



Tishk International University
Faculty of Applied Science
Department of CBS and AI
CBS 111 and AI Intro to IT

2026 January 6

Numbering System

Lecture 2

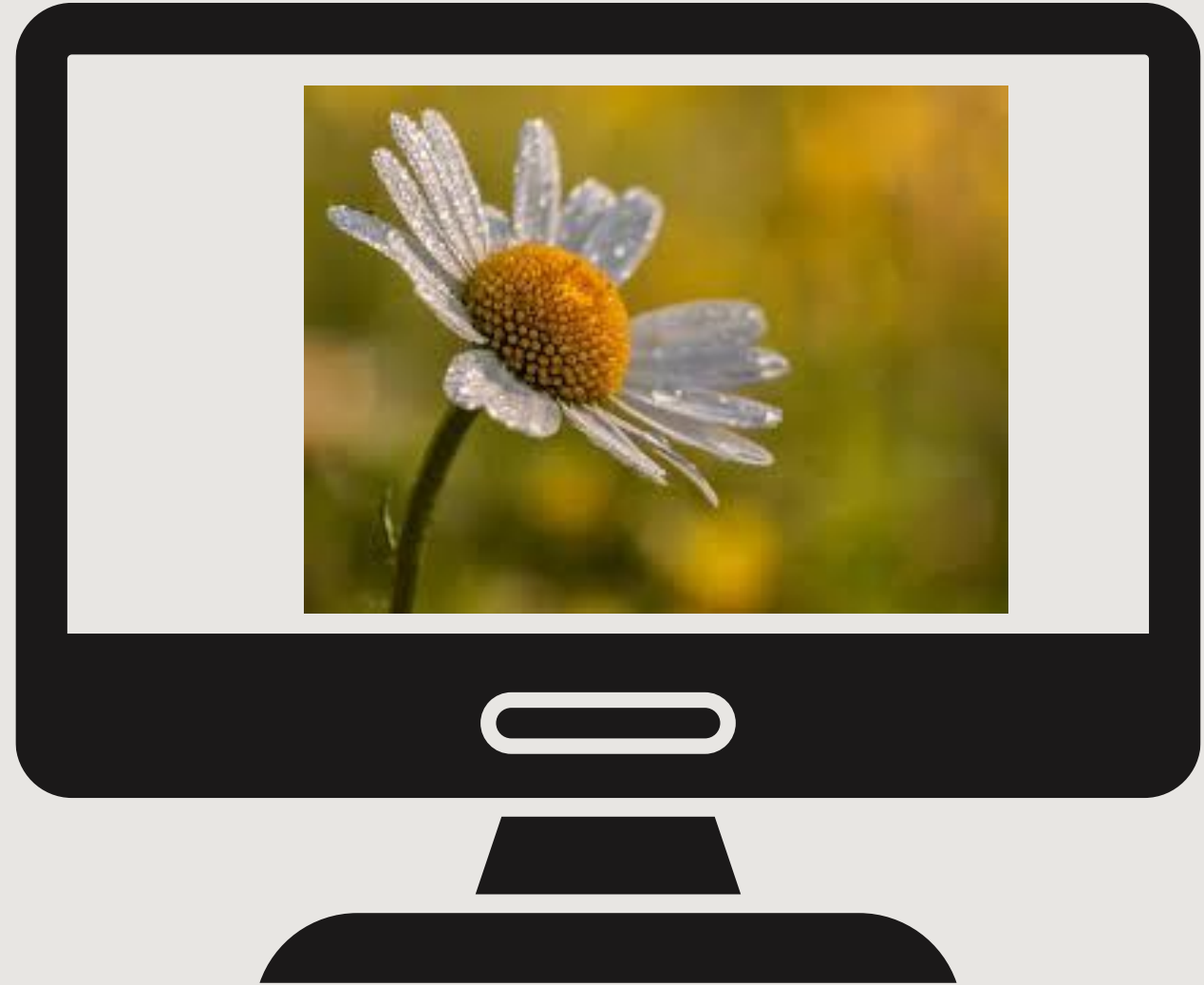
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Learning Outcome

- Explain what a numbering system means in simple words.
- Recognize that computers and humans may use different numbering systems.
- List the main types of numbering systems used in computing.
- Convert simple numbers between different numbering systems (introductory level).

