

Class Exercise 1

Number bases exercises

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Section 1: Conversion from Binary to Decimal, Octal and Hexadecimal

1. Convert 11110011 from base 2 to decimal

Column value	128	64	32	16	8	4	2	1
Binary number	1	1	1	1	0	0	1	1

$$\begin{aligned}\text{Decimal value} &= 128 + 64 + 32 + 16 + 2 + 1 \\ &= 243\end{aligned}$$

2. Convert 110001111 from binary to base 8

	2^2	2^1	2^0	2^2	2^1	2^0	2^2	2^1	2^0
Binary number	1	1	0	0	0	1	1	1	1
	$4+2+0$	$0+0+1$	$4+2+1$						
	6	1	7						

$$= 617_8$$

3. Convert 0110110011000111 from binary to base 16

	2^3	2^2	2^1	2^0	2^3	2^2	2^1	2^0	2^3	2^2	2^1	2^0
Binary	0	1	1	0	1	1	0	0	1	1	0	0
	$0+4+2+0$	$8+4+0+0$	$8+4+0+0$	$0+4+2+1$								
	6	12	12	7								
	6	C	C	7								

$$= 6CC7_{16}$$

4. Convert 11110011.11011 from base 2 to decimal

2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0	2^{-1}	2^{-2}	2^{-3}	2^{-4}	2^{-5}
1	1	1	1	0	0	1	1	1	1	0	1	1
								$\frac{1}{2}$	$\frac{1}{4}$		$\frac{1}{16}$	$\frac{1}{32}$
128	64	32	16			2	1	0.5	0.25	0.125	0.0625	0.03125
+	+	+				+		+	+	+	+	+

= 243.84375

5. Convert 110001111.10110 from binary to base 8

2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	1	0	0	0	1	1	1	1	0	1	1	0	0		
42					1	4	2	1	4		1	4			
6					1	7		5		4					8

Octal	to base 8
0	0
1	1
2	10
3	11
4	100
5	101
6	110
7	111
10	1000
11	1001
12	1010

6. Convert 0110110011000111.11101001 from binary to base 16

2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
0	1	1	0	1	1	0	0	1	1	0	0	1	1	1	0
42								42							
6								12							
6								12							
6								7							
6								14							
6								9							
6															

Section 2: Conversion from Decimal to Binary, Octal and Hexadecimal

1. Convert 11 from base 10 to Binary

$$11^{10} = (1 \times 10^0) + (1 \times 10^1)$$

$$11_{10} = 1011_2$$

2	11	
X	1	0
X	1	0

Binary position values

Multiplier = 32 16 8 4 2 1

↓ ↓ ↓ ↓

1 0 1 1

11 → 8 + 2 + 1

2. 764₁₀ to Octal

$$764_{10} \rightarrow 1374_8$$

$$764 \div 8 = 95.5 = 95R4$$

$$95 \div 8 = 11.875 = 11R7$$

$$11 \div 8 = 1.375 = 1R3$$

$$1 \div 8 = 0.125 = 0R1$$

$$764_{10} = 1374_8$$

3. 4681(decimal) to Hexadecimal

$$4681_{10} \rightarrow 1249_{16}$$

$$4681 \div 16 = 292.5625 = 292R9$$

$$292 \div 16 = 18.25 = 18R4$$

$$18 \div 16 = 1.125 = 1R2$$

$$1 \div 16 = 0.0625 = 0R1$$

$$4681_{10} = 1249_{16}$$

4. 1459_{10} to Octal

$$1459_{10} \rightarrow$$

$$1459 \div 8 = 182.375 = 182 R 3$$

$$182 \div 8 = 22.75 = 22 R 6$$

$$22 \div 8 = 2.75 = 2 R 6$$

$$2 \div 8 = 0.25 = 0 R 2$$

$$1459_{10} = 2663_8$$

5. 1459_{10} to Hexadecimal

$$1459_{10} \rightarrow 5B3_{16}$$

$$1459 \div 16 = 91.1875 = 91 R 3$$

$$91 \div 16 = 5.6875 = 5 R 11 \quad \left. \begin{array}{l} 11 = B \\ 3 = 3 \end{array} \right\}$$

$$5 \div 16 = 0.3125 = 0 R 5$$

$$1459_{10} = 5B3_{16}$$

6. 1159_{10} to Binary

$$1159_{10} \rightarrow$$

Column values.

1024	512	256	128	64	32	16	8	4	2	1
= 1	0	0	1	0	0	0	0	1	1	1

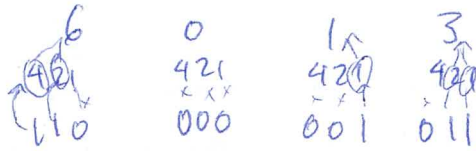
$$1159_{10} = 10010000111_2$$

$1159 \rightarrow 1024 + 128 + 4 + 2 + 1$

	1159			
1024	579	0	1	1024
289	289	0	1	135 - 128 = 7 (closest number on column value)
144	144	0	1	7 - 4 = 3
72	72	X	0	3 - 2 = 1
36	36	X	0	
18	18	X	0	
9	9	X	0	
4	4	X	1	
2	2	X	0	
1	1	X	0	
0	0	X	1	

Section 3: Conversion from Octal to Binary, Decimal, and Hexadecimal.

