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CSC 226 – SUMMER 2019 – QUIZ 1 Student #: V00884677

Question [2 marks]

a. Fill each box in a 3-by-3 arrangement of boxes with either 1, 0, or −1. For any such arrangement show that of the eight row, column, and diagonal sums, two sums must be equal. [1 mark]

a) a b c
d e f
g h i

There are 8 different sum arrangements (2 diagonal, 3 vertical, 3 horizontal) and 7 different numerical values for the sums ([-3, 3]). By the pigeonhole property, since there are more arrangements than values, at least two of the arrangements must have the same value.

b. Show that if any 14 integers are selected from the set S = {1, 2, 3, . . ., 25}, there are at least two whose sum is 26. [1 mark]

Hint: Let n be a positive integer. If n + 2 integers are selected from the set S = {1, 2, 3, . . ., 2n + 1}, there are at least 2 whose sum is 2n + 2 (generalized version).

b)
1 25
2 24
3 23
4 22
5 21
6 20
7 19
8 18
9 17
10 16
11 15
12 14
13 /

Consider each row of numbers as a pigeonhole, so we have 13 pigeonholes. Each row, except for 13, adds to 26. Since we have 14 integers from the set and only 13 pigeonholes (only 12 that actually sum to 26), at least one pigeonhole must have ~~at least~~ 2 integers, thus there are at least 2 numbers of 14 selected from [1,25] that add to 26.