Problem 1. Let S be a set with three subsets A, B, and C. Suppose that x is an element of S. How many of the sets

$$A, B, C, A \cap B, A \cap C, B \cap C, A \cap B \cap C$$

could contain x? Answer as precisely as possible.

A) 1

B) 7

C) an even number

D) an odd number

E) Any number between 1 and 7

Problem 2. How many of the integers x with $1 \leq x \leq 100$ are divisible by 2 or by 5?

A) 20 B) 50 C) 60 D) 70 E) 80

Problem 3. How many ways are there to rearrange the list $(1, 2, 3, 4, 5)$ such that 1, 3, and 5 do not wind up in the same place?

A) $2! = 2$

B) $5! - 5 \times 4! + 10 \times 3! - 10 \times 2! + 5 \times 1! = 120 - 120 + 60 - 20 + 5 = 45$

C) $5! - 3 \times 4! + 3 \times 3! - 2! = 120 - 72 + 18 - 2 = 64$

D) $5! = 120$