National University of Computer and Emerging Sciences, Lahore Campus

Assignment:3

Course: Discrete Structure CS1005, BCS-4L

Weight: 3.3 Total Marks:15

Submission deadline: **15-04-2023**

Instruction/Notes:

1. Understanding of the problems is part of the assignments. So, no query please.
2. You will get Zero marks if found any type of cheating.
3. 25 % deduction of over marks on the one-day late submission after due date.
4. 50 % deduction of over marks on the two-day late submission after due date. No submission after two days.
5. MUST BE HANDWRITTEN, IN-CLASS SUBMISSION.

Question 1:
Prove that the cardinality of (0,1) and (0,2) is same. [2]

Question 2:
Show that the relation R on the set of all bit strings such that sRt if and only if s and t contain the same number of 1s is an equivalence relation. [2]

Question 3:
What are the equivalence classes of the sets {0, 1, 2} and Z? [2]

Question 4: [4]

Q. Let $a_1 = 1$, $a_2 = 2$ and $a_n = (n-1)a_{n-1} + na_{n-2}$ for $n \geq 3$.

(a) Prove that $a_n \geq n!$.

(b) what type of Induction (weak or strong) is required in part (a)?

Question 5: **[2]**

Use strong induction to prove that every positive integer can be written as a sum of distinct powers of 2.

Question 6: **[3]**

Prove by Induction that

$$\frac{1}{2}\cdot\frac{3}{4}\cdot\cdots\cdots\cdots\cdots\frac{2n-1}{2n}<\frac{1}{\sqrt{3n+1}}$$