3.2(b) Arnav Singh

273.15

I First convert 273 into binary

2	273	
2	136	1
2	68	0
2	34	0
2	17	0
2	8	1
2	4	0
2	2	0
2	1	0
2	0	1

II Now do decimal .15

0.15 × 2	0.3	0
0.3 × 2	0.6	0
0.6 × 2	1.2	1
0.2 × 2	0.4	0
0.4 × 2	0.8	0
0.8 × 2	1.6	1
0.6 × 2	1.2	1

same step so we can loop

. . . 0
. . . 0
. . . 1
. . . 1
⋮

A 273 = 100010001

.15 = 0010011001100...

273.15 = 100010001.0010011001100...

B Scientific notation → normalizing

$1.0001000100100110011... \times 2^8$

C

	sign	Exponent 8 bits	23 fraction bits / Mantissa
	1	10000111	00010001001001100110011
+ → 0	↓	135 in binary is	
- → 1	negative number	127 + 8 = 135	

Exponent bias is 127
since 2^8 is a positive no.
we add 127 to the bias
Now write for every 4 bits

-273.15 = 1100 0011 1000 1000 1001 0011 0011

1) convert binary to decimal back

1) Negative since 1 is first bit

2) 10000111_{10} (7 6 5 4 3 2 1 0) $= 1 \cdot 2^0 + 1 \cdot 2^1 + 1 \cdot 2^2 \ldots + 1 \cdot 2^7$

$= 1 + 2 + 4 + 128 = 135$

$= 135 - 127 = 8$

3) Mantissa $= 0 \cdot 2^0 + 0 \cdot 2^{-1} + 0 \cdot 2^{-2} + 1 \cdot 2^{-3} \ldots\ldots$

General form:

$= (-1)\ (1 + 0.0648) \times 2^8$

$= -272.609..$

which is close to -273.15

5.1 Represent $-1, {}^{-8}$ in b complement

a)

base = 5 , n = 4

-1, -8 => take abs. value first

$a_3\, a_2\, a_1\, a_0$

1 => 0001

8 => 0013

Formula = $a_i = (b-1) - a_i$

So for -1, = $a_3 = 4 - 0 = 4$

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

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

$a_0 = 4 - 1 = 3$

Add one, $-1 = 4443 + 1 =$ **4444**

Now -8, = $a_3 = (4) - 0 = 4$

$a_2 = 4 - 0 = 4$

$a_1 = 4 - 1 = 3$

$a_0 = 4 - 3 = 1$

Add one, $-8 = 4431 + 1 =$ **4432**

b)

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  1 1 1
  4444
+ 4432
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 14431
```

$= a_3\, a_2\, a_1\, a_0 = 4431$

If addition is > 5 than carry over one and subtract 5

Now convert to decimal back

$a_3 = 4 - 4 = 0$

$a_2 = 4 - 4 = 0$

$a_1 = 4 - 3 = 1$

$a_0 = 4 - 1 = 3$

=> **0013 + 1 = 0014 => -9**