Graded Exercise 0

CSC218 Computer Organization

01 December 2017

1. Complete this table by providing the decimal representation of each two's complement number.

Two's complement binary	**Decimal**
1000	
1001	
1010	
1011	
1100	
1101	
1110	
1111	
0000	
0001	
0010	
0011	
0100	
0101	
0110	
0111	

Two's complement binary	Decimal
1000	-8
1001	-7
1010	-6
1011	-5
1100	-4
1101	-3
1110	-2
1111	-1
0000	0
0001	1
0010	2
0011	3
0100	4
0101	5
0110	6
0111	7

2. In an 8 bit two's complement system...

   (a) What is the representation of 0?

   (b) What is the representation of 1?

   (c) What is the representation of -1?

   (d) What is the representation of $2^7 - 1$?

   (e) What is the representation of -2^7?

   (a) The representation of 0 is 00000000.

   (b) The representation of 1 is 00000001.

   (c) The representation of -1 is 11111111.

   (d) The representation of $2^7 - 1 = 127$ is 01111111.

   (e) The representation of $-2^7 = -128$ is 10000000.

3. What is the base 2 representation of 1957?

   The base 2 representation can be found by repeatedly dividing 1957 by two and recording the remainders that each division produces.

	remainder
1957	1
978	0
489	1
244	0
122	0
61	1
30	0
15	1
7	1
3	1
1	1
0	

The decimal number 1957 is equal to the binary number 11110100101.

$$\begin{aligned} 11110100101_2 &= 1024_{10} + 512_{10} + 256_{10} + 128_{10} + 32_{10} + 4_{10} + 1_{10} \\ &= 1957_{10} \end{aligned}$$

4. What is the binary representation of 1905?

The binary representation of 1905 is 11101110001.

	remainder
1905	1
952	0
476	0
238	0
119	1
59	1
29	1
14	0
7	1
3	1
1	1
0	

$$\begin{aligned} 11101110001_2 &= 1024_{10} + 512_{10} + 256_{10} + 64_{10} + 32_{10} + 16_{10} + 1_{10} \\ &= 1905_{10} \end{aligned}$$

5. What is the decimal representation of 11110011011?

$$\begin{aligned} 11110011011_2 &= 1024_{10} + 512_{10} + 256_{10} + 128_{10} + 16_{10} + 8_{10} + 2_{10} + 1_{10} \\ &= 1947_{10} \end{aligned}$$

6. Write the truth table for this expression: $\neg(A \vee B)$.

A	B	$A \vee B$	$\neg(A \vee B)$
1	1		
1	0		
0	1		
0	0		

A	B	$A \vee B$	$\neg(A \vee B)$
1	1	1	0
1	0	1	0
0	1	1	0
0	0	0	1

7. Write the truth table for this expression: $\neg(A \vee A)$.

A	$A \vee A$	$\neg(A \vee A)$
1		
0		

A	$A \vee A$	$\neg(A \vee A)$
1	1	0
0	0	1

8. Write the truth table for $h(A, B)$.

$$f(A, B) = \neg(A \vee B)$$
$$g(A) = f(A, A)$$
$$h(A, B) = g(f(A, B))$$

A	B	f(A,B)	h(A,B) = g(f(A,B))
1	1		
1	0		
0	1		
0	0		

A	B	f(A,B)	h(A,B) = g(f(A,B))
1	1	0	1
1	0	0	1
0	1	0	1
0	0	1	0

9. What is the truth table $i(A, B)$?

$$f(A, B) = \neg(A \vee B)$$
$$g(A) = f(A, A)$$
$$h(A, B) = g(f(A, B))$$
$$i(A, B) = f(g(A), g(B))$$

A	B	g(A)	g(B)	i(A,B) = f(g(A), g(B))
1	1			
1	0			
0	1			
0	0			

A	B	g(A)	g(B)	i(A,B) = f(g(A), g(B))
1	1	0	0	1
1	0	0	1	0
0	1	1	0	0
0	0	1	1	0

10. Read the "Logical NOR" article on Wikipedia. What does it say about the Apollo Guidance Computer? What does that tell you about the choices available to us in our project?

Engineers built the computer for the spacecraft using only NOR gates.

It is possible to build any logical circuit using just NOR gates. It is also possible to build any logical circuit using just NAND gates.

We are building our computer with NAND gates, but we could just as well have chosen to use NOR gates.

11. Write two sentences that each tell us something about a person who contributed to the field that we are studying. Begin each sentence with the name of the person and an active verb (e.g., "created," "invented," "led," or "taught"—but not "is" or "was"). Separate the two sentences with a blank line.

12. Write two sentences that describe a trend or prediction related to the development of microprocessors, the industry that produces microprocessors, or the market for these products. Again, use the active voice and separate the two sentences with a blank line.