AP Computer Science Principles
Unit 1B: Computing Mathematics
Test 2
Mr. Svitilla

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)

2. $11\ 0010_{bin}$ to dec

3. $F50_{hex}$ to dec

4. 3210_{Four} to dec

5. 83_{dec} to bin

6. 8400_{dec} to hex

7. Convert the following binary number directly to a hexadecimal number: (3 points)

$0010\ 1010\ 1111_{bin}$

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

$D0_{hex}$

Part 2: Modular Arithmetic (3 points each)

9. $33 \pmod{5} \equiv$

10. $4 + 7 \pmod{2} \equiv$

11. $14 - 8 \pmod{8} \equiv$

12. $77 \pmod{7} \equiv$

13. $185 \pmod{19} \equiv$

14. 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)

15. Two's Compliment
16. Reverse
17. Checksum
18. String length
19. Most Significant Bit
20. Least Significant Bit
21. Concatenate
22. Pad

A. Each bit of a binary string changed to the opposite bit value
B. The leftmost bit
C. The rightmost bit
D. The number of characters in a string
E. Left fill zeros till the string is the desired length
F. The characters of a string written in the opposite order
G. The sum of the bit values of a string
H. Two strings combined into one string with the first string written to the left of the second string

23. Transpose the following strings two places. (4 points)

    a. 1111 0100

    b. today

24. Split the following strings into three strings. (4 points)

    a. 987654321

    b. 1011 0110

25. Given the following string 1011 0011 1000 1000 0111 0110 (5 points)

    a. What is the string length?

    b. How many bytes of information does it contain?

    c. What is the value of the most significant bit (MSB)?

    d. What is the value of the least significant bit (LSB)?

    e. 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)

26. Constant
27. Log
28. Root
29. Linear
30. Lin-Log
31. Exponential
32. Polynomial
33. Factorial

A. $O(n!)$
B. $O(\sqrt[x]{n})$
C. $O(n)$
D. $O(1)$
E. $O(n^x)$
F. $O(n \log n)$
G. $O(\log n)$
H. $O(2^n)$

34. Which two time complexities above are interchanged if the list is ordered from fastest to slowest. (2 points)

35. What two time complexities are a special case of a complexity above, where x is in the Big-O notation is 2? (2 points)

36. The tables below relates the complexity of an algorithm's input set to the number of steps the task requires to complete.

   a. Below each set calculate the incremental change. (4 points)
   b. Indicate whether the incremental change is near zero, near constant (non-zero), or increasing. (4 points)
   c. 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.

37. Worst Case Hash Table

38. Average Case Hash Table

39. Worst Case Binary

40. Worst Case Linear

A. $O(n)$
B. $O(1)$
C. $O(n^x)$
D. $O(n \log n)$
E. $O(\log n)$

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

41. Linear
42. Binary
43. Hash Table

A. Data is associated to a number, called an index, by a function and data is retrieved by finding the appropriate index.
B. Each piece of data is examined one after another till the target data is found or the list is exhausted
C. 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.