

اللهم صلي وسلم وبارك علي سيدنا محمد  
وعلي اله وأصحابه أجمعين





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**ProgrammingAdvices.com**

Mohammed Abu-Hadhoud





# اساسيات مهمه لكل مبرمج النظام الثماني في الكمبيوتر Octal System

8

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26+ Years of Experience

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# Computer Foundations

## What is Octal System?

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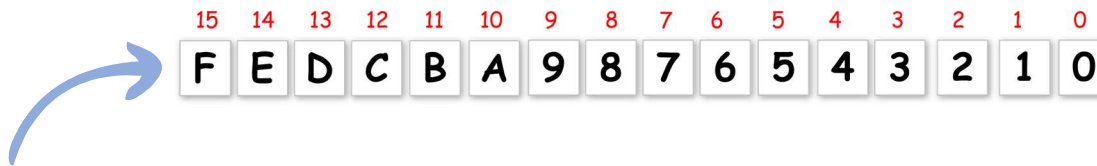
# Counting Systems?



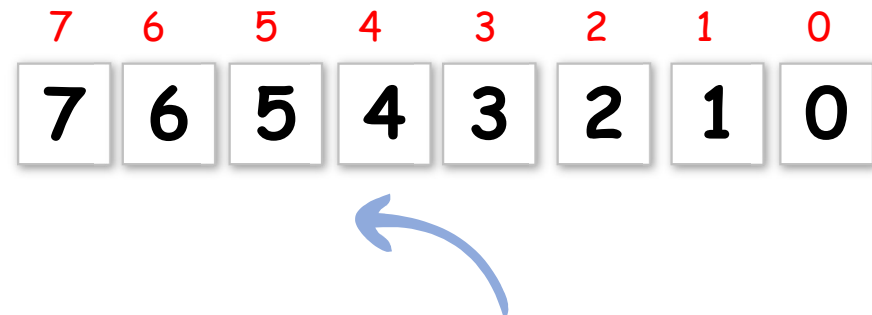
Decimal System (Base 10)



Binary System (Base 2)



Hexadecimal System (Base 16)



Octal System (Base 8)

The **Octal Numbering System** is very similar in principle to the previous hexadecimal numbering system except that in Octal,

Each octal digit represents 3 bits, so a 6-bit byte is two octal digits



# ASCII Table

dec	hex	oct	char	dec	hex	oct	char	dec	hex	oct	char	dec	hex	oct	char
0	0	000	NULL	32	20	040	space	64	40	100	@	96	60	140	`
1	1	001	SOH	33	21	041	!	65	41	101	A	97	61	141	a
2	2	002	STX	34	22	042	"	66	42	102	B	98	62	142	b
3	3	003	ETX	35	23	043	#	67	43	103	C	99	63	143	c
4	4	004	EOT	36	24	044	\$	68	44	104	D	100	64	144	d
5	5	005	ENQ	37	25	045	%	69	45	105	E	101	65	145	e
6	6	006	ACK	38	26	046	&	70	46	106	F	102	66	146	f
7	7	007	BEL	39	27	047	'	71	47	107	G	103	67	147	g
8	8	010	BS	40	28	050	(	72	48	110	H	104	68	150	h
9	9	011	TAB	41	29	051	)	73	49	111	I	105	69	151	i
10	a	012	LF	42	2a	052	*	74	4a	112	J	106	6a	152	j
11	b	013	VT	43	2b	053	+	75	4b	113	K	107	6b	153	k
12	c	014	FF	44	2c	054	,	76	4c	114	L	108	6c	154	l
13	d	015	CR	45	2d	055	-	77	4d	115	M	109	6d	155	m
14	e	016	SO	46	2e	056	.	78	4e	116	N	110	6e	156	n
15	f	017	SI	47	2f	057	/	79	4f	117	O	111	6f	157	o
16	10	020	DLE	48	30	060	0	80	50	120	P	112	70	160	p
17	11	021	DC1	49	31	061	1	81	51	121	Q	113	71	161	q
18	12	022	DC2	50	32	062	2	82	52	122	R	114	72	162	r
19	13	023	DC3	51	33	063	3	83	53	123	S	115	73	163	s
20	14	024	DC4	52	34	064	4	84	54	124	T	116	74	164	t
21	15	025	NAK	53	35	065	5	85	55	125	U	117	75	165	u
22	16	026	SYN	54	36	066	6	86	56	126	V	118	76	166	v
23	17	027	ETB	55	37	067	7	87	57	127	W	119	77	167	w
24	18	030	CAN	56	38	070	8	88	58	130	X	120	78	170	x
25	19	031	EM	57	39	071	9	89	59	131	Y	121	79	171	y
26	1a	032	SUB	58	3a	072	:	90	5a	132	Z	122	7a	172	z
27	1b	033	ESC	59	3b	073	;	91	5b	133	[	123	7b	173	{
28	1c	034	FS	60	3c	074	<	92	5c	134	\	124	7c	174	
29	1d	035	GS	61	3d	075	=	93	5d	135	]	125	7d	175	}
30	1e	036	RS	62	3e	076	>	94	5e	136	^	126	7e	176	~
31	1f	037	US	63	3f	077	?	95	5f	137	_	127	7f	177	DEL