Outline

- Why we need to learn Numbering System?
 - What is Numbering System?
 - Type of Numbering System
 - Decimal Numbering System
 - Binary Numbering System
 - Octal Numbering System
 - Hexadecimal Numbering System
-



I only Understand
0 and 1

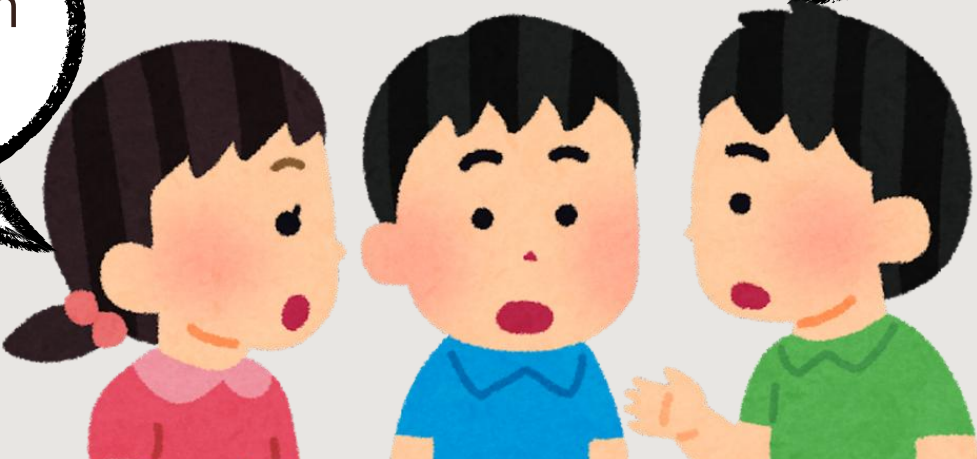
So, I see Only
0 and 1



What colors can
you, see?

it's white Flower

What objects do
you, see?



Why do we learn numbering systems

We learn numbering systems because computers understand only 0 and 1, and we want to communicate with them.



Number System

Decimal
Number system

Numbers with
base 10

EX- $(102)_{10}, (24.579)_{10}, \dots$

Binary
Number system

Numbers with
base 2

$(1011)_2, (101.0011)_2, \dots$

Octal
Number system

Numbers with
base 8

$(245)_8, (212.57)_8, \dots$

Hexadecimal
Number system

Numbers with
base 16

$(2B)_{16}, (D3F)_{16}, \dots$

Decimal Number System

- Base-10 system
- Digits used in it are 0,1,2,3,4,5,6,7,8,9
- Each digit in the number is at a specific place value that is **powers of 10**.
- For Example:
 - $(1234)_{10} = (1*10^3) + (2*10^2) + (3*10^1) + (4*10^0)$
= 1000 + 200 + 30 + 4
= 1234

Binary

- Base-2 system
- 0 mean OFF and 1 means ON
- Each digit represented an increasing power of 2
- **For Example:**

