



Introduction to Computers CC111/CS111

Section 2 *Numbering Systems*

Aim: To give students the basics on Binary and Decimal Numbering systems

Points to cover:

1. Decimal Numbering System

- Base 10: explain why it is a base 10 system; there are numbers from 0-9
- Explain what are weights and give an example

Weight	Value
10^0	1
10^1	10
10^2	100
10^3	1000
10^4	10000

10^2 10^1 10^0
567

$$5 \times 100 + 6 \times 10 + 7 \times 1 \rightarrow 500 + 60 + 7 \rightarrow 567$$

Section Questions

Please answer these questions with them so they can answer the sheet

1. What is the weight of digit 6 in 1386?

Answer: $10^0 = 1$

2. Express 100 as a power of ten

Answer: $100 = 10^2$

2. Binary Numbering System

- Base 2: Explain why it is a base 2 system; there are numbers from 0 and 1
- Explain the weights in a binary system and give an example

Binary Weights

Weight	Value
2^0	1
2^1	2
2^2	4
2^3	8
2^4	16
2^5	32
2^6	64
2^7	128

2^2 2^1 2^0
101

$$1 \times 4 + 0 \times 2 + 1 \times 1 \rightarrow 4 + 0 + 1 \rightarrow 5$$

Section Questions

Please answer these questions with them so they can answer the sheet

3. What is the highest decimal number that can be represented by 5 numbers of binary digits (bits)?

Answer: 5 bits → maximum number all 1s → 11111 in binary → convert to decimal → 31 in decimal

3. Binary to Decimal Conversion

- Explain how to convert from binary to decimal using the **sum-of-weights** method
- Give an example

2^3 2^2 2^1 2^0
1010

$$1 \times 8 + 0 \times 4 + 1 \times 2 + 0 \times 1 \rightarrow 8 + 0 + 2 + 1 \rightarrow 10$$

4. Decimal to Binary Conversion

- Explain how to convert from decimal to binary using the **sum-of-weights** method
- Give an example

48

i. What's the largest binary number that can be used to represent 48?

$$2^5 \rightarrow 32$$

$2^5=32$	$2^4=16$	$2^3=8$	$2^2=4$	$2^1=2$	$2^0=1$
1					

ii. $48 - 32 = 16$

iii. What's the largest number that can represent 16? $2^4 \rightarrow 16$

$2^5=32$	$2^4=16$	$2^3=8$	$2^2=4$	$2^1=2$	$2^0=1$
1	1				

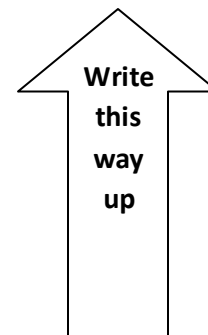
iv. $16 - 16 = 0$

$2^5=32$	$2^4=16$	$2^3=8$	$2^2=4$	$2^1=2$	$2^0=1$
1	1	0	0	0	0

- Explain how to convert from decimal to binary using the **divide-by-2** method
- Give an example

48

Number	Divide by 2	Carry (0 = no carry/1=carry)
48	24	0
24	12	0
12	6	0
6	3	0
3	1.5	1
1	0.5	1



110000

Remind students that Calculators are not allowed in the exam

Section Questions

Please answer these questions with them so they can answer the sheet

5. How many bits are required to represent 17?

Answer: Convert 17 to binary → 10001 → count the bits → 5 bits

5. Binary Addition

- Explain the rules of binary addition

<i>Addition</i>			<i>Value</i>	<i>Carry</i>
0	0		0	0
0	1		1	0
1	1		0	1
1	1	1	1	1

- Give an example

$$\begin{array}{r} 1\ 1\ 1\ 1 \\ 1\ 0\ 0\ 1 \\ +\ 1\ 1\ 1 \\ \hline 1\ 0\ 0\ 0\ 0 \end{array}$$

Assignment: Sheet 1 to hand in next section