**1. Show that if *n*+1 distinct integers are chosen from the set {1, 2, …, 3*n*}, then there are always two which differ by at most 2.**

answer: we choose all number from set which differ by at most 3,so the number of there is 3n/3 = n. According to pigeonhole principle, when we choose n+1 integers, there must exist at least two which differ by at most 2.

**2.** **Prove that of any five points chosen within a square of side length 1, there are two whose distance apart is at most *.***

answer: we divide the square into four square of side length , so the furthest distance in the square of side length is ***.*** .According to pigeonhole principle, there are at least two points in a square, so there are two whose distance apart is at most ***.***

**3. In a room there are 10 people with integer ages [1, 60]. Prove that we can always find two groups of people (with no common person) the sum of whose ages is the same.**

Answer: for the set of 10 people, the number of subset of 10 people is

Because the people`s age is between 1 to 60, so the sum of subset is between 1 to 600.

According to pigeonhole principle, put 1023 sets into 600 boxes, there exists a box which has two sets. If these two sets have common person, we just minus the common person .It means that there are two group of people (with no common person) the sum of whose ages is the same.