EECS 1012: Introduction to Computer Science

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More complex apps.

- Lets build a calculator

Could be fancier, and we will not do it all
(but it gives you an idea)

Start

- We need to define what is needed
  - “What is a calculator?”
  - Real numbers, +,-,*,/
  - No exponents
  - Decimal place

How do we design the display?

- Lets not deal with style (later, task for the student)
- How do we deal with input and output
  - Input ‘button’ (other choices too, but…)
  - Output ‘display’ (text)

Layout of buttons

- Many choices, lets use a table of buttons.

```
<table width="100%" height="100%">
  <tr>
    <td colspan="4" id="display"> 000000000000000</td>
  </tr>
  <tr>
    <td><button onclick="number('7');">7</button></td>
    <td><button onclick="number('8');">8</button></td>
    <td><button onclick="number('9');">9</button></td>
    <td><button onclick="div();">/</button></td>
  </tr>
```

Lets build this incrementally

- The choice of buttons means that you will enter a number digit by digit.
- So many buttons will ‘update’ the display of the current number.
- Call this number “display”.
  - Initially a zero.

What happens when you push a digit button

- Many options
  - Could treat the number as a string and concatenate the digits together
  - Could treat the number as a number and multiply by 10 and add the digit
  - Decimal point an issue in both cases
  - Starting state is an issue in both cases

Number

- display=3
- Enter a 6
  - display = display * 10 + 6
- display = 0.3
- Enter a 6
  - display = ?????

String

- display = “3”
- enter a 6
  - output is display + String(6)
- display = “0.3”
- enter a 6
  - output is “0.36”

Lets go for a String

- Decimal point is an issue though
  - “0.36” + “.” should not be “0.36.”

Wiring buttons

- onclick=“buttonOne()” etc.
- Can pass arguments, so we can use
  - onclick=“button(‘1’)”
  - onclick=“button(‘2’)”

s will be one of 0, 1, 2, …, 9 or .

```
function number(s) {
  "use strict";
  var x = document.getElementById("display");
  if(display == "0") {
    display = s;
  } else if((s != '.')||(display.indexOf(".") < 0)) {
    display = display + s;
  }
  x.innerHTML = display;
}
```

display is just “0” so make the display the input

```
function number(s) {
  "use strict";
  var x = document.getElementById("display");
  if(display == "0") {
    display = s;
  } else if((s != '.')||(display.indexOf(".") < 0)) {
    display = display + s;
  }
  x.innerHTML = display;
}
```

display is not just “0”, so as long as we don’t have a ‘ in the

```
function number(s) {
  "use strict";
  var x = document.getElementById("display");
  if(display == "0") {
    display = s;
  } else if((s != '.')||(display.indexOf(".") < 0)) {
    display = display + s;
  }
  x.innerHTML = display;
}
```

Could even be fancier, 0 display enter .
gets 0. but this is fine for now

Now the operation

- So there is a number in the display
  - 36
- And you type a ‘+’ operation, what do we want to do?
  - Have to save the 36
  - Have to save the +
  - Let another number be entered
  - Then the = sign means add the two numbers

Lets think about it

- +, -, *, /
  - Store the current number somewhere
  - Remember the operation
- =
  - Take the stored number and current number and do the operation and store the result

+, -, *, /

- All do the same thing (much like digits)
- So use a similar trick as with digits
  - onclick="op('+')"

```
function op(s) {
  register = Number(display);
  display = "0";
  document.getElementById("display").innerHTML = display;
  operation = s;
}
```

=

- Have to apply the saved operation and value to the current input

```
function equals() {
  if(operation == "+") {
    display = register + Number(display);
  } else if(operation == '-') {
    display = register - Number(display);
  } else if(operation == '*') {
    display = register * Number(display);
  } else if(operation == '/') {
    display = register / Number(display);
  }
  document.getElementById("display").innerHTML = display;
  operation = "";
}
```

Yet another problem

- Division by 0

```
function equals() {
  if(operation == "+") {
    display = register + Number(display);
  } else if(operation == '-') {
    display = register - Number(display);
  } else if(operation == '*') {
    display = register * Number(display);
  } else if(operation == '/') {
    display = register / Number(display);
    if(!isFinite(display)) {
      display = 0.0;
    }
  }
  document.getElementById("display").innerHTML = display;
  operation = "";
}
```

One more tweak

- Add a Clear button

```
function clr() {
  display = "0";
  operation = "";
  register = 0;
  document.getElementById("display").innerHTML = display;
}
```

What's left

- The display is not great
  - Add style to make it more attractive
- Add scientific functions (sin, cos, etc.)
  - Easily done