**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 |

Decimal value = 128 + 64 + 32 + 16 + 2 + 1
= 243

2. Convert 110001111 from binary to base 8

Binary number

| $2^2\ 2^1\ 2^0$ | $2^2\ 2^1\ 2^0$ | $2^2\ 2^1\ 2^0$ |
|---|---|---|
| 110 | 001 | 111 |
| 4+2+0 | 0+0+1 | 4+2+1 |
| 6 | 1 | 7 |

$= 617_8$

3. Convert 0110110011000111 from binary to base 16

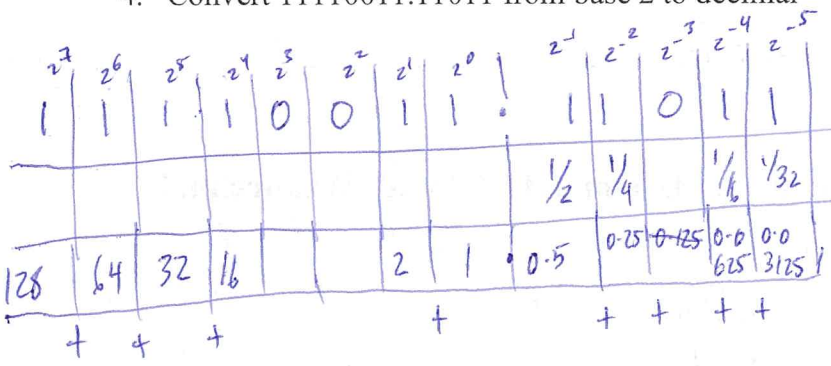
Binary

| | | | |
|---|---|---|---|
| 0110 | 1100 | 1100 | 0111 |
| 0420 | 8400 | 8400 | 0421 |
| 6 | 12 | 12 | 7 |
| 6 | C | C | 7 |

$6127_{16}$

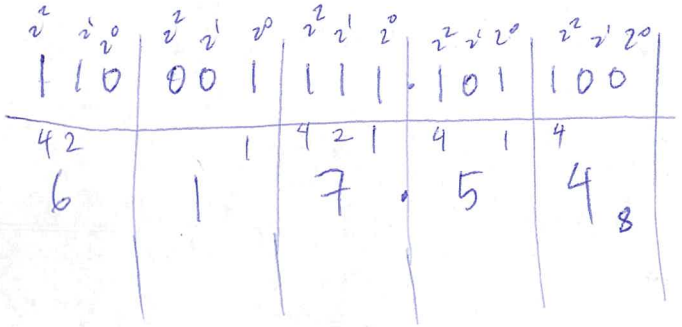
$= 6CC7_{16}$

4. Convert 11110011.11011 from base 2 to decimal



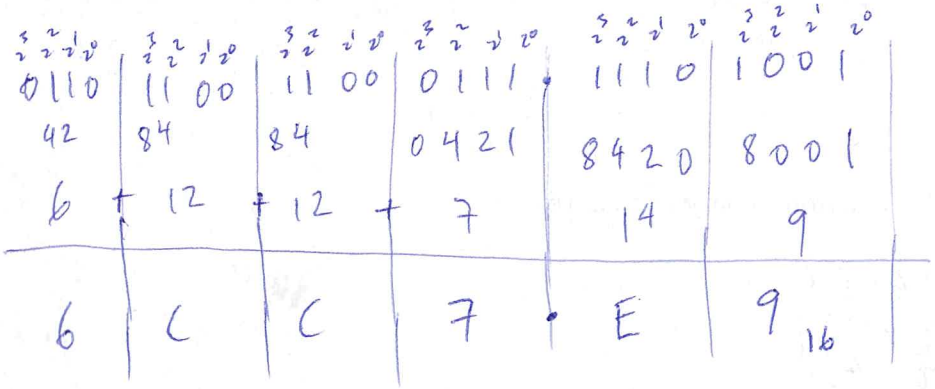

= 243.84375

5. Convert 110001111.10110 from binary to base 8




| Octal | table Binary |
|---|---|
| 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



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

1. Convert 11 from base 10 to Binary

| 2 | 11 | |
|---|---|---|
| ↓ | 1 | 0 |
| ↓ | 1 | 0 |

Binary position values

Multiplier = 32 16 8 4 2 1

1 0 1 1

$11 \rightarrow 8+2+1$

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

$11_{10} = 1011_2$

2. $764_{10}$ 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

$1459_{10} \rightarrow$

$1459 \div 8 = 182.375 = 182R3$

$182 \div 8 = 22.75 = 22R6$

$22 \div 8 = 2.75 = 2R6$

$2 \div 8 = 0.25 = 0R2$

$1459_{10} = 2663_8$

5. $1459_{10}$ to Hexadecimal

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

$1459 \div 16 = 91.1875 = 91R3$

$91 \div 16 = 5.6875 = 5R11$ (11 = B)

