ELE709 - Real-Time Computer Control Systems

Lab 1 - C Review

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1. **Exercise 1.1:**
   The value of a is 0.666667

I thought this would be 6.0, but:
ONE_THIRD seems to store 1.0/3.0 as text, not the actual value of one third. This can be seen when doing 2.0/ONE_THIRD, as it is equivalent to:
2.0/1.0/3.0 = (2.0/1.0)/3.0 = 2.0/3.0 ≃ 0.6667
Therefore ONE_THIRD should be stored with brackets around the text as (1.0/3.0) in order for 2.0/ONE_THIRD to be equal to 6.0.

2. **Exercise 1.2:** Express your answers in power of 2.

Data Type	Size (bytes)	Minimum Value	Maximum Value
int	4	-2^{31}	$2^{31}-1$
long long int	8	-2^{63}	$2^{63}-1$
unsigned int	4	0	$2^{32}-1$
unsigned long long int	8	0	$2^{64}-1$

3. **Exercise 1.3:**
   The sum of the array is 5050.000000

Note: For max and min value of data type,

if unsigned,

decimal	binary (3 bits = N)
→ 0	000
1	001
2	010
3	011
4	100
5	101
6	110
→ 7	111

min is always 0

max is 2^N-1 because 2^N entries start at 0, not 1

entries is $2^N = 8$

if 2's complement signed

decimal	binary (3 bits = N)
0	000
1	001
2	010
3	011
-4	100
-3	101
-2	110
-1	111

Max is $2^{N-1}-1$ because 2^{N-1} positive entries start from 0 → 3

Min is -2^{N-1} since list of negative entries starts from -1 and does not include 0.

$\frac{2^N}{2}$ non negative entries

$\frac{2^N}{2} = 2^{N-1}$ negative entries

2^N total entries

entries which have a 1 in the sign bit (leftmost bit)

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1. **Exercise 1.1:**
   The value of a is _____.

2. **Exercise 1.2:** Express your answers in power of 2.

Data Type	Size (bytes)	Minimum Value	Maximum Value
`int`			
`long long int`			
`unsigned int`			
`unsigned long long int`			

3. **Exercise 1.3:**
   The sum of the array is _____.

2's complement of all 3-bit numbers:

000 = 0
001 = 1
010 = 2
011 = 3

} These numbers are equivalent to their unsigned counter versions because the sign bit is 0

If a 2's complement number is negative, (has a sign bit of 1) invert all the bits and add 1 to it to find out what number it is

100 = $-(\overline{100}+1) = -(011+1) = -(100) = -4$

101 = $-(\overline{101}+1) = -(010+1) = -(011) = -3$

110 = $-(\overline{110}+1) = -(001+1) = -(010) = -2$

111 = $-(\overline{111}+1) = -(000+1) = -(001) = -1$

this number is kind of weird because its positive version is equal to its own complement and always has a sign bit of 1, regardless of it being -4 or +4.