Computer System I

Practical 01

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Practice Problem 2.1

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Perform the following number conversions:

A. $0x\ 39A7F8$ to binary

3	9	10	7	15	8
8421	8421	8421	8421	8421	8421
0011	1001	1010	0111	1111	1000

→ $0x\ 39A7F8 = (0011\ 1001\ 1010\ 0111\ 1111\ 1000)_2$

B Binary 1100100101111011 to hexadecimal

1100	1001	0111	1011
8421	8421	8421	8421
C	9	7	B

→ Binary 1100100101111011 = $0x\ C97B$

C. $0x\ D5E4C$ to binary

13	5	14	4	12
8421	8421	8421	8421	8421
1101	0101	1110	0100	1100

→ $0x\ D5E4C = (11010101\ 11001001\ 100)_2$

D. Binary 100110111001111011010 1 to hexa decimal.

1	0011	0111	0011	1101	1010	1
21	8421	8421	8421	8421	8421	8421
2	6	E	7	B	5	

→ Binary 1001101110011110110101 = $0x\ 26E7B5$

Practice Problem 2.2

Practice Problem 2.2

Fill in the blank entries in the following table, giving the decimal and hexadecimal representations of different powers of 2

Sl.No	n	2^n (Decimal)	2^n (Hexadecimal)
1	9	512	0x200
2	19	524,288	0x 80000
3	14	16,384	0x 4000
4	16	65536	0x 10000
5	17	131072	0x 20000
6	5	32	0x 20
7	7	128	0x 80

Soln ② 2^n (Decimal) 2^n (Hexadecimal)

$2^{19} = 524288$

$524288 \div 16 = 32768$, remainder 0

$32768 \div 16 = 2048$, remainder 0

$2048 \div 16 = 128$, remainder 0

$128 \div 16 = 8$, remainder 0

$8 \div 16 = 0$, remainder 8

0	0	0	0	8

$= 0x80000$

soln (3) $n = \sqrt{16,384} = 14$

soln (3) $2^n = 16384$

which can be written as 2^{14}

where $n = 14$

2^n (Hexadecimal)

0	0	0	4

$$16 \overline{)\,16384\,|\,1024\,|\,64\,|\,4\,|\,0} \quad \text{remainders: } 0,\ 0,\ 0,\ 4$$

$\rightarrow$ 0x4000

soln (4) 2^n (Decimal)

$0 \times 16^0 + 0 \times 16^1 + 0 \times 16^2 + 0 \times 16^3 + 1 \times 16^4$

$= 65536$

$n = ?$

$2^n = 2^{16}$

$n = 16$

Soln ⑤ 2^n (Decimal)

$n = 17$

$2^{17} = 131072$

2^n (Hexadecimal)

$$16 \overline{)131072}\ 8192\ (0$$
$$16 \overline{)8192}\ 512\ (0$$
$$16 \overline{)512}\ 32\ (0$$
$$16 \overline{)32}\ 2\ (0$$
$$16 \overline{)2}\ 0\ (2$$

