This is representative of the kinds of topics and kind of questions you may be asked on the exam . In addition to this practice exam, you should also review:
•   The handouts
•   Labs

1.) In decimal, how much is a 8 in position 5 worth?

$8 * 10^5$

2.) In binary, how much is a 1 in position 7 worth?

$1 * 2^7$

3.) In hexadecimal, how much is a E in position 4 worth?

$14 * 16^4$

4.) Convert decimal 19 into 8-bit unsigned binary. Show all work, including value of each digit.

0001 0011

$2^4 + 2^1 + 2^0 = 16 + 2 + 1$

5.) Convert unsigned binary 1101 1101 into decimal. Show all work, including value of each digit.

$2^0 + 2^2 + 2^3 + 2^4 + 2^6 + 2^7 = 1 + 4 + 8 + 16 + 64 + 128 = 221$

6.) Convert **two's complement** binary 1101 1101 into decimal. Show all work, including value of each digit.

Negation:
0010 0010

Add one:
0010 0011

$2^0 + 2^1 + 2^5 = 1 + 2 + 32 = 35$

-35

7.) Consider the following binary number:

1110 0110

Is it possible to tell if this number is in unsigned or two's complement representation? If yes, explain how. If not, explain why.

It's not possible to tell. Binary numbers are not self-describing. This could be an unsigned number, a two's complement number, a character, or any number of other things.

8.) Convert decimal 2028 to 4-digit hexadecimal. Show all work, including value of each digit.

A = 10
B = 11
C = 12
D = 13
E = 14
F = 15

2028 / 16^2 = 7, remainder 236
236 / 16^1 = 14 (E), remainder 12
12 / 16^0 = 12 (C), remainder 0

0x07EC

7 * 16^2 + 14 * 16^1 + 12 * 16^0 = 1792 + 224 + 12 = 2028

9.) Convert decimal -882 to 4-digit hexadecimal. Show all work, including value of each digit.

882 / 2^9 = 1, remainder 370
370 / 2^8 = 1, remainder 114
114 / 2^7 = 0, remainder 114
114 / 2^6 = 1, remainder 50
50 / 2^5 = 1, remainder 18
18 / 2^4 = 1, remainder 2
2 / 2^3 = 0, remainder 2
2 / 2^2 = 0, remainder 2
2 / 2^1 = 1, remainder 0
0 / 2^0 = 0, remainder 0

Unsigned magnitude: 0000 0011 0111 0010

(2^9 + 2^8 + 2^6 + 2^5 + 2^4 + 2^1 = 512 + 256 + 64 + 32 + 16 + 2 = 882)

Flip bits: 1111 1100 1000 1101
Add one: 1111 1100 1000 1110

To hex: 0xFC8E

10.) What is: 1111 1101 + 0100 0101? Specify if the result has a carry-out set and if the result sets the overflow bit. Show all work.

```
1 1  1  1  1  1  0  1  0

  1  1  1  1  1  1  0  1
+ 0  1  0  0  0  1  0  1
-----------------------
  0  1  0  0  0  0  1  0
```

Carry set, overflow not set

11.) What is 1111 1100 + 1000 0000? Specify if the result has a carry-out set and if the result sets the overflow bit. Show all work.

```
1  0  0  0  0  0  0  0  0

  1  1  1  1  1  1  0  0
+ 1  0  0  0  0  0  0  0
-----------------------
  0  1  1  1  1  1  0  0
```

Carry set, overflow set

12.) What is 1111 1100 - 1000 0000? Specify if the result has a carry-out set and if the result sets the overflow bit. Show all work.

Flip bits: 0111 1111
Adding one achieved by an initial carry-in of 1 below:

```
1 1  1  1  1  1  1  1  1
  1  1  1  1  1  1  0  0
+ 0  1  1  1  1  1  1  1
------------------------
  0  1  1  1  1  1  0  0
```

Carry set, overflow not set

13.) What is 0x3F & 0x5A? Provide the answer in two-digit hexadecimal. Show all work.

0x3F = 0011 1111
0x5A = 0101 1010

```
    0  0  1  1  1  1  1  1
& 0  1  0  1  1  0  1  0
------------------------
    0  0  0  1  1  0  1  0
```

0001 = 0x1
1010 = 0xA

0x1A

14.) What is 0x4E | 0xB2? Provide the answer in two-digit hexadecimal. Show all work.

0x4E = 0100 1110
0xB2 = 1011 0010

```
    0  1  0  0  1  1  1  0
| 1  0  1  1  0  0  1  0
------------------------
    1  1  1  1  1  1  1  0
```

1111 = 0xF
1110 = 0xE

0xFE

15.) What is 0x7A ^ 0x14? Provide the answer in two-digit hexadecimal. Show all work.

0x7A = 0111 1010
0x14 = 0001 0100

```
    0  1  1  1  1  0  1  0
^   0  0  0  1  0  1  0  0
------------------------
    0  1  1  0  1  1  1  0
```

0110 = 0x6
1110 = 0xE

0x6E

16.) What is ~0x87? Provide the answer in two-digit hexadecimal. Show all work.

0x8 = 1000
0x7 = 0111

Flip bits: 0111 1000

17.) What is 1101 0001 << 3? Express your answer in 8-bit binary.

1000 1000

18.) What is 1100 0101 >> 2 for **logical** shift right? Express your answer in 8-bit binary.

0011 0001

19.) What is 1100 0101 >> 2 for **arithmetic** shift right? Express your answer in 8-bit binary.

1111 0001

20.) What is 0100 0101 >> 2 for **arithmetic** shift right? Express your answer in 8-bit binary.

0001 0001

21.) Specify the mask and operation you would need to isolate bit 6 of an unknown 8-bit number. The result of the operation should be 0 (0x00) if bit 6 is 0, and non-zero if bit 6 is 1. The mask should be represented in 8-bit binary.

```
   XXXX XXXX
? ???? ????
-----------
   0X00 0000   (wanted)

X & 0 = 0
X & 1 = X
X | 0 = X
X | 1 = 1

   XXXX XXXX
& 0100 0000  (mask and operation)
-----------
   0X00 0000
```

22.) Specify the mask and operation you would need to set bits 1 and 4 of an unknown 8-bit number to 1. The result of this operation results in a new number, which the unknown number will be subsequently set to. The mask should be represented in 8-bit binary.

```
   XXXX XXXX
? ???? ????
-----------
   XXX1 XX1X   (wanted)

X & 0 = 0
X & 1 = X
X | 0 = X
X | 1 = 1

   XXXX XXXX
| 0001 0010  (mask and operation)
-----------
   XXX1 XX1X
```