# Why Octal?

- Previously in old computers the byte was only 6 digits not 8 digits.
- In **octal** a binary number is divided up into groups of only 3 bits, with each group or set of bits having a distinct value of **between 000 and 111**.
- The use of octal numbers has declined now, why?!

Because **most modern computers (use Nibbles)** no longer base their word length on multiples of three bits, (**they are based on multiples of four bits, so hexadecimal is more widely used**).



# It's hard for human to read binary!

## What does this mean?

01001001 00100000 01001100 01101111 01110110 01100101  
00100000 01011001 01101111 01110101 00100001



I Love You!



Both Hexadecimal and Octal Systems  
Provides a **human-friendly representation**

11010100 → D4 Hexa

11010100 → 212 Octal

# Computer Foundations

## Octal Prefix

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# Prefix:

## Hexa Prefix:

<u>Technology/Language</u>	<u>Prefix</u>	<u>Example</u>
HTML & CSS	#Code	#FFFFFF
C,C++,Java..etc	0x Code	0x725
XML	&#Code	&#C2A4
Unicode	U+Code	U+C2A4

## Octal Prefix:

0oCode → 0o725





# Computer Foundations

## How Octal works?

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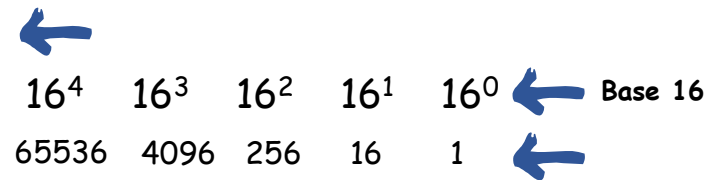
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# Remember that binary was base 2.

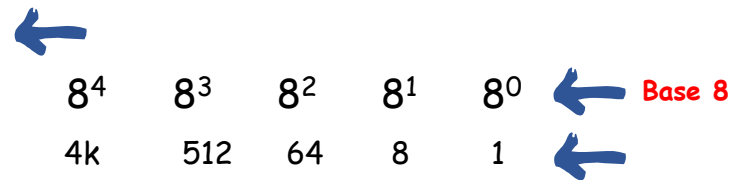
$2^7$	$2^6$	$2^5$	$2^4$	$2^3$	$2^2$	$2^1$	$2^0$	← Base 2
128	64	32	16	8	4	2	1	← Doubling

# Hexadecimal is base 16.



$16^4$	$16^3$	$16^2$	$16^1$	$16^0$	← Base 16
65536	4096	256	16	1	←

# Octal System is base 8.



$8^4$	$8^3$	$8^2$	$8^1$	$8^0$	← Base 8
4k	512	64	8	1	←



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# Convert Decimal to Octal

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conversion from decimal to octal and  
binary to octal