| 0 | 0 | 0 | 0 | 2 |

$\Rightarrow$ 0x20000

Soln ⑥ $n = ?$

$2^n = 32$

$2^n = 2^5$

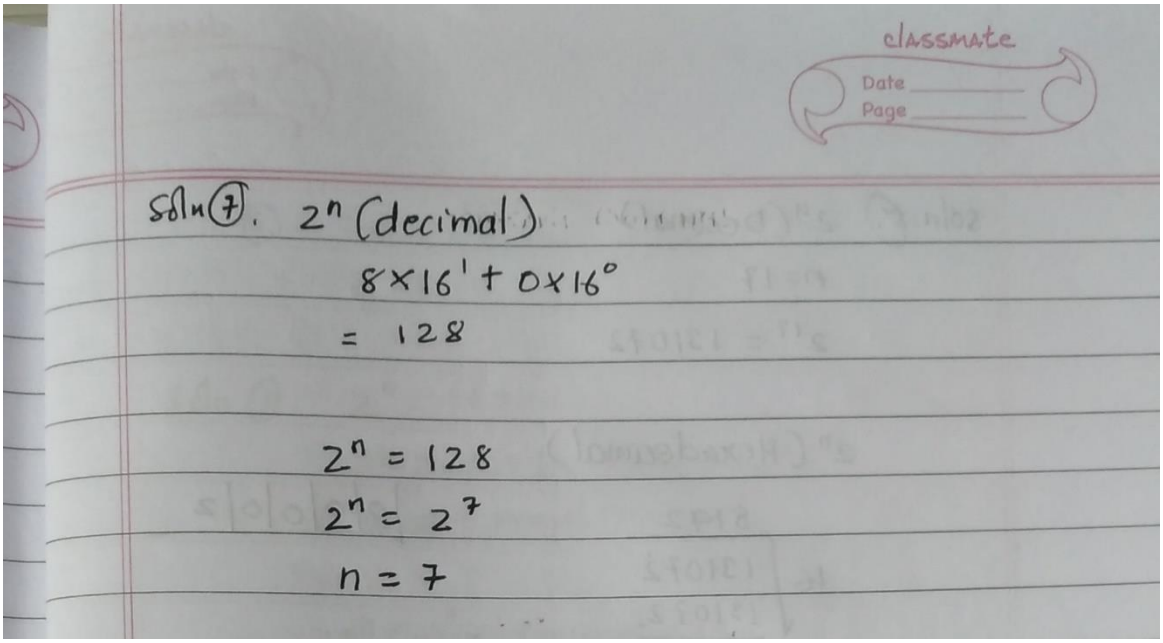
$n = 5$

2^n (Hexadecimal)

