

unsigned binary integer

UTF-8

UTF-16

UTF-32

virtual machine (VM)

virtual machine concept

Visual Studio

yottabyte

zettabyte

1.7 Review Questions and Exercises

1.7.1 Short Answer

1. In an 8-bit binary number, which is the most significant bit (MSB)?
2. What is the decimal representation of each of the following unsigned binary integers?
 - a. 00110101
 - b. 10010110
 - c. 11001100
3. What is the sum of each pair of binary integers?
 - a. 10101111 + 11011011
 - b. 10010111 + 11111111
 - c. 01110101 + 10101100
4. Calculate binary 00001101 minus 00000111.
5. How many bits are used by each of the following data types?
 - a. word
 - b. doubleword
 - c. quadword
 - d. double quadword
6. What is the minimum number of binary bits needed to represent each of the following unsigned decimal integers?
 - a. 4095
 - b. 65534
 - c. 42319
7. What is the hexadecimal representation of each of the following binary numbers?
 - a. 0011 0101 1101 1010
 - b. 1100 1110 1010 0011
 - c. 1111 1110 1101 1011
8. What is the binary representation of the following hexadecimal numbers?
 - a. 0126F9D4
 - b. 6ACDFA95
 - c. F69BDC2A
9. What is the unsigned decimal representation of each of the following hexadecimal integers?
 - a. 3A
 - b. 1BF
 - c. 1001

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10. What is the unsigned decimal representation of each of the following hexadecimal integers?
 - a. 62
 - b. 4B3
 - c. 29F
 11. What is the 16-bit hexadecimal representation of each of the following signed decimal integers?
 - a. -24
 - b. -331
 12. What is the 16-bit hexadecimal representation of each of the following signed decimal integers?
 - a. -21
 - b. -45
 13. The following 16-bit hexadecimal numbers represent signed integers. Convert each to decimal.
 - a. 6BF9
 - b. C123
 14. The following 16-bit hexadecimal numbers represent signed integers. Convert each to decimal.
 - a. 4CD2
 - b. 8230
 15. What is the decimal representation of each of the following signed binary numbers?
 - a. 10110101
 - b. 00101010
 - c. 11110000
 16. What is the decimal representation of each of the following signed binary numbers?
 - a. 10000000
 - b. 11001100
 - c. 10110111
 17. What is the 8-bit binary (two's-complement) representation of each of the following signed decimal integers?
 - a. -5
 - b. -42
 - c. -16
 18. What is the 8-bit binary (two's-complement) representation of each of the following signed decimal integers?
 - a. -72
 - b. -98
 - c. -26
 19. What is the sum of each pair of hexadecimal integers?
 - a. 6B4 + 3FE
 - b. A49 + 6BD

20. What is the sum of each pair of hexadecimal integers?
 - a. $7C4 + 3BE$
 - b. $B69 + 7AD$
21. What are the hexadecimal and decimal representations of the ASCII character capital B?
22. What are the hexadecimal and decimal representations of the ASCII character capital G?
23. *Challenge:* What is the largest decimal value you can represent, using a 129-bit unsigned integer?
24. *Challenge:* What is the largest decimal value you can represent, using a 86-bit signed integer?
25. Create a truth table to show all possible inputs and outputs for the boolean function described by $\neg(A \vee B)$.
26. Create a truth table to show all possible inputs and outputs for the boolean function described by $(\neg A \wedge \neg B)$. 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*?
27. If a boolean function has four inputs, how many rows are required for its truth table?
28. How many selector bits are required for a four-input multiplexer?

1.7.2 Algorithm Workbench

Use any high-level programming language you wish for the following programming exercises. Do not call built-in library functions that accomplish these tasks automatically. (Examples are `sprintf` and `scanf` from the Standard C library.)

1. Write a function that receives a string containing a 16-bit binary integer. The function must return the string's integer value.
2. Write a function that receives a string containing a 32-bit hexadecimal integer. The function must return the string's integer value.
3. Write a function that receives an integer. The function must return a string containing the binary representation of the integer.
4. Write a function that receives an integer. The function must return a string containing the hexadecimal representation of the integer.
5. Write a function that adds two digit strings in base b , where $2 \leq b \leq 10$. Each string may contain as many as 1,000 digits. Return the sum in a string that uses the same number base.
6. Write a function that adds two hexadecimal strings, each as long as 1,000 digits. Return a hexadecimal string that represents the sum of the inputs.
7. Write a function that multiplies a single hexadecimal digit by a hexadecimal digit string as long as 1,000 digits. Return a hexadecimal string that represents the product.