BY SUBMITTING THIS FILE TO CARMEN, I CERTIFY THAT I HAVE STRICTLY ADHERED TO THE TENURES OF THE OHIO STATE UNIVERSITY’S ACADEMIC INTEGRITY POLICY.

Name:

CSE 2421

Spring, 2020

Homework 1 – 117 points; grade reported in Carmen as a percentage (i.e. points earned/117)

**Due Date: Tuesday, January 21, 2020 by 11:30PM**. Only submissions via Carmen will be accepted without prior approval. To receive credit, **solutions must be clearly written or typed and appear in the same order as the questions below**. **If you choose not to break up your binary values into 4-bit nibbles, making it harder to read your work, the graders are authorized to lower your grade by 20%.** (e.g. if you would have received 80% on your homework, you will receive a grade of (80%\*.8) or 64%)

Early submissions are allowable although no bonus awarded for early homework. Late submissions accepted for up to 24 hours after due date with 25% penalty (%correct \*.75).

All of these exercises are to be completed without the use of any electronic devices. If you choose to ignore this requirement, know that you will likely have exercises very similar to those below on the mid-term where no electronic devices will be permitted. So you can learn how to manually solve these types of problems while doing this homework assignment or while you are taking your mid-term. :-) Choosing to ***validate*** your manually calculated answers via electronic means is highly encouraged.

[21 points] Convert the following then interpret the binary value as both a signed and unsigned value in decimal. Spaces in binary representations are there for readability only; you must use this technique in your answers. Use a comma after every 3 digits in your decimal answers.

1. 0x39F7B6 to binary
   1. binary value: 0011 1001 1111 0111 1011 0110
   2. signed interpretation of the binary value: 3,798,966
   3. unsigned interpretation of the binary value: 3,798,966
2. 0b 1101 0111 1001 1001 to hexadecimal
   1. hexadecimal value: 0xD799
   2. signed interpretation of the binary value: -10,343
   3. unsigned interpretation of the binary value: 55,193
3. 0xD5C7C3 to binary
   1. binary value: 1101 0101 1100 0111 1100 0011
   2. signed interpretation of the binary value: -2,766,909
   3. unsigned interpretation of the binary value: 14,010,307
4. 0b 1110 0110 1110 1011 0101 0011 to hexadecimal
   1. hexadecimal value: 0xE6EB53
   2. signed interpretation of the binary value: -1,643,693
   3. unsigned interpretation of the binary value: 15,133,523
5. 0xCD6 to binary
   1. binary value: 1100 1101 0110
   2. signed interpretation of the binary value: -810
   3. unsigned interpretation of the binary value: 3286
6. 0xF2754882 to binary
   1. binary value: 1111 0010 0111 0101 0100 1000 1000 0010
   2. signed interpretation of the binary value: -227,194,750
   3. unsigned interpretation of the binary value: 4,067,772,546
7. 0b 0100 0010 1010 0001 1110 to hexadecimal
   1. hexadecimal value: 0x42A1E4F
   2. signed interpretation of the binary value: 1,117,905,231
   3. unsigned interpretation of the binary value: 1,117,905,231
8. [20 points] Complete the following table. Binary values must be split into 4 bit nibbles for easier reading/grading. **Use enough binary digits so that there is no doubt about what value is being represented.** (i.e. positive vs negative value) **Binary values MUST be represented with a minimum of 8 bits and all binary values must be represented with a number of bits divisible by 4.**  (i.e. minimum of 8 bits, but could be 12, 16, 20, etc.) I suggest that when the decimal value is given, that you first convert to binary, then to hex. When given the hexadecimal value, convert to a binary representation first, then, based on what the binary representation tells you with respect to MSB, you can determine the correct signed decimal value.

Graders: Note that binary representations in this chart MUST have at least the number of binary digits present in order to represent no doubt about what value is being represented. More is OK, but correct sign must be extended through the bits in order for their answer to be correct.

|  |  |  |
| --- | --- | --- |
| Decimal | Hexadecimal | Binary |
| 12 | 0xC | 0000 1100 |
| -15 | 0xF1 | 1111 0001 |
| 110 | 0x6E | 0110 1110 |
| 102 | 0x66 | 0b 0110 0110 |
| 2914 | 0x0B62 | 0000 1011 0110 0010 |
| -422 | 0xE5A | 1110 0101 1010 |
| 1655 | 0x677 | 0110 0111 0111 |
| 52757 | 0x0CE15 | 0000 1100 1110 0001 0101 |
| -2122 | 0xF7B6 | 1111 0111 1011 0110 |
| -68 | 0xBC | 1111 1011 1100 |

1. [28 points] Complete the table below showing the effects of the different shift operations. Use 8 bits for the binary representations. Note that each operation is based off of x in leftmost column.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | | | |  | Logical |  | Arithmetic |
|  | x |  | x<<1 |  | x>>1 |  | x>>1 |
| Hex | Binary | Hex | Binary | Hex | Binary | Hex | Binary |
| 0xE3 | 1110 0011 | 0xC6 | 1100 0110 | 0x71 | 0111 0001 | 0xF1 | 1111 0001 |
| 0x6A | 0110 1010 | 0xD4 | 1101 0100 | 0x35 | 0011 0101 | 0x35 | 0011 0101 |
| 0x94 | 1001 0100 | 0x28 | 0010 1000 | 0x4A | 0100 1010 | 0xCA | 1100 1010 |
| 0xA5 | 1010 0101 | 0x4A | 0100 1010 | 0x52 | 0101 0010 | 0xD2 | 1101 0010 |

1. [28 points] Complete the table below showing the effect of the different shift operations. Use 16 bits for the binary representations. Note that each operation is based off of x in the leftmost column.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  | Logical |  | Arithmetic |
|  | x |  | x<<2 |  | x>>2 |  | x>>2 |
| Hex | Binary | Hex | Binary | Hex | Binary | Hex | Binary |
| 0xB414 | 1011 0100 0001 0100 | 0xD050 | 1101 0000 0101 0000 | 0x2D05 | 0010 1101 0000 0101 | 0xED05 | 1110 1101 0000 0101 |
| 0x8556 | 1000 0101 0101 0110 | 0x1558 | 0001 0101 0101 1000 | 0x2155 | 0010 0001 0101 0101 | 0xE155 | 1110 0001 0101 0101 |
| 0x124C | 0001 0010 0100 1100 | 0x4930 | 0100 1001 0011 0000 | 0x0493 | 0000 0100 1001 0011 | 0x0493 | 0000 0100 1001 0011 |
| 0x4794 | 0100 0111 1001 0100 | 0x1E50 | 0001 1110 0101 0000 | 0x11E5 | 0001 0001 1110 0101 | 0x11E5 | 0001 0001 1110 0101 |

1. [20 points]Complete the table below showing the results of the different bitwise operations. **All solutions should be shown in hexadecimal format.** You may have to convert each value to its binary representation to perform the operations and then convert back to represent it in hexadecimal.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| x | y | x & y | x | y | x ^ y | x ^ 0x44 | y ^ 0x77 |
| 0xE3 | 0xAA | 0xA2 | 0xEB | 0x49 | 0xA7 | 0xDD |
| 0x7F | 0x63 | 0x63 | 0x7F | 0x1C | 0x3B | 0x14 |
| 0x87 | 0xA7 | 0x17 | 0x87 | 0x20 | 0xC3 | 0xD0 |
| 0x3A | 0x42 | 0x02 | 0x7A | 0x78 | 0x7E | 0x35 |