

CS 2100: Discrete Mathematics for Computer Science

Tutorial 1

Instructor - John Augustine

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- Your name and roll number must be clearly written on the first page of your answer booklet. It should also be written on the first page of each additional booklet.
- Write spaciously and legibly.
- The tutorial starts at 9AM and ends at 9:50AM. The problems in this tutorial are designed to be easy so that you can complete them within the stipulated time. Be forewarned that the problems in the quiz will be a bit more involved.

1. (1 mark) A certain college class has 40 students. All the students in the class are known to be from 17 to 34 years of age. You want to make a bet that at least x students are of the same age. How large can you make x and yet be sure to win the bet.
2. (1 mark) Let S be a set with n elements. Show that there is a bijection from the power set of S and the set of all n -bit binary strings.
3. (2 marks) Let $A = \{1, 2, \dots, 8\}$.
 - a. If five integers are selected from A , must at least one pair of the integers have a sum of 9? Explain your answer.
 - b. If four integers are selected from A , must at least one pair of the integers have a sum of 9? Explain your answer.
4. (2 marks) Suppose $f : X \rightarrow Y$ and $g : Y \rightarrow Z$ are both bijections. Prove that $(g \circ f)^{-1}$ exists. What is the formula for $(g \circ f)^{-1}$ in terms of f^{-1} and g^{-1} ?
5. (2 marks) Let $A = \mathbb{Z}^+ \times \mathbb{Z}^+$. Define a binary relation R on A as follows. For all (a, b) and (c, d) in A ,
$$(a, b)R(c, d) \iff a + d = b + c.$$
 - a. Prove that R is an equivalence relation.
 - b. List five elements in $[(1, 2)]$.
6. (2 marks) Are there relations that are both symmetric and antisymmetric? If yes, give an example. If no, why not?