0 = represents no value
1 = represents a unit value

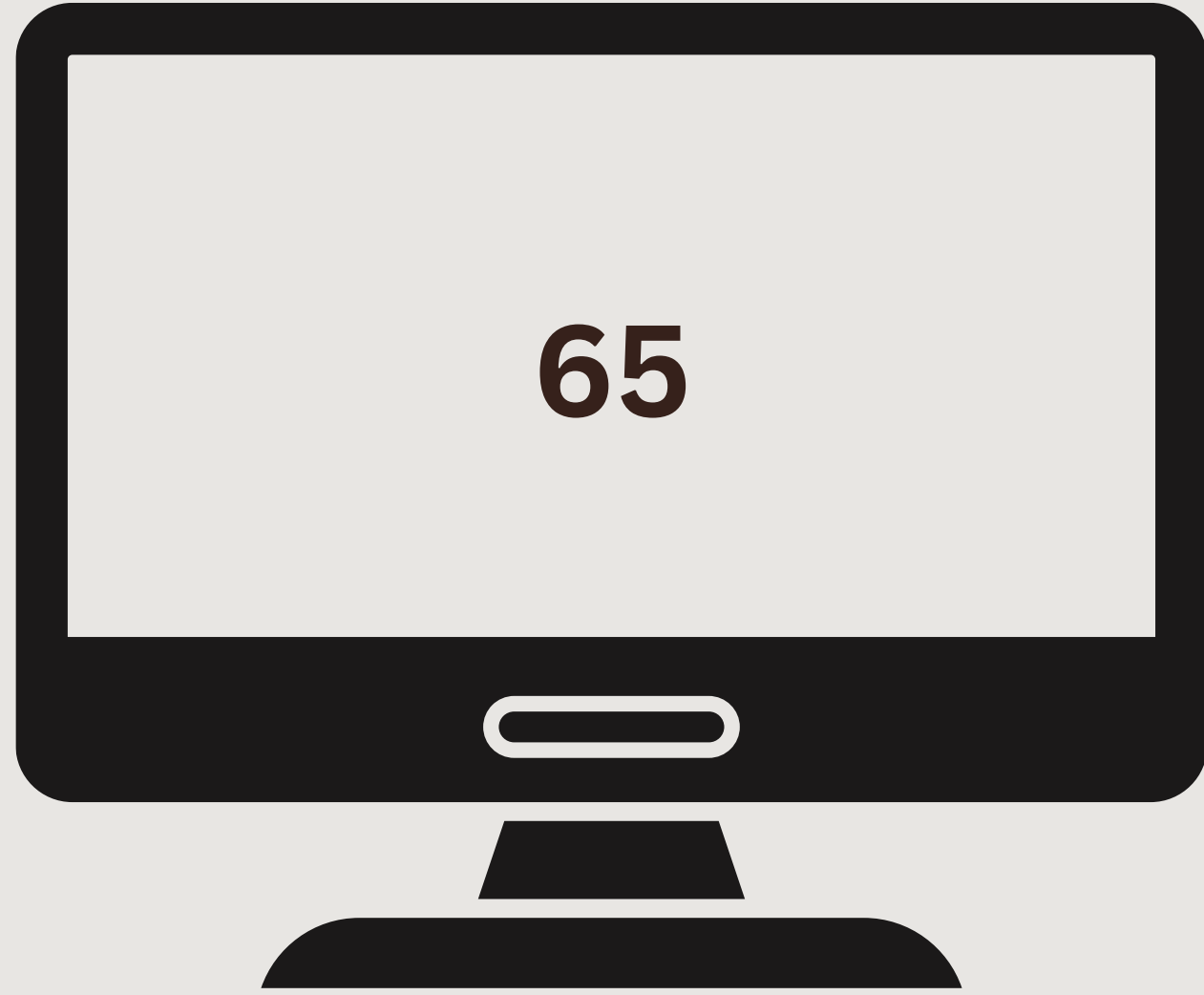
MSB

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

LSB

I only Understand
0 and 1

01000001



what is number
shown isn screen

65

65

Question Convert Binary to Decimal

- $(0101010)_2 \rightarrow (?)_{10}$
- $(11101010)_2 \rightarrow (?)_{10}$
- $(0111011)_2 \rightarrow (?)_{10}$
- $(10111010)_2 \rightarrow (?)_{10}$
- $(00001010)_2 \rightarrow (?)_{10}$
- $(00101010)_2 \rightarrow (?)_{10}$

Question Convert Decimal to Binary

- $(65)_{10} \rightarrow (?)_2$
- $(20)_{10} \rightarrow (?)_2$
- $(7)_{10} \rightarrow (?)_2$
- $(245)_{10} \rightarrow (?)_2$
- $(3)_{10} \rightarrow (?)_2$

Ali

01000001 01101100 01101001

I only Understand
0 and 1

How Computer
Understand
my Name?!

?

?

How Is Your Name Stored in Computer Memory?

