module 2

3.1 5 E D 4 − 0 7 A 4 = 5 7 3 0

(14) (13) (10)

0101 1110 1101 0100 0000 0111 1010 0100 = 0101 0111 0011 0000

3.2 5 E D 4 0101 1110 1101 0100

− 0 7 A 4 ~~+1111 1000 0101 1100~~

0000 0111 1010 0100

~~4 → 0100 → 1011+1 = 1100~~

~~A → 1010 → 0101~~

sign bit not set so calculation same as above

3.3 5 E D 4 0101 1110 1101 0100

Each hexadecimal number = 4 bits. Saves time and space. 1 byte = 2 hexa digits

3.4 ~~4365 → $4 \cdot 8^3 + 3 \cdot 8^2 + 6 \cdot 8^1 + 5 \cdot 8^0$~~

~~− 3412 → $3 \cdot 8^3 + 4 \cdot 8^2 + 1 \cdot 8^1 + 2 \cdot 8^0$~~

~~2293 − 1802 = 491~~ = $\boxed{0753_8}$

3.5 ~~3.5~~

4365 → binary 0100 0011 0110 0101 → 2293

− 3412 → 0011 0100 0001 0010 → 1802

0000 0111 0101 0011 → 491 $\boxed{0753_8}$ base 8

3 + 40 + 60.7 = 491

Encoded oct 4365

Bin 100 011 110 101

Sign 1

Magnitude Bin 00 011 110 101

Oct 365

3.6 185 = 128 + 32 + 16 + 8 + 1 = 10111001

122 = 64 + 32 + 16 + 8 + 2 = 122 = ~~01111010~~ 01111010

$\boxed{00111111 \quad \text{neither}}$

10111001

− 01111010

111011

1 1 1 1 0 1 0

64 32 16 8 4 2 1

122

64

58

32

26

16

10

8

3.5 and 3.7 (at the end)

3.7 ~~185 10111001~~

~~122 01111010~~

~~$\boxed{10011 0011 \quad \text{overflow}}$~~

3.5

~~4365 binary 100 011 110 101 → 2245~~

~~3412 011 100 001 010 → 1802~~

~~binary~~

~~4365 100 011 110 101~~

~~3412 011 100 001 010~~

~~→ 1802~~

~~oct 4365~~ ~~dec 2245~~

~~dec − 2245~~ ~~sum 1557 → ~~

~~how do I convert to octal?~~ octal $\boxed{3777}$

~~4365~~

~~− 3412~~

~~$0753_8$~~

(at the end)

3.8] A 185   10111001 → -57      -57   underflow
-B 122   01111010 → 122      - 122
too small → -179   ~~underflow~~   ~~overflow~~
signed (look at hints in module 2)   ~~10101011~~   ~~01111111~~   ~~neither~~   ~~neither~~

185 in binary
1 0 1 1 1 0 0 1
128 64 32 16 8 4 2 1
185 − 128 = 57, 57 − 32 = 25, 25 − 16 = 9, 9 − 8 = 1

3.9]   binary   two's   decimal
214   11010110   00101001 → 00101010   −105
151   10010111   01101000 → 01101001   −42

00101010
01101001
10010011   ← −147 ?   Sum of two positive numbers = negative   So overflow

decimal → binary conversion
214 → 1 1 0 1 0 1 1 0
128 64 32 16 8 4
214 − 128 = 86, 86 − 64 = 22, 22 − 16 = 6

3.10) 151 − 214
   Binary   twos complement
151   10010111   01101000 +1 ⇒ 01101001
214   11010110   00101001 +1 ⇒ 00101010
$\boxed{00111111}$ → 63 → −63

3.11]   binary
151   10010111
214   11010110   overflow
add   1)01101101 ← 365   ~~not right~~

3.32] A. $3.984375 \times 10^{-1} = 1.1001100000 \times 2^{-2}$ (see side note)   $A + B = 10.1111100000 \times 2^{-2}$
B. $3.4375 \times 10^{-1} = 1.0110000000 \times 2^{-2}$   or $1.0111100000 \times 2^{-1}$
C. $1.771 \times 10^{3} = 1.1011101011 \times 2^{10}$   +C

$0.0000000000|10111100000 \times 2^{10}$
$+\ 1.1011101011| \times 2^{10}$
$1.1011101011|101$
guard

round
$1.1011101100 \times 2^{10}$
$\boxed{= 11011101100_2 = 1772}$

side note
$3.984375 \times 10^{-1}$
$= 0.3984375$ ← convert to decimal
$= \frac{51}{128} = \frac{110011}{2^7} = 110011 \times 2^{-7}$
$= 1.10011 \times 2^{-2}$

3.33) $3.984375 \times 10^{-1} = 0.3984375$ in decimal $\rightarrow \frac{51}{128} = \frac{110011}{2^7} = 110011 \times 2^{-7}$

$= 1.10011 \times 2^{-2}$

$3.4375 \times 10^{-1} = .34375$ in decimal $\rightarrow \frac{11}{32} = \frac{1011}{2^5} = 1011 \times 2^{-5}$

$1.011 \times 2^{-2}$

$1.771 \times 10^3 = 1771$ in decimal $= 1.1011101011 \times 2^{10}$

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

25 to binary

| 1 | 1 | 0 | 0 | 1 |
|---|---|---|---|---|
| 16 | 8 | 4 | 2 | 1 |

| 1 | 1 | 1 | 0 | 0 | 1 | 0 |
|---|---|---|---|---|---|---|
| 64 | 32 | 16 | 8 | 4 | 2 | 1 |

1771
1024
748
512
236
...
128
107
64
43
32
11

114
64
50
32
18
16
2

$3.4375 \times 10^{-1} \rightarrow 1.0110000000 \times 2^{-2}$

$+\ 1.771 \times 10^3 \rightarrow 1.1011101011 \times 2^{10}$

$0.000000000001011 \times 2^{10}$

$+\ 1.1011101011|00000 \times 2^{10}$

$1.1011101011|01011 \times 2^{10}$

$+\ 0.0000000000|0110011 \times 2^{10}$

10th bit

$1.10011 \times 2^{-2} \rightarrow 2^{10}$

$0.000000000001.10011$

$\boxed{1.1011101011 \times 2^{10}}$

$= 11011101011_2$

$= \boxed{1771}$

3.34) It does not equal, Not associative.

3.5) 4365 - 3412 (base 8) is:

$4 \cdot 8^3 + 3 \cdot 8^2 + 6 \times 8^1 + 5 \times 8^0 - (3 \times 8^3 + 4 \times 8^2 + 1 \cdot 8^1 + 2 \times 8^0)$

$4 \cdot 512 + 3 \cdot 64 + 48 + 5 - 3 \cdot 512 + 4 \cdot 64 + 8 + 2$

$= 2293 - 1802 = 491$ in decimal $= \boxed{0753 \text{ in octal}}$

3.7) 185 + 122 = 051 (In hints)

signed so 10111001 = -57    10111001 is twos

01111010 = 122    diff signs so

$\boxed{= 65 \text{ no overflow, result is in range}}$

128 − 57 = 71

1010
0011
1101

10111001
− 01111010
0111101

10111001
− 01111010
11101

10111001
+ 10000110
100111111

10111001
01111010
01111111

How do I add the binaries for −57 and 122, I get

122
−57
+65

10111001
01111010
100110011

↑ this is too big, What am I doing wrong?

Can you help?

$\boxed{65 = 01000001}$