Introduction to Computer Science
Sheet # 5

8 5.1

a) -1 $b=5$ and $n=4$

$(1)_5 = 0001$

$\cancel{-1} \quad a_i = (b-1) - a_i$

$a_3 = (5-1) - 0$
$= 4$

$a_2 = (5-1) - 0$
$= 4$

$a_1 = (5-1) - 0$
$= 4$

$a_0 = (5-1) - 1$
$= 3$

$\therefore (-1)_5 = 4443 + 1$
$= 4444$ //

$(8)_5 = (0013)$

$a_i = (b-1) - a_i$

$a_3 = (5-1) - 0 = 4$

$a_2 = (5-1) - 0 = 4$

$a_3 = (5-1) - 1 = 3$

$a_4 \; (5-1) - 3 = 1$

$(-8)_5 = 4431 + 1$
$= 4432$ //

b) $\begin{array}{r} ^{1\,1\,1} \\ 4444 \\ +\ 4432 \\ \hline 4431 \end{array}$

$a_3 = (\cancel{5}-1) - \cancel{1}\,4$
$= 0$

$a_2 = (5-1) - 4$
$= 0$

$a_{\cancel{1}} = (5-1) - 3$
$= 1$

$a_0 = (5-1) - 2$
$= 3$

$\begin{array}{r} 0013 \\ +\ 1 \\ \hline -\ 0014 \end{array} = \cancel{1}$ (b-1) complement
b complement.

$\therefore \cancel{=8}$: Converting -0014 to base 7

$-(\cancel{0\times}\ 1\times5^1 + 4\times5^0)$
$\cancel{=9}\ \cancel{87}$ $= -9$ //

~~However the sign will be negative~~
~~as we had converted negative to~~

5.2.

a) -273.15

First as the sign is negative the first bit will be 1.

Now we convert 273 into ~~deci~~ binary.

$$
\begin{array}{r|l}
2 & 273 \rightarrow 1 \\
2 & 136 \rightarrow 0 \\
2 & 68 \rightarrow 0 \\
2 & 34 \rightarrow 0 \\
2 & 17 \rightarrow 1 \\
2 & 8 \rightarrow 0 \\
2 & 4 \rightarrow 0 \\
2 & 2 \rightarrow 0 \\
 & 1
\end{array}
$$

$(100010001)_2$, is 273 in binary.

Now lets convert (0.15) in binary

$0.15 \times 2 = 0.3 \rightarrow 0$

$0.3 \times 2 = 0.6 \rightarrow 0$

$0.6 \times 2 = 1.2 \rightarrow 1$

$0.2 \times 2 = 0.4 \rightarrow 0$

$0.4 \times 2 = 0.8 \rightarrow 0$

$0.8 \times 2 = 1.6 \rightarrow 1$

~~$0.6 \times 2 = 1.2 \rightarrow 1$~~

~~$0.2 \times 2 = 0.4$~~

$0.4 \times 2 \rightarrow 0.8$

$0.6 \times 2 = 1.2 \rightarrow 1$

$0.2 \times 2 = 0.4 \rightarrow 0$

$0.4 \times 2 = 0.8 \rightarrow 0$

$\cancel{0.6 \times 2 = 1.2}$

$0.8 \times 2 = 1.6 \rightarrow 1$

This is a never ending sequence therefore,

0.15 is $(0010011\overline{001}\cancel{1001}\,\cancel{1001}\,\cancel{1001}\,\cancel{1001}1)_2$

Now

273.15 is

$(100010001.00\overline{1001})_2$ $\cancel{1001\,1001}$

$1.00010001001\overline{001} \times 2^8$

As it is between -126 to $+127$ we add 127 to it therefore

$8+127=135$

$\therefore (135)_{10} = (10000111)_2$

$2 \,\lfloor 135 \rightarrow 1$

$2 \,\lfloor 67 \rightarrow 1$

$2 \,\lfloor 33 \rightarrow 1$

$2 \,\lfloor 16 \rightarrow 0$

$2 \,\lfloor 8 \rightarrow 0$

$2 \,\lfloor 4 \rightarrow 0$

$2 \,\lfloor 2 \rightarrow 0$

1

Now we know.

Sign is 1

Exponent 10000111

Mantissa 0001 0001 00 $\overline{100}$1

$\therefore$

1 | 10000111 | 00010001001001100110011 |

b) $00010001.0010011001100011 \times 2^8$

$= 100010001.001001\overline{100}110011$

Converting only the decimal part,

.0010011 00110011

~~= 1 × 2~~

$= 1 \times \left(\frac{\cancel{2}1}{2^3} + \frac{1}{2^6} + \frac{1}{2^7} + \frac{1}{2^{10}} + \frac{1}{2^{11}} + \frac{1}{2^{14}} + \frac{1}{2^{15}} \right)$

~~= 1 ×~~

$= \cancel{0.149999} \ldots \frac{4915}{32768}$

$= 0.149993$