ASCII control characters		
00	NULL	(Null character)
01	SOH	(Start of Header)
02	STX	(Start of Text)
03	ETX	(End of Text)
04	EOT	(End of Trans.)
05	ENQ	(Enquiry)
06	ACK	(Acknowledgement)
07	BEL	(Bell)
08	BS	(Backspace)
09	HT	(Horizontal Tab)
10	LF	(Line feed)
11	VT	(Vertical Tab)
12	FF	(Form feed)
13	CR	(Carriage return)
14	SO	(Shift Out)
15	SI	(Shift In)
16	DLE	(Data link escape)
17	DC1	(Device control 1)
18	DC2	(Device control 2)
19	DC3	(Device control 3)
20	DC4	(Device control 4)
21	NAK	(Negative acknowl.)
22	SYN	(Synchronous idle)
23	ETB	(End of trans. block)
24	CAN	(Cancel)
25	EM	(End of medium)
26	SUB	(Substitute)
27	ESC	(Escape)
28	FS	(File separator)
29	GS	(Group separator)
30	RS	(Record separator)
31	US	(Unit separator)
127	DEL	(Delete)

ASCII printable characters		
32	space	
33	!	
34	"	
35	#	
36	\$	
37	%	
38	&	
39	'	
40	(
41)	
42	*	
43	+	
44	,	
45	-	
46	.	
47	/	
48	0	
49	1	
50	2	
51	3	
52	4	
53	5	
54	6	
55	7	
56	8	
57	9	
58	:	
59	;	
60	<	
61	=	
62	>	
63	?	
64	@	
65	A	
66	B	
67	C	
68	D	
69	E	
70	F	
71	G	
72	H	
73	I	
74	J	
75	K	
76	L	
77	M	
78	N	
79	O	
80	P	
81	Q	
82	R	
83	S	
84	T	
85	U	
86	V	
87	W	
88	X	
89	Y	
90	Z	
91	[
92	\	
93]	
94	^	
95	_	
96	`	
97	a	
98	b	
99	c	
100	d	
101	e	
102	f	
103	g	
104	h	
105	i	
106	j	
107	k	
108	l	
109	m	
110	n	
111	o	
112	p	
113	q	
114	r	
115	s	
116	t	
117	u	
118	v	
119	w	
120	x	
121	y	
122	z	
123	{	
124		
125	}	
126	~	

Octal Number System

- Base-8 system
- numbers are formed using 8 digits i.e. 0, 1, 2, 3, 4, 5, 6, 7.
- **For Example:**
 - $(12)_8$

$$\begin{array}{ccc} \text{Octal} = 12 & & \\ & \swarrow & \searrow \\ & 8^1 & 8^0 \\ & 1 & 2 \end{array}$$

The result is $= (1 * 8^1) + (2 * 8^0) = (1 * 8) + (2 * 1) = (10)_{10}$ \longrightarrow Decimal

Octal representation of Binary number

- Each octal digit = **3 binary bits**
- **For Example:**
 - $(12)_8$

Octal = 12



The result is $\rightarrow (12)_8 = (001010)_2$

Question Convert Octal to Binary or Decimal

- $(250)_8 = (?)_2$
- $(434)_8 = (?)_2$
- $(620)_8 = (?)_{10}$
- $(5722)_8 = (?)_{10}$

Hexadecimal Number System

- Base-16 system
- numbers are formed using 16 digits i.e. 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, A, B, C, D, E, F.
- Here, A to F represent decimal values from 10 to 15:
 - A = 10, B = 11, C = 12, D = 13, E = 14, F = 15
- Each hexadecimal digit can be represented by **4 binary bits**.
- **For Example:**
 - $(2F3)_{16} = (755)_{10}$
 - $(2F3)_{16} = (?)_2$
 - $(2F3)_{16} = (?)_8$

Question Convert Binary to Hexadecimal or Octal

- $(0101010)_2 \rightarrow (?)_{16}$
- $(11101010)_2 \rightarrow (?)_{16}$
- $(0111011)_2 \rightarrow (?)_{16}$
- $(10111010)_2 \rightarrow (?)_8$
- $(00001010)_2 \rightarrow (?)_8$
- $(00101010)_2 \rightarrow (?)_8$

Question Convert Decimal to Hexadecimal or Octal

- $(650)_{10} = (?)_{16}$
- $(34)_{10} = (?)_{16}$
- $(88)_2 \rightarrow (?)_{16}$
- $(650)_{10} \rightarrow (?)_8$
- $(34)_2 \rightarrow (?)_8$
- $(88)_2 \rightarrow (?)_8$

THANK YOU