$$16 \overline{)32}\ 2\ (0$$
$$16 \overline{)2}\ 0\ (2$$

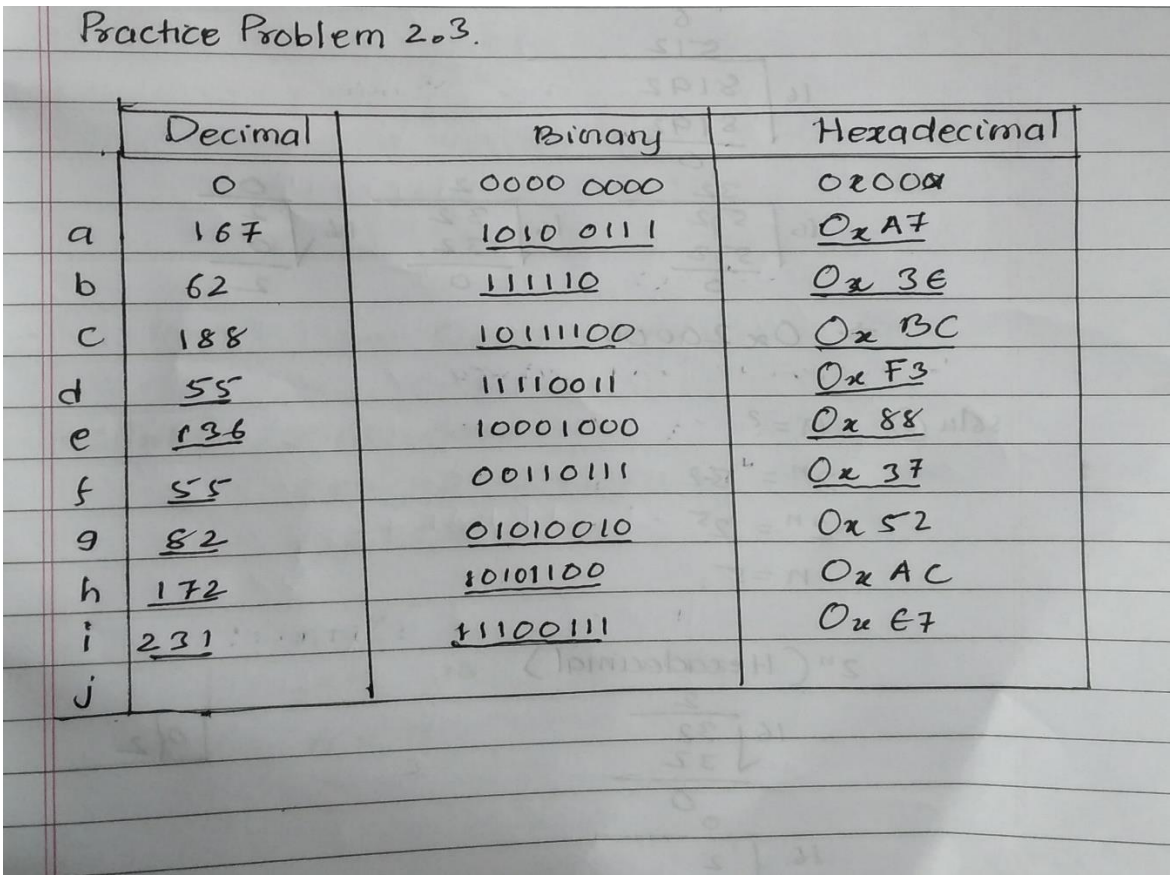
| 0 | 2 |

$= 0x20$



Practice Problem 2.3

A single byte can be represented by two hexadecimal digits. Fill in the missing entries in the following table, giving the decimal, binary, and hexadecimal values of different byte patterns:



	Decimal	Binary	Hexadecimal
	0	0000 0000	0x00
a	167	1010 0111	0xA7
b	62	111110	0x 3E
c	188	10111100	0x BC
d	55	11110011	0x F3
e	136	10001000	0x 88
f	55	00110111	0x 37
g	82	01010010	0x 52
h	172	10101100	0x AC
i	231	11100111	0x E7
j			

Soln a :- Binary From Decimal

2	167	1
2	83	1
2	41	1
2	20	0
2	10	0
2	5	1
2	2	0
2	1	1
	0	

$167 = (10100111)_2$

Binary to Hexadecimal.

1010	0111
8421	8421

A 7

$= 0x\,A7$

Soln b. Binary From Decimal

2	62	0
2	31	1
2	15	1
2	7	1
2	3	1
	1	1
	0	

$62 = (111110)_2$

Binary to Hexadecimal.

11	1110
21	8421

3E

$= 0x\,3E$

soln (c) Binary from Decimal

2	188	0
2	94	0
2	47	1
2	23	1
2	11	1
2	5	1
2	2	0
	1	1
	0	

$188 = (10111100)_2$

Binary to Hexadecimal ($?_{16}$)

10111100
8421 8421

B C $= 0_x BC$

soln (d) Decimal from Binary

$0\times2^7 + 0\times2^6 + 1\times2^5 + 0\times2^4 + 1\times2^3 + 1\times2^2$

soln (d) Decimal from Binary

$0\times2^7 + 0\times2^6 + 1\times2^5 + 1\times2^4 + 0\times2^3 + 1\times2^2 + 1\times2^1 + 1\times2^0$

$= 32 + 16 + 4 + 2 + 1$

$= 55$

Binary to hexadecimal

11110011
8421 8421 $= 0_x F3$

F 3

Soln (e) Binary to decimal

10001000

$1 \times 2^7 + 1 \times 2^3$

$= 128 + 8 = 136$

Binary to hexadecimal

1000 1000

8421 8421

8 8 $= 0x88$

Soln (f) Binary to decimal

00110111

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

$32 + 16 + 4 + 2 + 1$

$= 55$

Binary to hexadecimal

0011 0111

8421 8421

3 7 $= 0x37$

Soln (g) Hexadecimal to binary

0x52

5 2

8421 8421

0101 0010 $= (01010010)_2$

Binary to decimal

$1 \times 2^6 + 1 \times 2^4 + 1 \times 2^1$

$= 64 + 16 + 2$

$= 82$

Soln (h) Hexadecimal to binary

0xAC

10	12	
8421	8421	
1010	1100	$= (10101100)_2$

Binary to Decimal

10101100

$1\times2^7 + 1\times2^5 + 1\times2^3 + 1\times2^2$

$128 + 32 + 8 + 4$

$= 172$

Soln (i) Hexadecimal to binary

0xE7

14	7	
8421	8421	
1110	0111	$= (11100111)_2$

Binary to Decimal.

