MAT 115: Finite Math for Computer Science
Problem Set 5

Out: 11/21/2017 Due: 11/30/2017

Instructions:
I leave plenty of space on each page for your computation. If you need more sheet, please attach your work right behind the corresponding problem. If your answer is incorrect but you show the computation process, then partial credits will be given. Please staple your solution and use the space wisely.

First Name:

Last Name:

Group ID:

Score: **/100**

Problem 1 Permutation + Combinatorics: (20 pts)

Please explain how many ways to put balls into bins based on the condition:
(a) 4 identical bins and 3 identical balls

(b) 4 different bins (A, B, C, D) and 3 identical balls

(c) 4 identical bins and 3 different balls (Red, White, Green)

(d) 4 different bin (A, B, C, D) and 3 different balls (Red, White, Green)

Problem 2 Combinatorics (4 + 4 pts)

You are controlling a robot. The task is given that your robot is set at coordinate $(3, 6)$ and your robot has to move to coordinate (9,12). Let say each time your robot can only move up by 1 in Y axis or right by one in the X axis. Let us assume each move is of the same cost, therefore, all possible paths are of the same total cost. Please show how many paths there are for your robot to move from

(a) $(3, 6)$ to $(9, 12)$

(b) $(3, 6)$ to $(9, 12)$ but must pass $(6, 8)$ in the path.

Problem 3 Permutation: With Repetition (3×7 = 21 pts)

We work with the ordinary alphabet of 26-letters. Please solve the following:
(a) Define a 5-letter word to be any list of 5 letters that contains *at least* one of the vowels A, E, I, O and U. How many 5-letter words are there?

(b) We can solve (a) in one single step but we can do it in 6 steps. Here are the steps:
(b-1) How many 5-letter words with exactly 1 vowel

(b-2) How many 5-letter words with exactly 2 vowels

(b-3) How many 5-letter words with exactly 3 vowels

(b-4) How many 5-letter words with exactly 4 vowels

(b-5) How many 5-letter words with exactly 5 vowels

(b-6) Your sum from b-1 till b-5 is? The result should be equivalent to (a)

Problem 4 Permutation: With NO Repetition (3×7 = 21 pts)

We work with the ordinary alphabet of 26-letters. Please solve the following:
(a) Define a 5-letter word to be any list of 5 letters that contains *at least* one of the vowels A, E, I, O and U. How many 5-letter words are there?

(b) We can solve (a) in one single step but we can do it in 6 steps. Here are the steps:
(b-1) How many 5-letter words with exactly 1 vowel

(b-2) How many 5-letter words with exactly 2 vowels

(b-3) How many 5-letter words with exactly 3 vowels

(b-4) How many 5-letter words with exactly 4 vowels

(b-5) How many 5-letter words with exactly 5 vowels

(b-6) Your sum from b-1 till b-5 is? The result should be equivalent to (a)

Problem 5 Permutation: With and Without Repetition (5×3 = 15 pts)

We are interested in forming 3 letter words using the letters in THELITTLEST.
(a) How many words can be made with no repeated letters?

(b) How many words can be made with unlimited repetition allowed?

(c) How many words can be made if repeats are allowed but no letter can be used more than it appears in THELITTLEST?

Problem 6 Permutation: With and Without Repetition (5×3 = 15 pts)

We are interested in forming 3 letter words using the letters in CSSUNYPOLYUTICA.
(a) How many words can be made with no repeated letters?

(b) How many words can be made with unlimited repetition allowed?

(c) How many words can be made if repeats are allowed but no letter can be used more than it appears in CSSUNYPOLYUTICA?