Introduction to Computer Science

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Electrical Engineering and Computer Science

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Computer Science

In this class, we are going to

- Learn what it means to program a computer
- Learn basic programming
- Enhance an existing Program (a simple game)
- Program a bot (give a virtual agent "smarts")

Monday is a lab, in the engineering commons.

First - who is Andy Gill?

- Researcher in the field of programming languages
- Ph.D. from the University of Glasgow
- Spent 12 years in industry as a compiler engineer
 - Worked on a Java compiler, a C++ compiler, and a Haskell compiler
 - Co-founded a technology startup in Portland, OR, that used Haskell
- 6th year as professor at KU; teaching since 2002
- Want to share my research interests: Computers and Programming Languages

Why does we have computers?

?

Computer Science is not

Computer Science is **not** about programming.

- CS uses programming as a tool to get a job done.
- CS uses programming in the same way most engineering subjects use Math.
- Furthermore, programming is its own type of Math.
- Programming can be executable and/or declarative.

We are going to see some basic programming today.

What does Computer Science using programming for?

- Mechanization Example: HVAC controller
- Simulation CS helping others
- Graphics User Interfaces
- Search Finding things
- Storage "The Cloud"
- The Web Online shopping carts

All use programming as a means to an end.

What does Computer Science using programming for?

Think of a single digit number.

- Square it.
- Add the result to your original number.
- Divide by your original number.
- Add, oh, how about 17.
- Subtract your original number.
- O Divide by 6.

We are going to automate (program) this.



What is a Computer?

"The trouble with computers is, they're very sophisticated idiots. They do exactly what you tell them at amazing speeds."

— The 4th Doctor.

Programming "Think of a number"

```
// Think of a number.
x = 9:
// Square it.
a = x * x:
// Add the result to your original number.
a = a + x;
// Divide by your original number.
a = a / x;
// Add, oh, how about 17.
a = a + 17;
// Subtract your original number.
a = a - x;
// Divide by 6.
a = a / 6:
// Print the number to the screen.
console.log(a);
```



2nd Problem - find your direction

- You are on a 2-dimensional plane.
- You want to point towards another (given) point on the plane.
- How do you compute this?

if x, y are your coordinates, then atan2(y, x) is the direction you are from the origin, in radians.

Programming "Find your direction"

```
// Original Coords.
x = 3; y = 4;
// Target Coords.
xt = 5; yt = 2;
// Take the difference between the vectors.
xd = xt - x;
yd = yt - y;
// Compute the radian
r = atan2(yd,xd);
// Print the result.
console.log(r);
```



Types of expressions

Expressions are on the right hand side of assignments.

Numbers:

Arithmetic:

Parenthesis:

Assignment Statements

var = expr;

var is a variable name. letters and numbers, starting with a letter. Upper case is for constant variables, like PI.

expr is an expression, like x + 1. Complex expressions are allowed, as are parenthesis. expressions can contain calls to functions, like **atan2**.

Remember to close with semi-colon.

Controlling the boat

Task:

- Make the boat go North.
- (Get eaten by monster.)

Question: Is there a way of escaping?

What if we want to do something conditionally?

Conditionals are a way of making choices.

Task:

- Assign x to -1,0 or 1, depending if y is negative, zero, or positive.
- Split this problem into three parts first.

Computing absolutes

```
y = 0;
if (y < 0) {
  x = -1;
if (y == 0) {
   x = 0;
if (y > 0) {
  x = 1;
console.log(x);
```

Form of a conditional

```
if (condition) {
    assignment;
    assignment;
    assignment;
}
```



Types of conditions

The boring ones:

• true, false

Equality and inequality:

Comparisons:

not!

•

Chaining comparisons:

&&, | |

Parenthesis:

• (...)



Aside...

- Almost everything in computer science can be nested.
- if statements can contain if statements.
- if statements can contain if statements that contain if statements.
- . . .

New task

Control the boat.

- Make the boat go North.
- After 100 steps, make the boat go West.

Advanced:

- Make the boat go North.
- After 100 steps, make the boat turn West gradually.

Assignment Statements and Conditionals

- We have learned about assignment statements.
- Assignments give a new value to a named variable.
- Assignments compute this new value.
- We have learned about conditionals.
- Conditionals optionally do assignments.
- On Monday
 - Lab (in Engineering Commons)
 - Escape from Crater Lake!