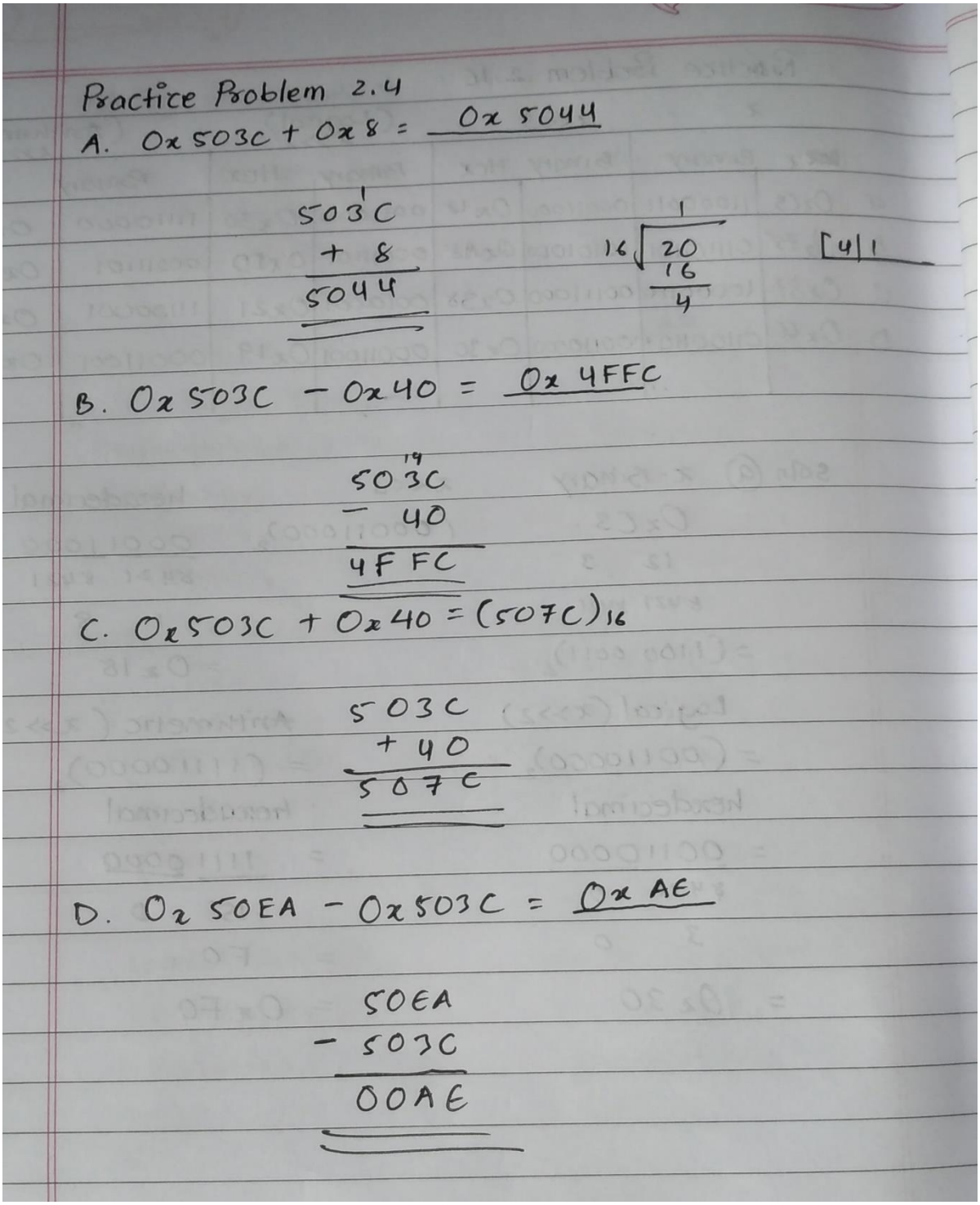
$1\times2^7 + 1\times2^6 + 1\times2^5 + 1\times2^2 + 1\times2^1 + 1\times2^0$