$5 \div 16 = 0.3125 = 0R5$

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

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 |

$1159_{10} = 10010000111_2$

| 2 | | |
|---|---|---|
| 1159 | ~~0~~ | 1 |
| 579 | ~~0~~ | 1 |
| 289 | ~~0~~ | 1 |
| 144 | ~~0~~ | 0 |
| 72 | X | 0 |
| 36 | X | 0 |
| 18 | X | 0 |
| 9 | X | 0 |
| 4 | ~~0~~ | 1 |
| 2 | X | 0 |
| 1 | ~~0~~ | 0 |
| 0 | X | 1 |

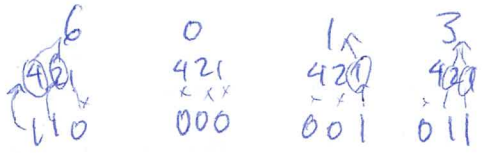
1159 → 1024 + 128 + 4 + 2 + 1

- 1024
- 135 − 128 = 7 (closest number on column value)
- 7 − 4 = 3
- 3 − 2 = 1

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

1. Convert 6013 from octal to binary

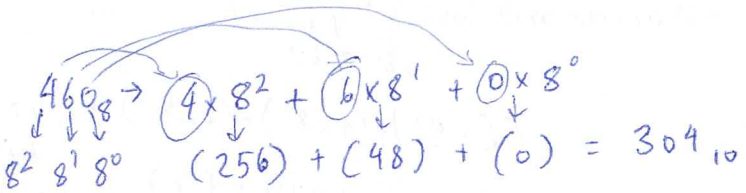
$6013_8 \rightarrow$




(each number) (split into 421) → what numbers to equal number add 1 so;

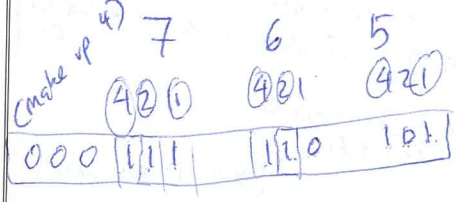
$6013_8 = 110\ 000\ 001\ 011_2$

2. 460 Octal to Decimal

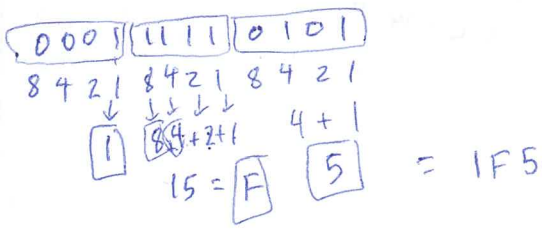



$460_8 = 304_{10}$

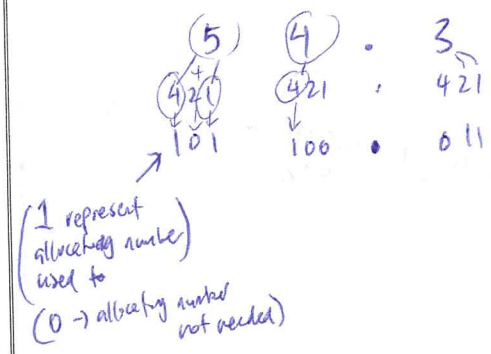
3. $765_8$ to Hexadecimal $765_8 \rightarrow$ (convert to binary first)




