

**True/False** - No explanation needed. (2pts)

1. Some counting problem about DNA sequences may not involve powers of 4, although there are 4 bases of nucleotides. **True/False**

*sol.* Consider the following problem: How many DNA sequences of length 5 that don't contain A? The answer is  $3^5$ .

2. The formula  $|B \setminus A| = |B| - |B \cap A|$  is false when the set  $B$  is contained in the set  $A$ . **True/False**

*sol.* When  $B$  is contained in  $A$ , then  $B \setminus A = \emptyset$  and  $|B \setminus A| = 0$ . Also,  $B \cap A = B$  so  $|B| - |B \cap A| = 0$ . Hence the formula also holds. Actually, it holds for any finite set  $A$  and  $B$ .

**Problems** - Need justification. No justification means **zero**!

1. How many functions are there from the set  $\{1, 2, 3, 4, 5\}$  to the set  $\{1, 2, 3\}$ ? (5pts)

*sol.* For each number in the domain, there are 3 choices in the range to be assign. Since there are 5 numbers in the domain, and since their choices are independent, we have  $3 \times 3 \times 3 \times 3 \times 3 = 3^5$  many functions.

2. How many 4-digits numbers that contain at least one 1? (5 points)

*sol.* There are  $9 \times 10 \times 10 \times 10 = 9000$  4-digits numbers. Among them, there are  $8 \times 9 \times 9 \times 9 = 5832$  4-digits numbers that do not contain any 1. By the subtraction rule, we have  $9000 - 5832 = 3168$  4-digits numbers that contain at least one 1.

**Note.** 4-digit numbers and strings of 4 decimal digits are different. First one can't start with 0, but the latter one can. For example, we don't count 0123 as a 4-digit number, but we count it as a string of 4 decimal digits. I gave partial credits to someone who consider it as latter one.