CS182 – Foundations of Computer Science

PSO sessions 1 and 2, week of Apr 6, 2020

PSO 1

Problem 1. Consider all bit strings (i.e., strings of 1s and 0s) of length 12.

- How many begin with 110?
- How many begin with 11 and end in 10?
- How many begin with 11 or end in 10?

Problem 2. Let A and B be sets.

- Let $|A| = 4$ and $|B| = 10$. Find the number of functions $f : A \to B$.
- Let $|A| = 4$ and $|B| = 10$. Find the number of 1-1 functions $f : A \to B$.
- Let $|A| = 10$ and $|B| = 4$. Find the number of 1-1 functions $f : A \to B$.

Problem 3. DNA sequences are sequences of bases, where each base can take one of the four "values" A, C, T, and G. Two examples of DNA sequence of length eight are $GACCATTT$ and $GTAATTAC$.

- How many length eight DNA sequences start with C and end with C?
- How many length eight DNA sequences do not contain C?
- How many length eight DNA sequences do not contain all four bases A, C, T, and G?
- How many length eight DNA sequences contain exactly four C's?

PSO 2

Problem 1. You pick cards one at a time without replacement from an ordinary deck of 52 playing cards. What is the minimum number of cards you must pick in order to guarantee that you get:
(a) a pair (for example, two kings or two 5s);
(b) three of a kind (for example, three 7s).

Problem 2.

- Find the number of subsets of $S = \{1, 2, 3, ..., 10\}$ that contain the number 5.
- Find the number of subsets of $S = \{1, 2, 3, ..., 10\}$ that contain neither 5 nor 6.
- Find the number of subsets of $S = \{1, 2, 3, ..., 10\}$ that contain both 5 and 6.
- Find the number of subsets of $S = \{1, 2, 3, ..., 10\}$ that contain no odd numbers.