Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Date: \_\_\_\_\_\_\_\_\_

Part 1: Number Bases

1. Fill in the following decimal, hexadecimal binary table for 1 to 15. (4 points)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Dec | Hex | Bin | Dec | Hex | Bin |
| 0 |  |  | 8 |  |  |
| 1 |  |  | 9 |  |  |
| 2 |  |  | 10 |  |  |
| 3 |  |  | 11 |  |  |
| 4 |  |  | 12 |  |  |
| 5 |  |  | 13 |  |  |
| 6 |  |  | 14 |  |  |
| 7 |  |  | 15 |  |  |

Convert the following. (3 pts each)

1. 11 0010bin to dec
2. F50hex to dec
3. 3210Four to dec
4. 83dec to bin
5. 8400dec to hex
6. Convert the following binary number directly to a hexadecimal number: (3 points)

0010 1010 1111bin

1. Convert the following 2 digit hexadecimal number directly into an eight bit binary number. (3 points)

D0hex

Part 2: Modular Arithmetic (3 points each)

1. 
2. 
3. 
4. 
5. 
6. Define what it means for a whole number, a, to be divisible by another whole number, b, in terms of mod arithmetic.(2 points)

a is divisible by b if

Part 3: String Operators

Match each of the following string operators to its description by writing the letter next to each operation (2 points each)

1. Two’s Compliment
2. Reverse
3. Checksum
4. String length
5. Most Significant Bit
6. Least Significant Bit
7. Concatenate
8. Pad
9. Each bit of a binary string changed to the opposite bit value
10. The leftmost bit
11. The rightmost bit
12. The number of characters in a string
13. Left fill zeros till the string is the desired length
14. The characters of a string written in the opposite order
15. The sum of the bit values of a string
16. Two strings combined into one string with the first string written to the left of the second string
17. Transpose the following strings two places. (4 points)
    1. 1111 0100
    2. today
18. Split the following strings into three strings. (4 points)
    1. 987654321
    2. 1011 0110
19. Given the following string 1011 0011 1000 1000 0111 0110

(5 points)

* 1. What is the string length?
  2. How many bytes of information does it contain?
  3. What is the value of the most significant bit (MSB)?
  4. What is the value of the least significant bit (LSB)?
  5. What is the value of the checksum?

Part 4: Time Complexity

Match each of the following time complexities to its Big-O notation representation. (1 point each)

1. Constant
2. Log
3. Root
4. Linear
5. Lin-Log
6. Exponential
7. Polynomial
8. Factorial
9. 
10. 
11. 
12. 
13. 
14. 
15. 
16. 
17. Which two time complexities above are interchanged if the list is ordered from fastest to slowest. (2 points)
18. What two time complexities are a special case of a complexity above, where x is in the Big-O notation is 2? (2 points)
19. The tables below relates the complexity of an algorithm’s input set to the number of steps the task requires to complete.
    1. Below each set calculate the incremental change. (4 points)
    2. Indicate whether the incremental change is near zero, near constant (non-zero), or increasing. (4 points)
    3. Write the Big-O notation or function name representing the time complexity of the algorithm. (2 point)

Set A

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Input Set Complexity | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| Steps to complete | 8 | 14 | 20 | 26 | 34 | 40 | 46 | 52 |

Match each time complexity to its search algorithm.

1. Worst Case Hash Table
2. Average Case Hash Table
3. Worst Case Binary
4. Worst Case Linear
5. 
6. 
7. 
8. 
9. 

Match each search algorithm to its description. (1 point each)

1. Linear
2. Binary
3. Hash Table
4. Data is associated to a number, called an index, by a function and data is retrieved by finding the appropriate index.
5. Each piece of data is examined one after another till the target data is found or the list is exhausted
6. An ordered list is halved. The half that may contain the target data is halved again repeatedly till the target is found or the list is exhausted.