$= 128 + 64 + 32 + 4 + 2 + 1$

$= 231$

Practice Problem 2.4

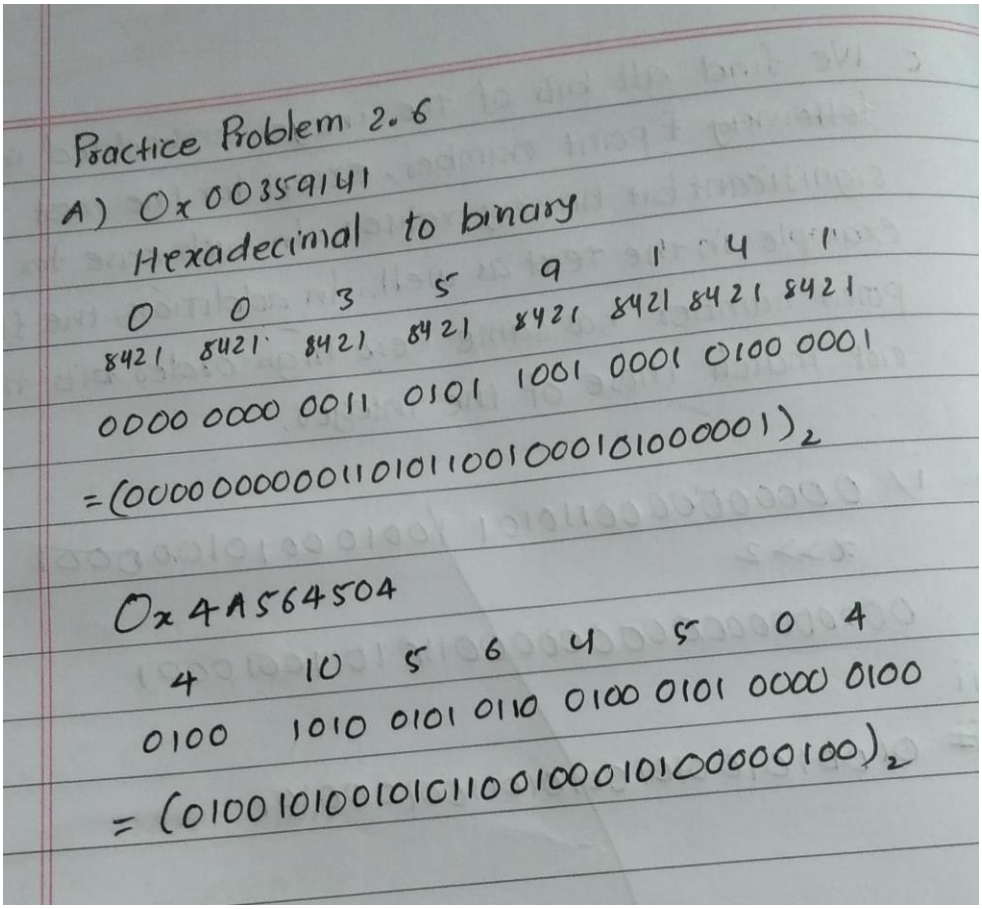
Without converting the numbers to decimal or binary, try to solve the following arithmetic problems, giving the answers in hexadecimal. Hint: Just modify the methods you use for performing decimal addition and subtraction to use base 16.