$765_8 = 1F5_{16}$



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




$54.3_8 = 101100.011_2$

5. 642.67 octal to decimal $642.67_8 \rightarrow$

$8^2\ 8^1\ 8^0$

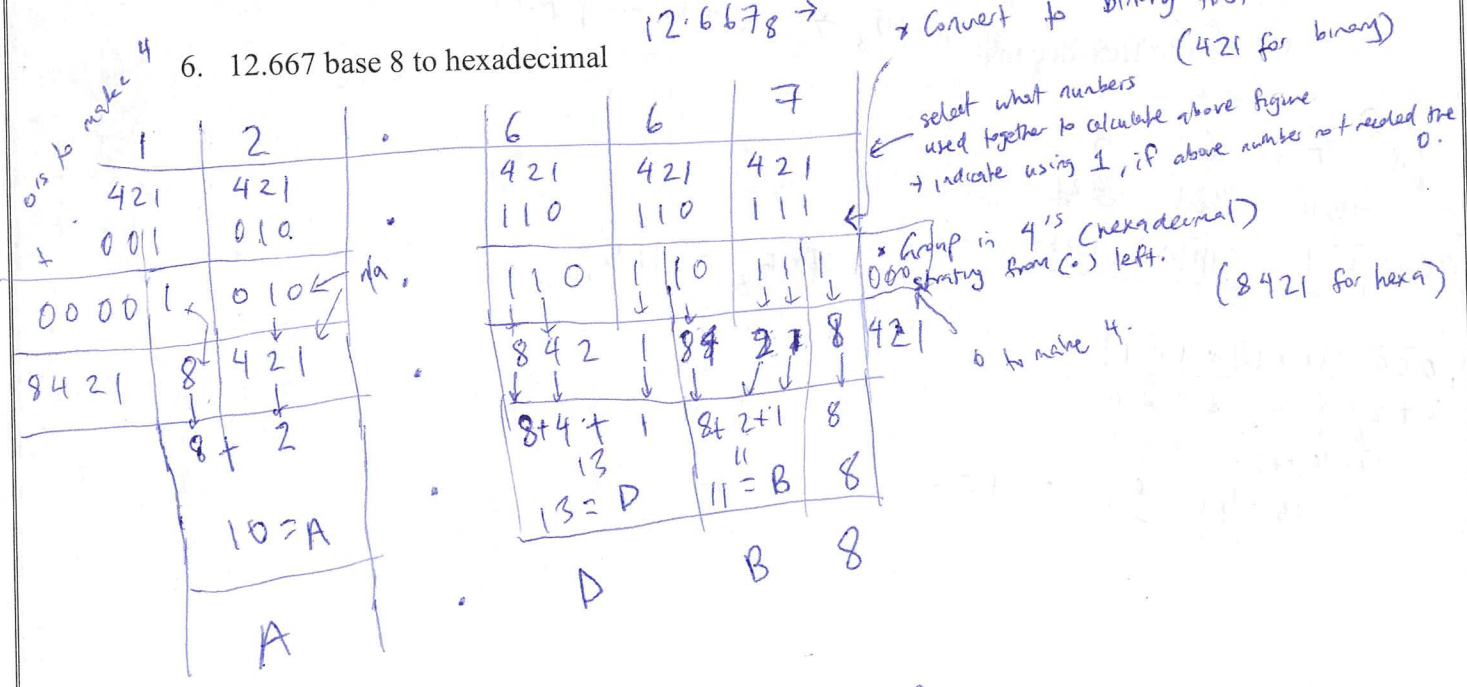
$(6\times8^2)+(4\times8^1)+(2\times8^0)+(6\times8^{-1})+(7\times8^{-2})$

$=6/8 \quad =7/64$

$(384)+(32)+(2)+(0.75)+(0.109375)$

$642.67_8 = 418.859375_{10}$

6. 12.667 base 8 to hexadecimal $12.667_8 \rightarrow$




$12.667_8 = A.DC8_{16}$

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

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

| 7 | 0 | A=(10) | 3 | |
|---|---|---|---|---|
| 8 4 2 1 | 8 4 2 1 | 8 4 2 1 | 8 4 2 1 | → $(2^0, 2^1, 2^2, 2^3)$ |
| 0 1 1 1 | 0 0 0 0 | 1 0 1 0 | 0 0 1 1 | |

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

2. CDF2 $_{16}$ 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 | |
| 8 4 2 1 | 8 4 2 1 | 8 4 2 1 | (Pair of $2^1, 2^1$) |
| 1 1 0 1 | 1 1 1 1 | 0 0 1 1 | (Binary) |
| 1 1 0 1 1 1 1 0 0 1 1 | | | change in groups of 3 (octal) |
| 4 2 1 / 4+2 | 4 2 1 / 4+2+1 | 4 2 1 / 4+2 | 4 2 1 / 2+1 (Pair of $2^0, 2^1, 2^2$) |
| 6 | 7 | 6 | 3 |

$DF3_{16} = 6763_8$

BC.4D →

4. BC.4D base 16 to binary

| B | C | . | 4 | D |
|---|---|---|---|---|
| 11 | 12 | | 4 | 13 |
| 8421 | 8421 | | 8421 | 8421 |
| 1011 | 1100 | . | 0100 | 1101 |

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

A5.3F →

5. A5.3F $_{16}$ to Decimal

| A | 5 | . | 3 | F |
|---|---|---|---|---|
| 10 | 5 | | 3 | 15 |

$(10\times16^1) + (5\times16^0) + (3\times16^{-1}) + (15\times16^{-2})$

$(160) + (5) + (3/16)$ $\quad 15/16^2\ 3\ (15/256)$

$(165) + (0.1875) + (0.05859375)$

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

8DC.1B →

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

| 8 | D | C | . | 1 | B | |
|---|---|---|---|---|---|---|
| 8 | 13 | 12 | | 1 | 11 | |
| 8421 | 8421 | 8421 | | 8421 | 8421 | |
| 1000 | 1101 | 1100 | | 0001 | 1011 | |
| 100 | 011 | 001 | . | 100 | 000 | 110 |
| 421 | 421 | 421 | | 421 | 421 | 421 |
| 4 | 3 | 3 | | 4 | 0 | 6 |

group in 3's

(add 4 numbers)

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