Follows the same pattern as we have seen  
previously for hexadecimal

# Convert 469 to Octal

<u>Number / 8</u>	<u>Result</u>	<u>Integer</u>	<u>Fraction</u>	<u>Remainder</u>		<u>Octal</u>
469 / 8 =	58.625	58	0.625	8 × 0.625 = 5	→	5
58 / 8 =	7.25	7	0.25	8 × 0.25 = 2	→	2
7 / 8 =	--	--	--	7	→	7

$469_{10} \rightarrow 725_8$



# Computer Foundations

## Convert Oct to Decimal.

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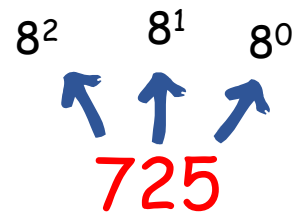
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# Convert Octal **725** to Decimal



$$5 \times 8^0 = 5 \times 1 = 5 +$$

$$2 \times 8^1 = 2 \times 8 = 16 +$$

$$7 \times 8^2 = 7 \times 64 = 448$$

---

**469**



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## Convert Octal to Binary.

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Way 1:

# How to Convert Octal to Binary?

- Two steps:
  1. Convert octal to decimal.
  2. Convert decimal to binary.

That's it.

Way 2:

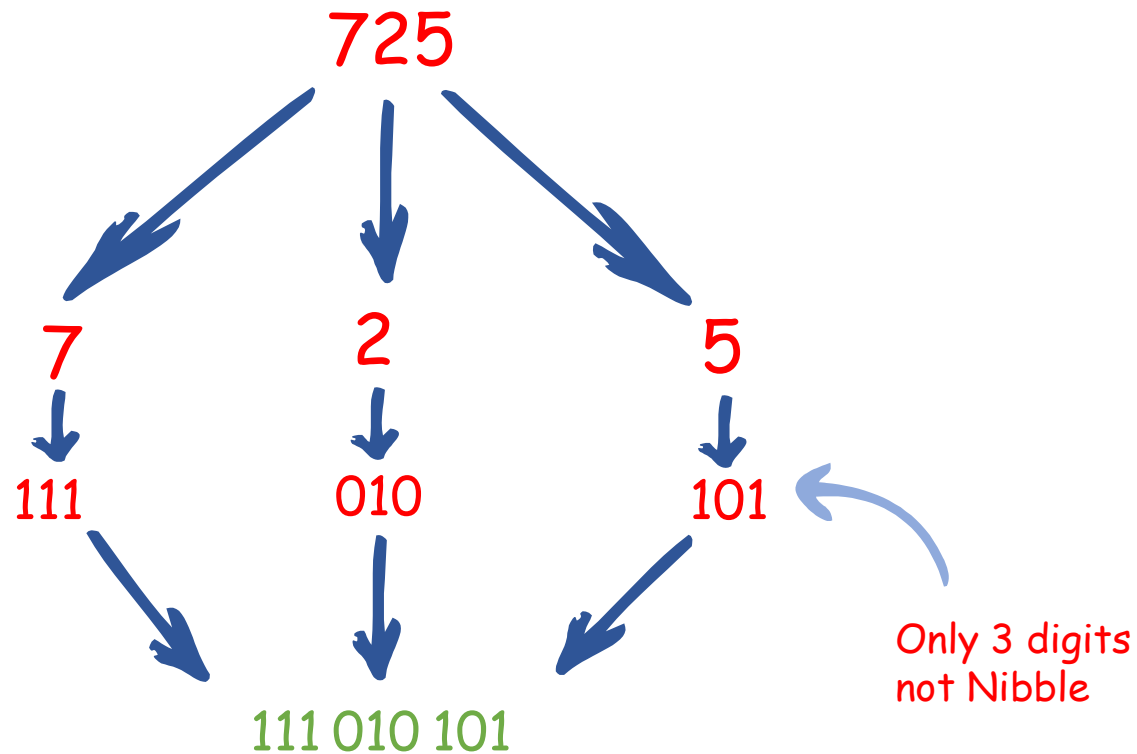
# How to Convert Octal to Binary?

