Count The Dots

Name_____

based on an activity from
CS Unplugged by Tim Bell,
Ian H. Witten, and Mike Fellows

1. Make sure you have one of each of the eight sheets with dots on them. Arrange them face up, left-to-right, from highest number of dots to lowest. How many dots appear on each sheet?

2. If there were another sheet with more dots, how many would it have to continue the pattern?

3. By turning some of the sheets so the dots show, and others so that the blank side is up, you can show different numbers of dots. Turn all the sheets face-down, then turn up the first, third, and fifth, counting from the right. How many dots are showing?

4. What is the smallest number of dots you can express by using your sheets of paper face-up or face-down? What is the largest number of dots?

5. You can represent 6 dots by turning up the sheets with 2 and 4 dots. Is there any other way to have exactly 6 dots showing?

6. Complete the table below. In the first row, write the number of dots for each sheet. In the other rows, place a check mark for each sheet that must be placed dots up to represent the given number.

	Sheets of Paper							
Total # of dots		64				4		1
11					√		√	√
5								
9								
17								
21								
37								
50								
61								
136								
175								
252								

7. Is there any number (up to the largest you already identified) that you *can't* represent using this system?

8. How many different numbers, including the smallest and largest, can be represented by the eight sheets you have?

9. To make it easier to represent numbers of dots, we'll use the number 1 to represent a piece of paper with the dots up, and a 0 to represent a piece of paper with the dots down. Given this representation, find the total number of dots that each string of 1's and 0's below represents
   a. 00100110 = _____   f. 00011110 = _____

   b. 00011001 = _____   g. 00111100 = _____

   c. 10101011 = _____   h. 10010001 = _____

   d. 00110011 = _____   i. 11111111 = _____

   e. 11110000 = _____   j. 00011000 = _____

10. Without adding up the dots, how can you tell if a string of 1's and 0's represents an odd number?

11. Given a string of 1's and 0's, what can you do to it to find the string representing twice as many dots?

12. Beginning on the right, what is the maximum number of dots you can represent with
    1 sheet?
    2 sheets?
    5 sheets?
    8 sheets?
    10 sheets?
    n sheets?

13. Start from 0 dots and begin counting. See if you can discover a pattern. As concisely as possible, answer the following: If a certain number of dots are showing, what procedure can you follow to get that number of dots plus one? You may refer to left, right, face-up, and face-down, but you may not refer to the number of dots showing.

14. You may discard the three largest sheets, because we only need 26 dots to represent all the letters of the alphabet:

_	a	b	c	d	e	f	g	h	i	j	k	l	m	n	o	p	q	r	s	t	u	v	w	x	y	z
0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26

Using the numbers above to stand for letters and the space, decode the following message:
11001 01111 10101 00000 01000 00001 10110 00101 00000 01010 10101 10011 10100 00000

01100 00101 00001 10010 01110 00101 00100 00000 10100 01000 00101 00000 00010 01001

01110 00001 10010 11001 00000 01110 10101 01101 00010 00101 10010 00000 10011 11001

10011 10100 00101 01101

15. Rewrite the message here: