Exercise 0 (points = 3)

Please post a screenshot of your course evaluation summary to confirm that your evaluation is complete. **Do not include your evaluation content, as it should always remain anonymized.**

With this extra credit of two points, the total score for this homework will be 103 😃

Exercise 1. (points = 20)

Given six integers chosen randomly. Prove the sum or difference of two of them is divisible by 9.

[Hint: Any number n can be represented as one of the five cases: 9k, 9k ± 1, 9k ± 2, 9k ± 3, 9k ± 4]

Exercise 2. (points = 20)

Consider a square whose side length is one unit. Select any five points from inside this square. Prove that at least two of these points are within $\sqrt{2}/2$ units of each other.

[Hint: Consider covering the square of one unit with four circles.]

Exercise 3 (points = 60)

Fill this table with "T" for true or "F" for false. You do not need to explain why.

	Reflexive	Symmetric	Transitive	Equivalence relation
#1				
#2				
#3				
#4				
#5				

1. Consider the relation $R = \{(a,a),(b,b),(c,c),(d,d),(a,b),(b,a)\}$ on the set $A = \{a,b,c,d\}$. Is R reflexive? Symmetric? Transitive? Is R an equivalence relation?
2. Consider the relation $R = \{(a,b),(a,c),(c,b),(b,c)\}$ on the set $A = \{a,b,c\}$. Is R reflexive? Symmetric? Transitive? Is R an equivalence relation?
3. Consider the relation $R = \{(0,0),(2,0),(0,2),(2,2)\}$ on the set of $A = \{0,2\}$. Is R reflexive? Symmetric? Transitive? Is R an equivalence relation?
4. Define a relation on *integers* as xRy if $|x-y| < 1$. Is R reflexive? Symmetric? Transitive? Is R an equivalence relation?
5. Let A be the set of people living in the world today. A relation R is defined on A as follows: For all $p, q \in A$, pRq if p lives within 100 miles of q. Is R reflexive? Symmetric? Transitive? Is R an equivalence relation?

Hint for question 5: Consider if everyone lives within 100 miles of themselves (reflexivity), if the distance between two people is the same in both directions (symmetry), and if the first person being within 100 miles of a second person and that second person being within 100 miles of a third person implies the first person is within 100 miles of the third person (transitivity).