# CECS 228 Group Assignment 1

September 1st, 2021

## Instructions

Pair up with another student to solve both problems below. Each of you is responsible for authoring a (handwritten) solution to one of the problems. For example, if you author the solution to Problem A, then your partner authors the B solution. Make sure you write your name as well as your partner's name in the upper-right corner of your solution, since both of you will receive points for each of the solutions. You are only allowed to discuss the problems with your partner and the lab instructor. Use of course notes, textbook, and lecture recordings is permitted, but no other online resources or outside communication is allowed. Upload your solution in a single file to the appropriate drop box before the end of class.

## Problems

A. Consider the set $S = \{1, 2, 3, 4, 5, 6, 7\}$. Find seven subsets $A_1, A_2, \ldots A_7$ of $S$ that satisfy the following properties.

   1. $|A_i| = 3$, for all $i = 1, 2, \ldots, 7$,
   2. For each pair of numbers $(r, s)$, where $1 \leq r < s \leq 7$, there is exactly one $i \in \{1, 2, 3, 4, 5, 6, 7\}$ for which $\{r, s\} \subset A_i$.

   Verify that each pair (how many are there?) $\{r, s\}$ is a subset of exactly one $A_i$. Do this by listing each pair and indicating which set contains it. (10 points)

B. The Heaven Hotel has an infinite number of floors and an infinite number of rooms on each floor. Each room is identified using two positive integers $i \geq 1$ and $j \geq 1$, where $i$ is its floor number, and $j$ is the order in which it appears on the floor after getting off the elevator. The Hotel's motto is "You can check in any time you like, but you'll never (want to) leave!" Because of this, each guest is assigned a room that has never before been occupied.

1. Assuming the hotel is initially free of guests, describe a method for determining the room to assign to a newly-arriving guest. The method must ensure that every room eventually gets assigned (assuming an infinite number of guests). Hint: let $r_{ij}$ denote the $j$ th room on floor $i$. Please use complete sentences. (10 pts)

2. According to your method, which room will the 59th guest be assigned? (5 pts)

3. If each guest is assigned an id $(1, 2, \ldots)$ based on the order in which they checked in, which guest will be assigned room 65 on the 13 th floor? (5 pts).