

SHEET 5

1) $b = 5$ $n = 4$

a) The smallest:

1000 \rightarrow the smallest 4-digit number with base 5. Because 1 represents the smallest negative number with base 5 while the 0's don't count for anything.

In decimal: $1000 \rightarrow -5^3 \cdot 1 = -125$

The largest

0444 \rightarrow the largest 4-digit number.

If we put 1, 2 and 3 in the first position, the number will become negative because they are integers

In decimal: 0444 $\rightarrow 5^0 \cdot 4 + 5^1 \cdot 4 + 5^2 \cdot 4 = 124$

b) -1 and -8 in b-complement notation

-1 \rightarrow 4444

-8 \rightarrow 4432

c) Addition: 4444

+ 4432

4431

We add two negative numbers

4431 is a negative number too

In order to obtain the value of the number, we find its absolute value going backwards:

- Remove 1:

$$\begin{array}{r} 4431 \\ - 1 \\ \hline 4430 \end{array}$$

- Take its 2's complement

It is 0014

- Convert it into binary

$$5^{\circ}.4 + 5'.1 = 4 + 5 = 9$$

$$4430 = -9$$

$$100010$$

$$1000100$$

$$10001000$$

$$100010001$$

$$1000100010$$

$$5 \text{ mod } 2 = 1$$

$$5 \text{ mod } 2 = 1$$

$$5 \text{ mod } 2 = 1$$

$$5 \text{ mod } 2 = 1$$

$$5 \text{ mod } 2 = 1$$

$$5 \text{ mod } 2 = 1$$

$$5 \text{ mod } 2 = 1$$

$$5 \text{ mod } 2 = 1$$

$$5 \text{ mod } 2 = 1$$

$$5 \text{ mod } 2 = 1$$

2) how -273.15_{10} converted into a single precision floating point number

a)

- The number is negative \Rightarrow sign bit = 1

- Distinguish the whole part and the decimal part

whole part = 273

decimal part = 0.15

Whole part \Rightarrow binary

273 mod 2

1

136 mod 2

0

68 mod 2

00

34 mod 2

000

17 mod 2

1000

8 mod 2

010000

4 mod 2

0010000

2 mod 2

00010000

1 mod 2

100010000

0 mod 2

0100010000

Decimal part \Rightarrow binary

$$0,15 \cdot 2 = 0,3$$

$$0,3 \cdot 2 = 0,6$$

$$0,6 \cdot 2 = 1,2$$

$$0,2 \cdot 2 = 0,4$$

$$0,4 \cdot 2 = 0,8$$

$$0,8 \cdot 2 = 1,6$$

$$0,6 \cdot 2 = 1,2$$

$$0,2 \cdot 2 = 0,4$$

$$0,4 \cdot 2 = 0,8$$

$$0,8 \cdot 2 = 1,6$$

We stop because the digits are repeated

• Normalize the number

$$100010001,001001 = 1,0001000100100 \cdot 10^8$$

• Add the exponent bias $(127)_{10}$ to the exponent $\Rightarrow (8)$

$$127 + 8 = 135$$

• Convert 135 to binary

$$135 \text{ mod } 2 = 1$$

$$67 \text{ mod } 2 = 1$$

$$33 \text{ mod } 2 = 1$$

$$16 \text{ mod } 2 = 0$$

$$8 \text{ mod } 2 = 0$$

$$4 \text{ mod } 2 = 0$$

$$2 \text{ mod } 2 = 0$$

$$1 \text{ mod } 2 = 1$$

$$0 \text{ mod } 2 = 0$$

$$5 = 2 \cdot 2 + 1$$

$$2 = 2 \cdot 1 + 0$$

$$1 = 2 \cdot 0 + 1$$

$$0 = 2 \cdot 0 + 0$$

$$0 = 2 \cdot 0 + 0$$

$$0 = 2 \cdot 0 + 0$$

$$0 = 2 \cdot 0 + 0$$

$$1 = 2 \cdot 0 + 1$$

$$0 = 2 \cdot 0 + 0$$

• Drop the leading 1 from the representation

$$\text{Mantissa} = (00010001001001)$$

It is 14 bits

• Fill the 9 bits that have remained. We fill

it with the repeated sequence

0001000100100110011001110 000

b) Combine the results

sign bit = 1

exponent $(10000111)_2$

Mantissa = $(00010001001001100110011)_2$

$273,15 = 1\ 10000111\ 00010001001001100110011$

3) hexadecimal notation :

f0 9f 90 84



4 bytes

Binary :

1111	000	1001	1111	1001	0000	1000	0100
f	0	9	f	9	0	8	4

Unicode point in binary

000 01111101 01000010 00010000



0001 1111 0100 0000 0100

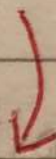
1

f

4

0

4



u + 1f404

The equivalent character is a cow.