CMPE-013/L

Engineering a Cat Door

Maxwell James Dunne
The Problem

Definition

Every engineering problem begins with a need that winds up driving the solution. Engineering is the art of finding a feasible solution to the problem that meets all of the constraints (be they cost, resources, durability, etc.)

- Engineering is the study of **trade-offs**
- Techniques for managing the complexity apply across domains
- The right solution can be elegant, but is often only visible only in hindsight

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The Cat
The Cat
The Door
The Door
The Problem

• The cat needs to be indoors by nightfall
• Getting him in during the evening can be difficult
  – Chasing the cat
  – Bribing him with food
  – Not always successful
• Cat comes in approximately every two hours during the day
The Solution

• Need to make the cat door one-way, so the cat can **reenter** the house, but not **leave** again
• Set it to one way at **5PM**, cat will be in by **7PM** (before darkness)
• Don’t have to be home to get the cat in
Commercial Solution

• Try to go for a commercial solution
• Buy rather than build
• Not exactly what you need, but can perhaps be made to work.

• “Hav-a-Hart” live animal trap.
Commercial Solution
Commercial Solution
Commercial Solution
Need a new approach

FAILURE!
The Door
New approach: Inside Door

- Add a second door inside the first on the wall
- Hinged up for normal operation
- Down to form a “double seal” or one way valve for the cat door
- Larger than opening, cannot be pushed through.
Inside Door

3 day
How would I make a product?

Simple two "paw" button action to select modes

Cat and moon shaped lights to indicate various modes

Porch sensor reads only your cat's microchip number

Magnetic latch to stop the flap opening in the wind

CMPE-013/L: “C” Programming
Robust In-Only Option

- Use the existing guillotine door rails
- Allow the cat entry, but block the door from opening to the outside
- Needs to be robust to clever cat ✓
- Needs to be accepted by cat ✓
  - Doesn’t work if cat won’t use it
- Will need some refinement to get right
The Prototype
The Prototype in Action

[Two images of a cat standing on a blue mat, facing a glass door with a bar stool behind it.]
One-way Action Confirmed

- Cat can get in
- Cat cannot get out

- Prototype successful, move on to better implementation
Prototype version 2
Need to refine prototype

FAILURE!
Prototype version 3
Happy Cat!
Conclusion

Inspiration and Iteration are two very necessary parts of finding your way to a solution that works well. Failure is the genesis of further experimentation, which leads to better design.

- Fail early and often
  - Early reduction of less promising ideas
- Be flexible
  - Don’t get married to the first solution you try
  - Be ready to jettison something that isn’t working

Experimentation leads to more understanding

3.5 week
900%
18 hours
New Problem
Questions?
CMPE-013/L

Introduction to “C” Programming

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do not cheat

RPG
git repo
Environment Setup

• Lab Computers
  – Work from your X:\Drive and open files directly. This is simplest. Notepad++ recommended.

• Windows
  – Use Putty or other terminal program to connect to the Unix servers to run and compile code.
  – Use Notepad++ with the NppFTP plugin to edit the files.
  – Cygwin for the brave.

• Linux/Mac:
  – You have support for this. Up to you to figure it out.

Regardless: Must run on UNIX cluster for grading.
Room Format

Binary: RPG

<table>
<thead>
<tr>
<th>Title</th>
<th>Item requirements</th>
<th>Description</th>
<th>Items contained</th>
<th>Exits</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>(repeated)</td>
<td></td>
</tr>
</tbody>
</table>

- Room format is the same as discussed in the file I/O lecture except that the files are encrypted with XOR and unique encryption keys.
- To figure out the key for a particular room you add the room number to a base key given in game.h

$32 + 122$
Reading Room Files

- Each time you enter a room you will read in its entire contents and parse it appropriately into a struct.
- After that (for drawing the screen or determining which room to load next) you will reference the struct only.
- Re-reading the file for this data will result in lost points.
- You will only re-read the file when you have exited the room and re-enter it.
```python
open("c:\user\foo\room32.txt")
```

```
Roomfiles\room_32.txt

```map.pdf
```

```
new code
```

```
.png
```

```gv
```
Terminal Programs

console programs

- While standard users typically use GUI’s these days terminal programs are still very important.
  - Especially for remote system where you do not have direct access to the machine.

- There are several frameworks to make terminal programs (curses comes to mind) but we will use one of the oldest: VT100
  - Originally designed when the monitors had serial connections
VT100 Escape Codes

- Every sequence starts with the ESC character or 0x1B and is followed by a command.
- For example “\x1b[2J” will clear the screen.
- Similar commands will change colors and allow the position of the cursor on the screen to be modified.
// printf(\"\e[1m\e[33mE25\n\")

Turn in your VNO