Direct Conversion.



Direct Conversion:

# Convert Octal **725** to Binary



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Way 1:

# How to Convert Binary to Octal?

- Two steps:
  1. Convert Binary to Decimal.
  2. Convert Decimal to Octal.

That's it.

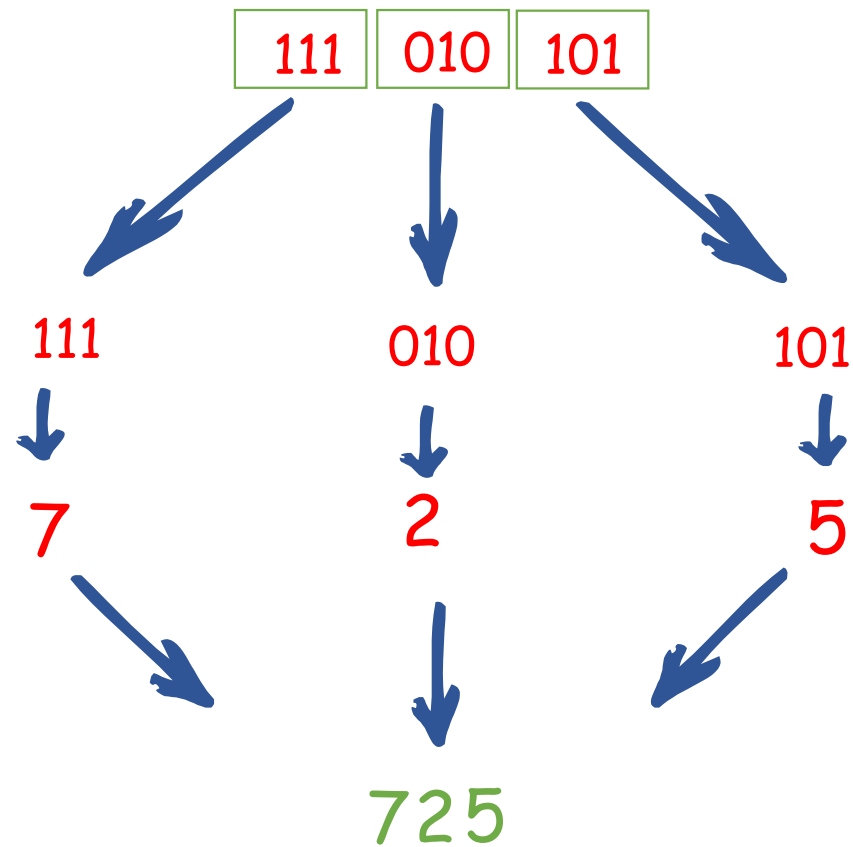
Way 2:

# How to Convert Binary to Octal?

Direct Conversion.



Convert **000111010101** to Octal



# Homework



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1- Convert those **Octal** numbers to **Decimal**:

- 100
- 512

## 2- Convert those **Decimal** numbers to **Octal**:

- 64
- 330



## 2- Convert (direct) those **Octal** numbers to **Binary** :

- 100
- 512

3- Convert (direct) those **Binary** numbers to **Octal** :

- 0100 0000
- 0001 0100 1010

# Solution Homework



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## Solutions:

1:

- 100 → 64
- 512 → 330

2:

- 64 → 100
- 330 → 512

3:

- 100 → 0100 0000
- 512 → 0001 0100 1010

4:

- 0100 0000 → 100
- 0001 0100 1010 → 512



Thank you 😊

124 150 141 156 153 040 131 157 165 040 072 055 051 015 012