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Assignment 2

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Answers and typed in **RED.**

1. In an 8-bit binary number, which is the most significant bit (MSB)?
The most significant bit of 1 byte to the bit on the very left.

2. What is the decimal representation of each of the following unsigned binary integers?
a. 00110101
(1 x 2^5) + (1 x 2^4) + (1 x 2^2) + (1 x 2^0) = **53**
b. 10010110
(1 x 2^7) + (1 x 2^4) + (1 x 2^2) + (1 x 2^1) = **150**
c. 11001100
(1 x 2^7) + (1 x 2^6) + (1 x 2^3) + (1 x 2^2) = **204**

3. What is the sum of each pair of binary integers?
a. 10101111 + 11011011 = 175 + 219 = **394**
b. 10010111 + 11111111 = 151 + 255 = **406**
c. 01110101 + 10101100 = 245 + 172 = **417**

4. Calculate binary 00001101 minus 00000111.
00001101 – 00000111 = 13 – 7 = **6**

5. How many bits are used by each of the following data types?
a. word 16 bits
b. doubleword 32 bits
c. quadword 64 bits
d. double quadword 128 bits

6. What is the minimum number of binary bits needed to represent each of the following unsigned decimal integers?
a. 4095 → 1111 1111 1111 → **12 bits**
b. 65534 → 1111 1111 1111 1110→ **16 bits**
c. 42319 → 1010 0101 0100 1111 → **16 bits**

7. What is the hexadecimal representation of each of the following binary numbers?
a. 0011 0101 1101 1010 = 3 5 13 10 → **35DA**
b. 1100 1110 1010 0011 = 12 14 10 3 → **CEA3**
c. 1111 1110 1101 1011 = 15 14 13 11 → **FEDB**

8. What is the binary representation of the following hexadecimal numbers?
a. 0126 F9D4 → 0001 0010 0110 1111 1001 1101 0100
b. 6ACD FA95 → 0110 1010 1100 1101 1111 1010 1001 0101

c. F69BDC2A → 1111 0110 1001 1011 1101 1100 0010 1010

10. What is the unsigned decimal representation of each of the following hexadecimal integers?
a. 62 → 98
b. 4B3 → 1203
c. 29F → 671

11. What is the 16-bit hexadecimal representation of each of the following signed decimal integers?
a. – 24 → 0000 0000 0001 1000 → 1111 1111 1110 0111 + 1 = 1111 1111 1110 1000 = **FFEB**
b. – 331 → 0000 0001 0100 1011 → 1111 1110 1011 0100 +1 = 1111 1110 1011 0101 = **FEB5**

12. What is the 16-bit hexadecimal representation of each of the following signed decimal integers?
a. – 21 → 0000 0000 0001 1001 → 1111 1111 1110 0110 + 1 = 1111 1111 1110 0111 = **FFE7**
b. – 45 → 0000 0000 0010 1101 → 1111 1111 1101 0010 + 1 = 1111 1111 1101 0011 = **FFD3**

13. The following 16-bit hexadecimal numbers represent signed integers. Convert each to decimal.
a. 6BF9 → 0110 1011 1111 1001 → 1001 0100 0000 0110 + 1 = 1001 0100 0000 0111 = **-27551**
b. C123 → 1100 0001 0010 0011 → 0011 1110 1101 1100 + 1 = 0011 110 1101 1101 = **7901**

14. The following 16-bit hexadecimal numbers represent signed integers. Convert each to decimal.
a. 4CD2 → 0100 1100 1101 0010 → 1011 0011 0010 1101 + 1 = 1011 0011 0010 1110 = **-19576**
b. 8230 → 1000 0010 0011 0000 → 0111 1101 1100 1111 + 1 = 0111 1101 1101 0000 = **32208**

15. What is the decimal representation of each of the following signed binary numbers?
a. 1011 0101 → 0100 1010 +1 = **74**
b. 0010 1010 → 1101 0101 + 1 = 1101 0110 = **-10**
c. 1111 0000 → 0000 1111 +1 = 0001 0000 = **16**

16. What is the decimal representation of each of the following signed binary numbers?
a. 1000 0000 → 0111 1111 + 1 = 1000 0000 = **-128**
b. 1100 1100 → 0011 0011 + 1 = 0011 0100 = **52**
c. 1011 0111 → 0100 1000 + 1 = 0100 1001 = **73**

17. What is the 8-bit binary (two's-complement) representation of each of the following signed decimal integers?
a. – 5 → 0000 0101 → 1111 1010 + 1 = **1111 1011**
b. – 42 → 0010 1010 → 1101 0101 + 1 = **1101 0110**
c. – 16 → 0001 0000 → 1110 1111 + 1 = **1111 0000**

18. What is the 8-bit binary (two's-complement) representation of each of the following signed decimal integers?
a. – 72 → 0100 1000 → 1011 0111 + 1 = **1011 1000**
b. – 98 → 01100010 → 1001 1101 + 1 = **1001 1110**
c. – 26 → 00011010 → 11100101 + 1 = **11100110**

19. What is the sum of each pair of hexadecimal integers?

11
a. 6B4
3FE
AB2

1 1
b. A49
6BD
11 06

20. What is the sum of each pair of hexadecimal integers?

1 1
a. 7C4
3BE
B 82

1 1
b. B69
7AD
13 16

21. What are the hexadecimal and decimal representations of the ASCII character capital B?

42h and 66d

22. What are the hexadecimal and decimal representations of the ASCII character capital G?

48h and 72d

23. Challenge: What is the largest decimal value you can represent, using a 129-bit unsigned integer?

(2^129) – 1

24. Challenge: What is the largest decimal value you can represent, using a 86-bit signed integer?

(2^86) - 1

25. Create a truth table to show all possible inputs and outputs for the boolean function described by ¬(A ∨ B).

A	B	(A ∨ B)	¬(A ∨ B)
T	T	T	F
T	T	T	F
T	F	T	F
T	F	T	F
F	T	T	F
F	T	T	F

F	F	F	T
F	F	F	T

26. Create a truth table to show all possible inputs and outputs for the boolean function described by (¬A ∧ ¬B). How would you describe the rightmost column of this table in relation to the table from question number 25? Have you heard of De Morgan's Theorem?

A	B	¬A	¬B	(¬A ∧ ¬B)
T	T	F	F	F
T	T	F	F	F
T	F	F	T	F
T	F	F	T	F
F	T	T	F	F
F	T	T	F	F
F	F	T	T	T
F	F	T	T	T

27. If a boolean function has four inputs, how many rows are required for its truth table?

16

28. How many selector bits are required for a four-input multiplexer?

Two selector bits are required.

[Extra Credit] The address of var1 is 00400020. The address of the next variable after va28. How many selector bits are required for a four-input multiplexer?r1 is 0040006A. How many bytes are used by var1?

x40006A – x400020 = x4A

x4A = (4 * 16) + 10

= 74 byte