Name Jeff Guo UIN 670009684

CS 261 Machine Organization Fall 2019

This assignment is due via GradeScope. For part **A** you need to submit your hwkOneA.c file that contains JUST your function to the hw1a submission on gradescope where 15/20 points will be immediately autograded. The remaining 5 points will be autograded as well, but not visible until after the due date.

For parts **B** and **C** you need to fill in the table in the fillable pdf form and submit the entire pdf form to the hw1b submission on gradescope. You can include your extra work after the tables. We have set up the submission to expect 6 pages after the table. If you do not want to show your work that is fine, then include 6 blank pages.

A: Write a C function hwkOneA, that takes a long int x as well as two integers n and m as arguments, and returns a long int. Here is the function declaration:
long int hwkOneA (long int x, int n, int m);

The function should swap nibble n and m of a long int x (64-bit integer). A nibble is a four-bit aggregation. For this problem, the index of the most significant nibble is 0, and the index of the least significant nibble is 15 (so 0 <= m, n <= 15). So, if x = 0x0123456789ABCDEF (a 64-bit integer), and if you swap two nibbles say that are at the 3rd and 10th index, x would now be x=0x012A4567893BCDEF. Your implementation should be generic and work for any valid value of x, m, and n.

You are not allowed to use division, multiplication, or modulus, relative comparisons (<, >, <=, >=), loops, switches, function calls, macros, conditionals (if or ?:) You are allowed to use all bit level and logic operations, left and right shifts, addition and subtraction, equality and inequality tests, integer constants (<=255), INT_MIN and INT_MAX, and casting between data types. *(20 points)*.

B: Fill in the missing values in the following table. The values should be in two's complement form and be 16 bits. *(40 points, 2 points for each missing value)*

Decimal	Binary	Hexadecimal
31	0b0000000000011111	0x001F
-31	0b1111111111100001	0xFFE1
145	0b0000000010010001	0x0091
-2641	0b1111010110101111	0xF5AF
16203	0b0011111101001011	0x3F4B
-5547	0b1110101001010101	0xEA55
-5024	0b1110110001100000	0xEC60
27914	0b0110110100001010	0x6D0A
8639	0b0010000110111111	0x21BF
-685	0b1111110101010011	0xFD53
8096	0b0001111110100000	0x1FA
-14932	0b1100010110101100	0xC5AC

C: Fill the missing values in the following table. The values should be expressed in two's complement form and have 8 bits before the binary decimal point and 8 bits after the binary decimal point. For the decimal version you should write as a mixed fraction) *(40 points, 2 points for each missing value)*

Decimal	Binary	Hexa Decimal
17 1/16	0b00010001.00010000	0x11.10
-17 1/16	0b11101110.11110000	0xEE.F0
-84 13/16	0b10101011.00110000	0xAB.30
91 1/128	0b01011011.00000010	0x5B.02
-41 83/256	0b11010110.10101101	0xD6.AD
116 9/64	0b01110100.01000100	0x74.44
-84 14/128	0b10101011.00011100	0xAB.1C
-36 105/128	0b11001010.00101101	0xCA.2D
-125 105/128	0b10000010.11010010	0x82.D2
63 15/32	0b00111111.01111000	0x3F.78
57 53/128	0b00111001.01101010	0x39.6A

Useful Notes:

1. For A, please pay attention to what you are allowed to use and what you are not allowed to use.
2. For B and C, please show intermediate steps on the following pages if you wish to get partial credit in case your answer is wrong. You can submit handwritten work and merge back into the pdf you submit.

B1) 145:

0b 0000 0000 1001 0001

128 16 1 = 145

0 0 9 1 = 0x0091

B2) 0b 1111 0101 1010 1111:

F 5 A F

0000 1010 0101 0000

\+ 1

0000 1010 0101 0001 = -(2641)

B3) 0b 0011 1111 0100 1011:

3 F 4 B

$2^{13}+2^{12}+2^{11}+2^{10}+2^{9}+2^{8}+2^{6}+2^{3}+2^{1}+2^{0} = 16203$

B4) 0x EA55

1110 1010 0101 0101

0001 0101 1010 1010

\+ 1

0001 0101 1010 1011

$2^{12}+2^{10}+2^{8}+2^{7}+2^{5}+2^{3}+2^{1}+2^{0} = -5547$

B5) -5024

0001 0011 1010 0000 = 5024

1110 1100 0101 1111

\+ 1

1110 1100 0110 0000 = EC60

$-2^{15}+2^{14}+2^{13}+2^{11}+2^{10}+2^{6}+2^{5} = -5024$

B6) 0x6D0A

0110 1101 0000 1010

$2^{14}+2^{13}+2^{11}+2^{10}+2^{6}+2^{3}+2^{1} = 27914$

B7) 0b 0010 0001 1011 1111

2 1 B F

$2\cdot16^{3} + 16^{2} + 11\cdot16^{1} + 16\cdot16^{0} = 8640$

B8) 0x FD53

1111 1101 0101 0011

0000 0010 1010 1100 → $2^{9}+2^{7}+2^{5}+2^{3}+2^{2}+2^{0} = -685$

\+ 1

B9) 8096

0001	1111	1010	0000
1	F	A	0

B10) 0b 1100 1011 1010 1100 → 0011 1010 0101 0011

1100	1011	1010	1100	+
C	5	A	C	1

$2^{13}+2^{12}+2^{11}+2^{9}+2^{6}+2^{4}+2^{2}$

$= -14932$

(1) 0b 1010 | 1011 . 0011 | 0000

A | B . 3 | 0

01010100 . 1100

\+ 1

01010100 . 1101

$64 + 16 + 4 = 84 . \frac{1}{2} + \frac{1}{4} + \frac{1}{16}$

$\frac{8}{16} + \frac{4}{16} + \frac{1}{16} = \frac{13}{16}$

(2) 0x 5B . 02

0101 1011 . 0000 0010

$2^6 + 2^4 + 2^3 + 2^1 + 2^6 = 91\ \frac{1}{128}$

(3) 0x D6.AD

1101 0110 . 1010 1101

00101001 . 01010010

\+ 1

00101001 . 01010011 $= -(41.\frac{83}{256})$

$\frac{1}{4} + \frac{1}{16} + \frac{1}{128} + \frac{1}{256}$

$\frac{64}{256} + \frac{16}{256} + \frac{2}{256} + \frac{1}{256} =$

(4) 116 $\frac{9}{64}$

0111 | 0100 . 0100 | 0100

7 | 4 . 4 | 4

(5) $-84\ 14/128 \rightarrow \frac{14}{128} = \frac{7}{64}$

$01010100 . 00011100$

$10101011 .$

$+ \quad 1 . \quad$

$10101100 = -128+32+8+4 = -84$

$1010|1011 . 1110|0100$

A B E 4

(6) $0b11001010 . 00101101$

C A . 2 D

$00110101 . 11010010$

$+ \quad 1 .$

$00110110 . 11010010$

$-36 . \frac{1}{2}\ \frac{1}{4}\ \frac{1}{16}\ \frac{1}{128}$

$\frac{64}{128} + \frac{32}{128} + \frac{8}{128} + \frac{1}{128} = \frac{105}{128}$

(7) $0x82.D2$

$1000\ 0010 . 1101\ 0010$

$0111\ 1101 . \frac{1}{2}\ \frac{1}{4}\ \frac{1}{16}\ \frac{1}{128}$

$+ \quad 1 . \quad \frac{64}{128}\ \frac{32}{128}\ \frac{8}{128} + \frac{1}{128} = \frac{105}{128}$

$0111\ 1110$

$-125.$

(8) $63\ \frac{15}{32}$

$0011|1111 . 0111|1000$

$\frac{1}{4}\ \frac{1}{8}\ \frac{1}{16}\ \frac{1}{32}$

$\frac{8}{32}\ \frac{4}{32}\ \frac{2}{32}$

3 F . 7 8

(9) $0b0011|1001 . 0110|1010$

3 9 6 A

$57 . \frac{1}{4}\ \frac{1}{8}\ \frac{1}{32}\ \frac{1}{128}$

$\frac{32}{128}\ \frac{16}{128}\ \frac{4}{128}\ \frac{1}{128} = \frac{53}{128}$