Computer Science 141
Computing Hardware

Instructor: Prof. David Brooks
dbrooks@eecs.harvard.edu
Moore’s Law
Computing Performance

• Examples:
  – 1951 UNIVAC — 5K adds/sec in a 4400 ft³ package (22’ x 20’ x 10’)
  – 2010 Nvidia GTX580 GPU — 1.58T FPadd/sec

*And demand is keeping pace!*
Portable (low-power) Computing

- 1951 UNIVAC — 124.5 KW
- SigmaTel STMP3550
  - 50 hours on a AA battery
  - 32-bit RISC core with DSP for audio decode
  - Very similar to final CS141 project design!
What will you learn?

Digital Logic Design

Computer Organization

<table>
<thead>
<tr>
<th>A</th>
<th>B</th>
<th>Output</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>1</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>

Verilog

```verilog
module seq1101_mesaI(k, y, CLK, RESET);
    input x;
    input CLK;
    input RESET;
    output y;
    reg y;

    parameter start = 2'b00, g01 = 2'b01, g01

    reg [1:0] D: // state variables
    reg [1:0] D: // next state logic output
```

Computer Science 141
David Brooks
XSA-3S1000 Board

https://xess.com/prods/prod035.php
CS141 FAQ

• Prereqs?
  – Programming familiarity (CS50)
  – Some familiarity with number systems (binary)
  – Basic experience with Windows (CAD tools)

• When?
  – Fall 2011

• What else?
  – CS146 (Computer Architecture)
  – CS148 (Digital VLSI Design)
  – Several grad courses, research opportunities…