ubc.ca/~hoos/cpsc101](cs.ubc.ca/~hoos/cpsc101)

**Why Connect With Other Disciplines?**

• computer tools and computational thinking augment (and constrain) discourse and activities in so many disciplines
• ideas and tools from other fields change discourse and activities in computer science too

**Why Connect With Other Disciplines?**

“… the machine, which is thought to be cold and inhuman, can help to realize what is most subjective, unattainable, and profound in a human being.”

- Vera Molnar, computer artist
Why Connect With Other Disciplines?

“... if you figure out a way to make technology work for you, you can explore curved shapes and make them possible at competitive costs. You can do this because of the computer.”
- Frank Gehry

Why Reflect and Assess?

- the impact of computing on our world and on our lives is linked to history and culture of the field
- computing culture influences who uses computers, who gets computing education, who designs computing technologies
- women currently comprise about 11% of computer science bachelor degree recipients in North American PhD-granting institutions

Learning Goals for the Course (II)

- analyze artifacts and concepts to infer what they do or what they mean, and debug errors, using experimentation and conceptual models; and
- reflect on the factors that influence participation in the field of computing and assess your own interest in and aptitude for further computing education

Why Reflect and Assess?

“I limited my own intelligence by refusing to take pleasure in abstract problems or in information that had no human content ... But technical insecurity is a constant strain, and in the end it limits your thinking. I was stacking up trouble for the future.”
- Nuala O'Faolain
Why Reflect and Assess?

- examples throughout the course show the ways that both women and men from many disciplines contribute to computing
- understanding the cultural and social factors that influence participation in computing can help inform your own perceptions of the field and decisions on furthering your own education in computing

Summary

- this course is for science credit and is technical and includes programming activities
- this course is unique among CS courses, in
  - emphasizing connections with other disciplines
  - highlighting the work of women and men
  - presenting some historical context
- the course project, plus material on factors that influence who participates in computing, provide opportunities for students to explore topics at the intersection of their interests and computing technology

Learning Goals for the Course (II)

- **analyze** artifacts and concepts to infer what they do or what they mean, and debug errors, using experimentation and conceptual models; and
- **reflect** on the factors that influence participation in the field of computing and assess your own interest in and aptitude for further computing education

Learning Goal for Today

- become comfortable with articulating and refining conceptual models in learning technical concepts; specifically
  - *categorize a well-described device as a computer or non-computer with clear, articulate reference to your own explicit definition and our course’s definition*
Exercise: What is a Computer?

• get together with two or three neighbours, introduce yourselves, and discuss!
• use the cards we distributed
• for ALL exercises, write the names and student IDs of each student participating on one sheet of paper. (Only groups of 2 to 4 students will receive credit!)

Exercise: What is a Computer?

• divide your cards into two stacks: “computer” and “not a computer”
• write a clear 1-2 sentence definition of a computer (i.e., the definition that you used to create your stacks); this is your conceptual model
• pick an interesting card from each stack and write down your justification of its placement based on your definition

If you have just one stack at step 4, justify the lack of the other stack in place of your second card.

Exercise: What is a Computer?

• Course definition of a computer: A device that receives a list of instructions (drawn from a well-defined set of possible instructions) and interprets them to perform some process in the world, such as physical activity or transformation of information.
• This definition isn’t “the right one”. It’s just a useful one.
• Based on this definition, how should would we classify these as computers (or not)...

Learning Goal for Today [review]

• become comfortable with articulating and refining conceptual models in learning technical concepts; specifically categorize a well-described device as a computer or non-computer with clear, articulate reference to (for one pass) your own explicit definition and (for another) our course’s agreed definition

How did the exercise relate to the learning goal?
Learning Goal for Today [review]

“become comfortable with articulating and refining conceptual models…”
• learning happens when you build and refine on existing knowledge
• you’re learning when you can explain your thinking to someone else
• the process of experimenting and refining is key (if you get it all right first time you’re not learning anything)

Other Information

• course web page is at: cs.ubc.ca/~hoos/cpsc101
• make sure to follow up on To-Do’s listed on the web page and read announcements
• check the web page to learn about course staff, labs, quizzes and exams and more

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Module I: Data Organization

Data Types and Data Structures
Learning Goals [for today]

**you should be able to**

- recognize examples of **data types** and illustrate how properties associated with familiar data types can influence the behaviour of computer applications which act on these data types

- recognize examples of **data structures** and classify data structures as networked, hierarchical, and/or tabular when applicable

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**Exercise: Data Types**

- write down two (universal) properties of each of the following data types; then compare with your neighbours’ properties; then share with the class
  - rectangles
  - files (on a computer)
  - mammals
  - text (in a document)

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**Exercise: Data Types**

- “...illustrate how properties associated with data types can influence … computer applications”
- experiment on Holger’s laptop:
  - what types of data can you see in a .pdf file? How does the type of data influence the behaviour of the Select tool in Acrobat?
  - what properties of a file change when you change the extension of the file, e.g. .html to .txt? Does this influence what you see when you open the file with a text viewer?

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**Exercise: Data Types**

- the preference settings of an application might be considered properties of the application; these influence the behaviour of the application too.
  - can you change the preferences of text viewer so that it displays the contents of an html file in a format resembling a web page, once you open it on Holger’s laptop?
Data Structures

networked | hierarchical | tabular

- network structures show relationships between pairs of data items
Data Structures

• *example:* draw an arrow (i.e. directed link or edge) from one course web page to another if there is a web link from the first to the second:

![Diagram of web pages](image)

Data Structures

• in *hierarchical structures,* data is organized at branch points and/or leaves of a “tree”

![Tree diagram](image)

Data Structures

• *example:* phylogenetic trees

![Phylogenetic tree](image)

Data Structures

• *hierarchical structures* can be represented visually in many distinct ways

![Another tree diagram](image)
Data Structures

• data may be organized in more than one way at the same time
• this is often the case on web pages, which provide different menus for accessing information
• in what ways might the contents of a textbook be organized? (networked? hierarchical? tabular?)

Learning Goals [review]

**you should be able to**

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