Course Name:	Discrete Structures	Course Code:	CS-211
Program:	Computer Science	Semester:	Fall 2018
Duration:	60 Minutes	Total Marks:	10+10+10+15
Paper Date:	November 16, 2018	Weight	
Section:	ALL	Page(s):	2
Exam Type:	Sessional - 2		

Student : Name:_____ **Roll No.**_____ **Section:**_____

Instruction/Notes:
1. Solve the exam on this question paper. You can get extra sheets for rough work but they will NOT be marked or graded.
2. Sharing calculators is strictly NOT allowed.
3. 1 A4 handwritten cheat sheet is allowed in the exam.

QUESTION 1: Prove by mathematical induction: $n^3 + 2n$ is divisible by 3, $\forall n (n \in Z \wedge n \geq 1)$. Show all steps. **(Marks: 10)**

QUESTION 2: What are the solutions of the following system of congruences? Specify all values such that $10 \leq z \leq 400$

$z \equiv 3 \bmod 7$ \qquad $z \equiv 6 \bmod 5$ \qquad $z \equiv 8 \bmod 3$ \hfill **(Marks: 10)**

QUESTION 3: Show that the set of integral multiples of 3 are in one-to-one correspondence with the set of integral multiples of 7. (**Marks: 10**)

QUESTION 4a: Let A = { 2,3,8,12,18}. Define a relation R on A as R= { (x,y): x divides y, for all x,y in A}. Draw R and check (by stating 'yes' or 'no') whether R is (**Marks: 2+5**)

(i)   Reflexive   _____

(ii)   Symmetric _____

(iii) Antisymmetric _____

(iv) Equivalence _____

(v)   Transitive _____

Draw clear edges

2   3

8

12   18
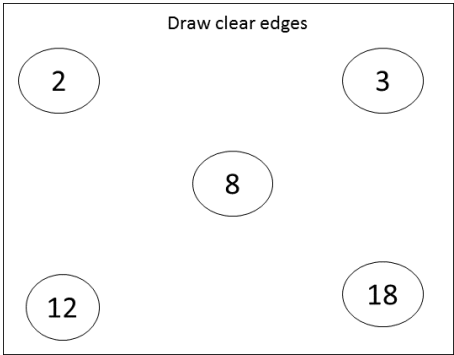
QUESTION 4b: Tick all properties that hold for the following functions. (**Marks: 3**)

i. f(x) = |x| f: (-1,1)→ (0,1)   ☐ Surjective(onto)   ☐ Injective(1-to-1)   ☐ Bijective

ii. f(x) = x²   f: (1,2) → (1,4)   ☐ Surjective(onto)   ☐ Injective(1-to-1)   ☐ Bijective

iii. f(x) = 2x+1   f: (-1,1)→ (-1,4)   ☐ Surjective(onto)   ☐ Injective(1-to-1)   ☐ Bijective

QUESTION 4c: Let R = {(a,b),(a,c),(a,a)}, R defined on {a,b,c,d}   (**Marks: 3**)

i. What is the reflexive closure for R?   _____

ii. What is the symmetric closure for R?   _____

iii. What is the transitive closure for R?   _____

QUESTION 4d   (**Marks: 2**)

Give the recurrence relation for the number of bit strings of length n that begin with 1. Also write the initial conditions.