1. Convert 6013 from octal to binary



6013₈ →

(each number)
Split into 421 → what numbers to equal number
add 1 so?

$$6013_8 = 110\ 000\ 001\ 011_2$$

2. 460 Octal to Decimal

Handwritten calculation for 460₈ to decimal:

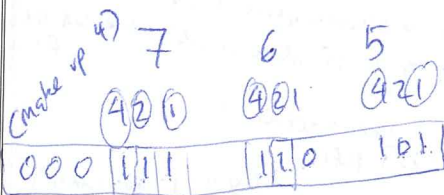
$$460_8 \rightarrow 4 \times 8^2 + 6 \times 8^1 + 0 \times 8^0$$

$$(256) + (48) + (0) = 304_{10}$$

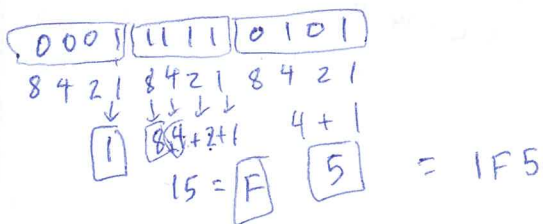
$$460_8 = 304_{10}$$

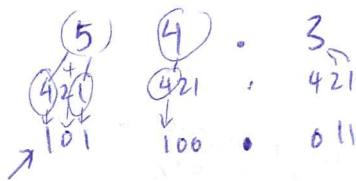
3. 765₈ to Hexadecimal

765₈ → (convert to binary first)



$$765_8 = 1F5_{16}$$



4. 54.3 octal to binary $54.3_8 \rightarrow$ 

$$54.3_8 = 101100.011_2$$

(1 represent
allocating number)
used to
(0 → allocating number
not needed)

5. 642.67 octal to decimal

$$642.67_8 \rightarrow$$

$$(6 \times 8^2) + (4 \times 8^1) + (2 \times 8^0) + (6 \times 8^{-1}) + (7 \times 8^{-2})$$

$$(384) + (32) + (2) + (0.75) + (0.107375)$$

$$642.67_8 = 418.859375_{10}$$

6. 12.667 base 8 to hexadecimal

 $12.667_8 \rightarrow$

Convert to binary first
(421 for binary)

0s to make 4

1	2	.
421	421	
001	010	
0000	010	
8421	8421	
8	8+2	
	10=A	
	A	

6	6	7
421	421	421
110	110	111
110	110	111
842	842	842
8+4+1	8+2+1	8
13	11	8
13=D	11=B	8
D	B	8

select what numbers
used together to calculate above figure
→ indicate using 1, if above number not needed the 0.

Group in 4's (hexadecimal)
starting from (.) left.

(8421 for hex)

$$12.667_8 = A.DB8_{16}$$

Section 4: Conversion from Hexadecimal to Binary, Decimal, and Octal

1. Convert 70A3 from Hexadecimal to binary 70A3 →

7	0	A = (10)	3
8421 0111	8421 0000	8421 1010	8421 0011

→ $(2^0, 2^1, 2^2, 2^3)$

$$70A3_{16} = 0111\ 0000\ 1010\ 0011_2$$

2. CDF2₁₆ to decimal CDF2 →

C	D	F	2
(12)	(13)	(15)	(2)
↓	↓	↓	↓

$$(12 \times 16^3) + (13 \times 16^2) + (15 \times 16^1) + (2 \times 16^0)$$

$$49152 + 3328 + 240 + 2 = 52722$$

$$CDF2_{16} = 52722_{10}$$

3. DF3 Hexadecimal to Octal DF3 →

D	F	3
13	15	3
8421 1101	8421 1111	8421 0011
110 ↓ ↓ 421 ↓ ↓ 4+2 6	111 ↓ ↓ ↓ 421 ↓ ↓ ↓ 4+2+1 7	110 ↓ ↓ ↓ 421 ↓ ↓ ↓ 4+2 6
		011 ↓ ↓ 21 2+1 3

(Pair of $2^{10}, 2^1$)
(Binary)
change in 3/5 groups of 3 (Octal)
(Pair of $2^0, 2^1, 2^2$)

$$DF3_{16} = 6763_8$$

BC.4D \rightarrow

4. BC.4D base 16 to binary

B	C	.	4	D
11	12		4	13
8 4 2 0	8 4 2 1		8 4 2 1	8 4 2 1
1 0 1 1	1 1 0 0	.	0 1 0 0	1 1 0 1

$$BC.4D_{16} = 10111100.01001101_2$$

5. A5.3F $_{16}$ to DecimalA5.3F \rightarrow

A	5	.	3	F
10	5		3	15
$(10 \times 16^1) + (5 \times 16^0) + (3 \times 16^{-1}) + (15 \times 16^{-2})$				
$(160) + (5) + (3/16) + (15/256)$				
$(165) + (0.1875) + (0.05859375)$				

$$A5.3F_{16} = 165.24609375_{10}$$

6. 8DC.1B $_{16}$ to base 88DC.1B \rightarrow

8	D	C	.	1	B
8	13	12		1	11
8 4 2 1	8 4 2 1	8 4 2 1		8 4 2 1	8 4 2 1
1 0 0 0	1 1 0 1	1 1 0 0		0 0 0 1	1 0 1 1
100	011	011		100	000
421	421	421		421	421
4	3	3	.	4	0
					6

Group in 3's

(add 1 number)

$$8DC.1B_{16} = 4334.066_8$$