Quiz-SET THEORY
CS 203: Discrete Structures

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INSTRUCTIONS: Answer all questions. You have to give a clear answers with proper justification. Submit one single pdf file containing solutions to all problems. Take clear pictures and convert to a single pdf file. Name your file as *rollno.pdf*. For example, 200010018.*pdf*. An activity named quiz 1 is added in moodle under assignment section. Submit it there. Late submissions will not be graded. Do not use web resources or answers from your peers to obtain solutions. If anyone is involved in malpractice of any sort, then suitable disciplinary action will be taken. If required, there would be a viva to selected set of students. The exam is from 11.45 am to 12.45 pm. You can submit your answer up to 1.00 pm. If you are unable to submit within 1.00 pm, mail your answer sheets to all the TAs(Sagartanu-183061001, Tephilla-183061002, Ravi-191061001, Sourav-211011002). You should send a single mail addressed to all four of us. After you have emailed your solution, you **must** upload your solution in moodle before 1.30 pm. Only moodle submission will be considered. Mail version will not be evaluated however will be cross verified.

1. Let A, B, C denote the set of integers divisible by 4,9 and 10 respectively. Describe the set $A \cap B \cap C$? (1)

2. Show that no two of the three sets $\emptyset, \{\emptyset\}$, and $\{\{\emptyset\}\}$ are equal to each other. (1)

3. Let A and B be two sets such that A is uncountable and $A \subseteq B$. What can you tell about the cardinality of B. Justify your answer. (1)

4. Let $S = \{3, 4, 5, 6, 9\}$. Let S_1 and S_2 denote two subsets of S. It is known that S_1 contains all elements which are multiple of 3 and S_2 contains all elements that are non-prime numbers.

   - Determine $S_1^c - S_2^c$ where A^c denotes the complement of A.
   - Is $(S_1 \cup S_2)^c = \{\}$
   - Determine if S_1 and S_2 are overlapping or disjoint? Justify. (1)

5. Let A and B denote two arbitrary sets. Prove that $powerset(A \cap B) = powerset(A) \cap powerset(B)$. (2)

6. Find a set with cardinality greater than the set of real numbers($\mathbb{R}$). Justify. (1)

7. Let $f : \mathbb{N} \to \mathbb{N}$ such that $f(n) = n + 15$. Then f is

   (a) Bijective
   (b) One-one
   (c) Onto
   (d) Not a function

   Justify. (1)

8. Let $A_n = ((-1)^n/n, 1-(-1)^n/n)$. Let $\liminf_{n\to\infty} A_n = \cup_{n\geq 1} \cap_{j\geq n} A_j$ and let $\limsup_{n\to\infty} A_n = \cap_{n\geq 1} \cup_{j\geq n} A_j$. Compute $\liminf_{n\to\infty} A_n$ and $\liminf_{n\to\infty} A_n$ for the given sequence of sets. (1+1)