ECE253—a

Jonah Chen

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Contents

1 Number Conversions

- Computers use binary. We use hexadecimal to make it less error-prone writing binary numbers.
- Convert binary to hex: grouping four bits together makes the conversion easier. $0101\,1110 = 5e$.
- Converting hex to binary: $a6 = 1010\,0110$
- Converting binary to decimal: find the bit positions for all the "1"s. $101\,0111 = 2^6 + 2^4 + 2^2 + 2^1 + 2^0 = 87$.
- Converting decimal to binary: Repeatedly divide by two and get quotient and remainder. The remainders from the binary digits from least significant to most significant bits.

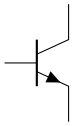
$$\begin{aligned} 76/2 &= 38 \\ 38/2 &= 19 \\ 19/2 &= 9 + 1/2 \\ 9/2 &= 4 + 1/2 \\ 4/2 &= 2 \\ 2/2 &= 1 \\ 1/2 &= 0 + 1/2 \end{aligned}$$

  Thus, $76 = 1001100$.
- Converting hex to decimal: $3e = 3 \times 16 + 14 = 62$.
- Converting decimal to hex: We can use algorithmic way, which is repeatedly dividing by sixteen and take the remainders to extract the hex digits but dividing by 16 is very difficult. So, first convert to binary then convert to hex. $96 = 110\,0000 = 60$

2 Binary addition

- Each step of computation has three inputs and two outputs.

3 Primative logic gates



x	y	$x+y$	xy	$\overline{x}$	$\overline{y}$
0	0	0	0	1	1
0	1	1	0	1	0
1	0	1	0	0	1
1	1	1	1	0	0

Example 1 ()

Say X is a 3-bit number, with bits $x_2x_1x_0$. Design a circuit with X as input and one output f. f should be 1 if $X \geq 5$, otherwise f should be 0.

	x_2	x_1	x_0	f
0	0	0	0	0
1	0	0	1	0
2	0	1	0	0
3	0	1	1	0
4	1	0	0	0
5	1	0	1	1
6	1	1	0	1
7	1	1	1	1

$f = x_2(x_1 + x_0)$

- Equation
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- Timing Diagram