Discussion

Did last week’s lectures and the assigned reading from “Flesh and Machines” make you look at things around you in a new way?

How would you summarize Brooks’ key insights that led him to design Genghis?
Telling a computer how to behave
(via pseudocode, a workaround for Computing’s Tower of Babel.)

2/14/2006
COS 116
Instructor: Sanjeev Arora
Paul Saffo at Silicon Valley's Institute for the Future says that “Google is a religion posing as a company.”

Playing God
If Google is a religion, what is its God?

It would have to be The Algorithm.
Recall: Scribbler

Inputs
- Stall sensor
- Light sensors
- Obstacle sensor emitter
- Obstacle sensor detector
- Line sensor (underneath)

Outputs
- Speaker
- Motor/wheels
- Light outputs
Recall: Scribbler’s “Language”

- Several types of simple instructions
  - E.g. “Move forward for 1 s”
- Two types of compound instructions

**Conditional (a.k.a. Branching)**

```plaintext
If <condition> Then
{
    List of instructions
}
Else
{
    List of instructions
}
```

**Loop**

```
Do for i = 1 to x
{
    List of instructions
}
```
Scribbler language illustrates essential features of all computer languages

- Fundamental features of human languages: nouns/verbs/adjectives, subjects/objects, pronouns, etc.
- Computer languages also share fundamental features, e.g. conditional and loop statements, variables, **ability to perform arithmetic**, etc.
For a computer, everything’s a number

Audio waveform

Sequence of Numbers representing frequency, amplitude, etc.

Image

Sequence of Numbers representing red/green/blue color value of each pixel.
A simple problem

- Say your robot is getting ready for a big date…

- How would a robot identify the cheapest bottle? (Say it can scan prices)
Solution

- Pick up first bottle, check price

- Walk down aisle, for each bottle, do the following:
  - If price on bottle < price on bottle in hand, put down the one in your hand and pick up the new bottle
Similar question in different setting

- Suppose robot has $n$ prices stored in memory

- Want to find minimum price
Memory: a simplified view

- A scratchpad that can be perfectly erased and re-written any number of times

- A variable: a piece of memory with a name; stores a “value”
Examples

\[ i \leftarrow 5 \quad \text{Sets } i \text{ to value 5} \]

\[ i \leftarrow j \quad \text{Sets } i \text{ to whatever value is in } j; \text{ leaves } j \text{ unchanged} \]

\[ i \leftarrow j + 1 \quad \text{Sets } i \text{ to } j + 1; \text{ leaves } j \text{ unchanged} \]
Arrays

- $A$ is an array of $n$ values, $A[i]$ is the $i$'th value

$$A = \begin{bmatrix} 40.99 & 62.99 & 52.99 & \ldots & 22.99 \end{bmatrix}$$

Procedure findmin

- $n$ items, stored in array $A$
- Variables are $i$, $best$
- $best \leftarrow 1$
- Do for $i = 2$ to $n$
  
  
  
  
  
  
  
  
  
  
  
  
  
  
  
  best $\leftarrow i$

}
Another way to express the same procedure.

\[\begin{align*}
\text{best} & \leftarrow 1; \\
i & \leftarrow 2 \\
\text{Do while (} i \leq n \text{)} \\
\{ \\
\quad \text{if (} A[i] < A[\text{best}] \text{)} \text{ then} \\
\quad \quad \{ \text{best} \leftarrow i \} \\
\quad i \leftarrow i + 1; \\
\} 
\end{align*}\]
```c
#include <stdio.h>
int main(void)
{
    int count;
    for (count = 1; count <= 500; count++)
        printf("I will not throw paper airplanes in class.\n");
    return 0;
}
```
New problem for robot: sorting

Arrange them so prices increase from left to right.
Solution

Do for $i=1$ to $n-1$

{ 
Find cheapest bottle among those numbered $i$ to $n$

Swap that bottle and the $i$'th bottle.
}

“selection sort”
Swapping

- Suppose $x$ and $y$ are variables. How do you swap their values?

- Need extra variable!

\[
\begin{align*}
  tmp &\leftarrow x \\
  x &\leftarrow y \\
  y &\leftarrow tmp
\end{align*}
\]
Algorithm

- A precise unambiguous procedure for accomplishing a task

- Named for Abu Abdullah Muhammad bin Musa al-Khwarizmi

- For example, addition, long division, selection sort.