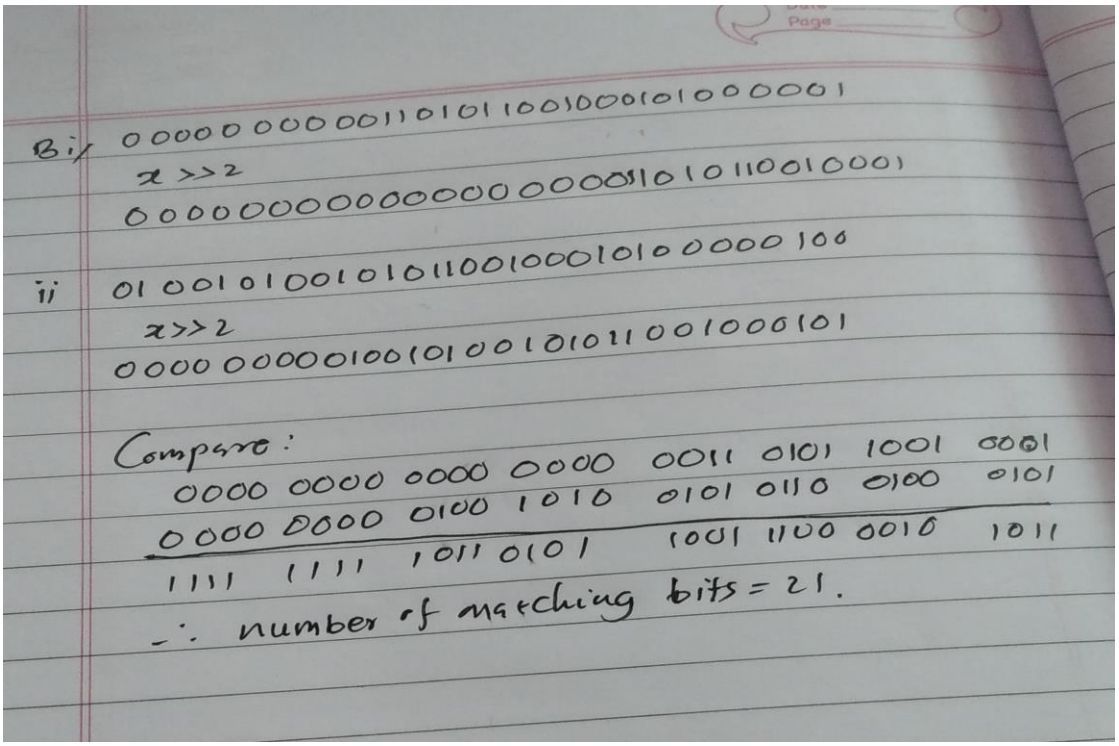
Practice Problem 2.6

Using show_int and show_float, we determine that the integer 3510593 has hexadecimal representation 0x00359141, while the floating-point number 3510593.0 has hexadecimal representation 0x4A564504.

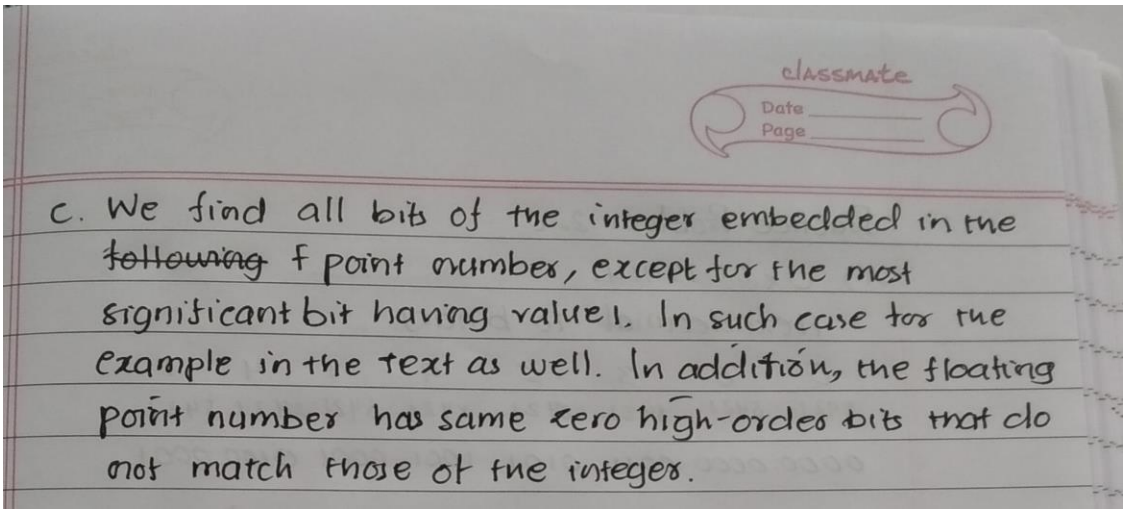
A. Write the binary representations of these two hexadecimal values.



