National University of Computer and Emerging Sciences, Lahore Campus				
	Course:	**Discrete Structures**	**Course Code:**	**CS1005**
	Program: BS-CS 4L			
	Section:		**Total Marks:**	**30**
			Weight	3.33
			Page(s):	2
	Assignment:4			
Instruction/Notes:	1. MUST BE HAND WRITTEN. 2. Plagiarized work will result in zero marks. 3. No retake or late submission will be accepted.			
Due Date:	20-05-2023			

Q:1

Find the remainder of 3^{456} when divided by
   (a) 2.   (b) 5.   (c) 7.   (d) 9.

Q:2

Three kids, Alberto, Bernadette, and Carlos, decide to share 11 cookies. They wonder how many ways they could split the cookies up provided that none of them receive more than 4 cookies (someone receiving no cookies is for some reason acceptable to these kids).

Q:3

Solve each of these congruences using the modular inverses
a) $34x \equiv 77 \pmod{89}$
b) $144x \equiv 4 \pmod{233}$
c) $200x \equiv 13 \pmod{1001}$

Q:4

In how many ways can a dozen books be placed on four distinguishable shelves
a) if the books are indistinguishable copies of the same title?
b) if no two books are the same, and the positions of the books on the shelves matter?

Q:5

Use the construction in the proof of the Chinese remainder theorem and backward substitution to find all solutions to the system of congruences

$x \equiv 1 \pmod 2$,

$x \equiv 2 \pmod 3$,

$x \equiv 3 \pmod 5$, and

$x \equiv 4 \pmod{11}$.

Q:6

a) Find a recurrence relation for the number of bit strings of length n that contain three consecutive 0s.
b) What are the initial conditions?
c) How many bit strings of length seven contain three consecutive 0s?

Q:7
Messages are transmitted over a communications channel using two signals. The transmittal of one signal requires 1 microsecond, and the transmittal of the other signal requires 2 microseconds.
a) Find a recurrence relation for the number of different messages consisting of sequences of these two signals, where each signal in the message is immediately followed by the next signal, that can be sent in n microseconds.
b) What are the initial conditions?
c) How many different messages can be sent in 10 microseconds using these two signals?