Part 1: The Basics
1. Describe at least five divisibility tests for base 12 numbers and describe their types (divisors/powers, addition/subtraction, etc.)

2. Describe at least five divisibility tests for base 30 numbers and describe their types (divisors/powers, addition/subtraction, etc.)

3. The three-digit base 15 number $27A$ is a multiple of 3. Which values of $A$ make this possible?

4. Find all values of $Z$ such that $4Z2$ is a multiple of 4 in base 7.

5. Is 143245 a multiple of 5 in base 6? Is it a multiple of 7? Try the divisibility tests we discussed in class.

6. Find all ordered pairs $(X, Y)$ such that $67X7Y$ is a multiple of 4 in base 12.

7. Find all ordered pairs $(X, Y)$ such that $5XY3$ is a multiple of 11 in base 12. What if $5XY3$ is a multiple of 13 in base 12?

8. Find all values of $Z$ such that $5ZZZZ$ is divisible by 10 in base 6.

Part 2: Problem Solving
1. Find the number of positive base 4 integers less than 10000_{4} that can be written using only the digits 0, 1, and 2 (no 3s).

2. What are the five smallest positive integers that can be written using only the digits 0 and 1 in base 3? What is the tenth smallest positive integer? What is the twenty-ninth smallest positive integer?

3. What are the five smallest positive integers that can be written using only the digits 0 and 1 in base 4? What is the tenth smallest positive integer? What is the twenty-ninth smallest positive integer?

4. Find the 100th smallest positive integer that can be written using no digits other than 0 and 1 in base 3.

5. A four-digit number consists of the digits 1, 2, 3, and 4, each appearing exactly once. The number is divisible by 4. How many such numbers exist in base 10? What about base 6? What about base 11?

6. How many digits are in the base-6 representation of the product $2^8 \cdot 3^6$?