B. Shift these two strings relative to one another to maximize the number of matching bits. How many bits match?

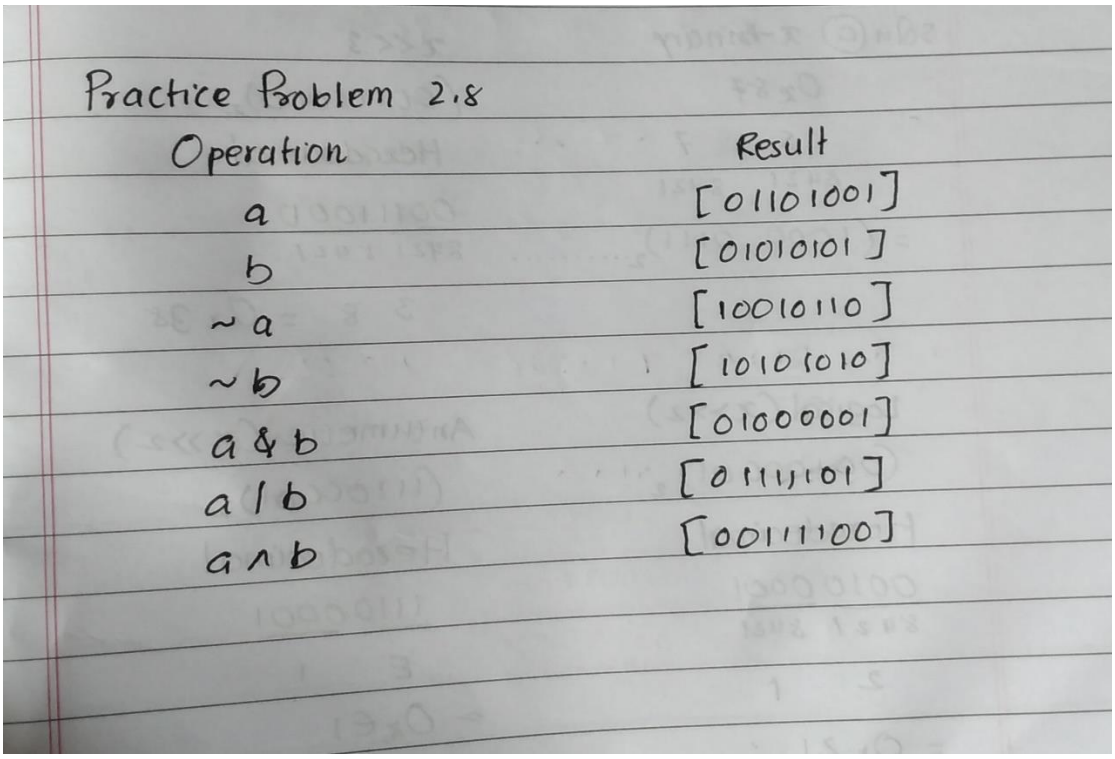


C. What parts of the strings do not match?



Practice Problem 2.8

Fill in the following table showing the results of evaluating Boolean operations on bit vectors.

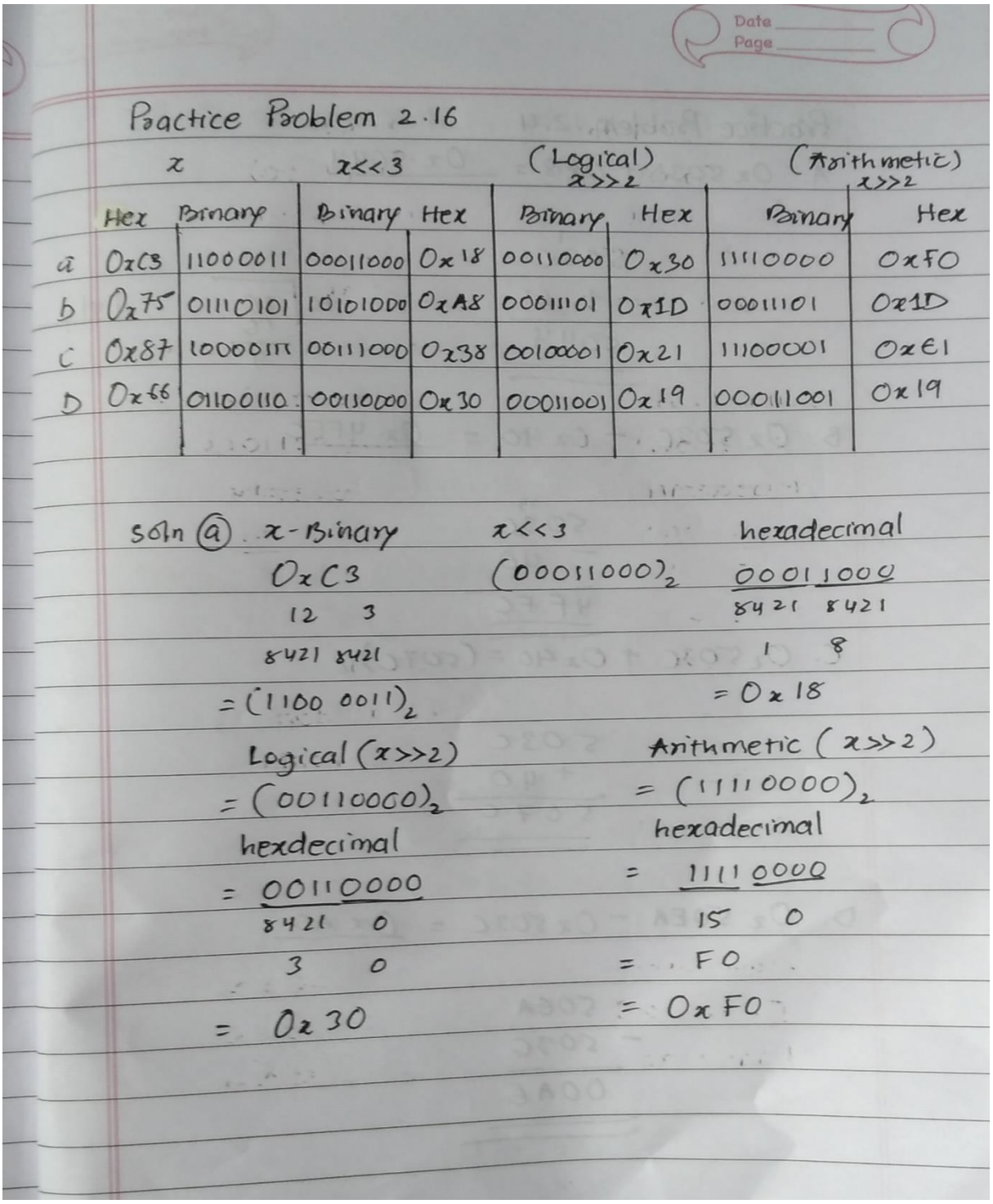


Practice Problem 2.8

Operation	Result
a	[01101001]
b	[01010101]
~a	[10010110]
~b	[10101010]
a & b	[01000001]
a | b	[01111101]
a ^ b	[00111100]

Practice Problem 2.16

Fill in the table below showing the effects of the different shift operations on singlebyte quantities. The best way to think about shift operations is to work with binary representations. Convert the initial values to binary, perform the shifts, and then convert back to hexadecimal. Each of the answers should be 8 binary digits or 2 hexadecimal digits.



Practice Problem 2.16

	x		x<<3		(Logical) x>>2		(Arithmetic) x>>2	
	Hex	Binary	Binary	Hex	Binary	Hex	Binary	Hex
a	0xC3	11000011	00011000	0x18	00110000	0x30	11110000	0xF0
b	0x75	01110101	10101000	0xA8	00011101	0x1D	00011101	0x1D
c	0x87	10000111	00111000	0x38	00100001	0x21	11100001	0xE1
D	0x66	01100110	00110000	0x30	00011001	0x19	00011001	0x19

Soln (a) x - Binary

0xC3

12 3

8421 8421

= (1100 0011)$_2$

x<<3

(00011000)$_2$

hexadecimal

00011000

8421 8421

1 8

= 0x18

Logical (x>>2)

= (00110000)$_2$

hexdecimal

= 00110000

8421 0

3 0

= 0x30

Arithmetic (x>>2)

= (11110000)$_2$

hexadecimal

= 11110000

15 0

= FO

= 0xF0

Soln (B) x - Binary

0x75

7 5

8421 8421

$= (0111\ 0101)_2$

x<<3

$(10101000)_2$

Hexa decimal

10101000

8421 8421

A 8 = 0x A8

Logical (x>>2)

$(00011101)_2$

Hexadecimal

00011101

8421 8421

= 0x 1D

Arithmetic (x>>2)

$(00011101)_2$

Hexadecimal

0001 1101

1 D

= 0x 1D

Soln (C) x - Binary

0x 87

8 7

8421 8421

$= (1000\ 0111)_2$

x<<3

$(00111000)_2$

Hexadecimal

00111000

8421 8421

3 8 = 0x 38

Logical (x>>2)

$(00100001)_2$

Hexadecimal

00100001

8421 8421

2 1

= 0x 21

Arithmetic (x>>2)

$(11100001)_2$

Hexadecimal

11100001

E 1

= 0x E1

soln (D) x-Binary

0x66

6 6

8421 8421

$(0110\ 0110)_2$

x<<3

$(00110000)_2$

Hexadecimal

00110000

3 0 = 0x30

Logical (x>>2)

$(00011001)_2$

Hexadecimal

00011001

1 9

= 0x19

Arithmetic (x>>2)

$(00011001)_2$

Hexadecimal

00011001

1 9

= 0x19