Course Name:	Discrete Structures	Course Code:	CS 211
Degree Program:	BSCS	Semester:	Fall 2019
Exam Duration:	180 Minutes	Total Marks:	50
Paper Date:	23.12.2019	Weight	50
Section:	ALL	Page(s):	2
Exam Type:	Final Exam		

Student : Name: [redacted] Roll No. [redacted] Section:________

Instruction/Notes: Attempt all questions.

Q1. Let $L(x, y)$ be the statement "*x loves y*", where the universe of discourse for both x and y consists of all people in the world. Use quantifiers to express each of following statements. **[Marks: 5]**

(a). There is somebody whom everybody loves.

(b). There is exactly one person whom everybody loves.

(c). There is someone who loves no one besides himself or herself.

Q2. Determine whether these are valid arguments. **[Marks: 5]**

(a). "If x^2 is irrational, then x is irrational. Therefore, if x is irrational, it follows that x^2 is irrational."

(b). "If x^2 is irrational, then x is irrational. The number $x = \pi^2$ is irrational. Therefore, the number $x = \pi$ is irrational.

Q3. Use mathematical induction to show that $n^2 - 7n + 12$ is a non-negative if n is an integer greater than 3. **[Marks: 5]**

Q4. When the students in a classroom were grouped into 4, 3 were left out. When they were grouped into 5, 2 were left out. When they were divided into groups of 7, 1 student was left out. What could be the least number of students present in that classroom. **[Marks: 5]**

Q5. Show that if n is a positive integer, then $\binom{2n}{2} = 2\binom{n}{2} + n^2$. **[Marks: 5]**

Q6. How many solutions are there to the equation $x_1 + x_2 + x_3 + x_4 = 17$. Where x_1, x_2, x_3 and x_4 are non-negative integers. **[Marks: 5]**

n=4
r=17

Q7. Find the solution to the following recurrence relation with the given initial condition. **[Marks: 5]**

$a_n = a_{n-1} + 2n + 3,\ a_0 = 4$

Q8. Find the number of positive integers not exceeding 100 that are not divisible by 5 or by 7. **[Marks: 5]**

Q9. Which of these relations on $\{0, 1, 2, 3\}$ are equivalence relations? Justify your answer.

[Marks:

(a). $\{(0, 0), (1, 1), (2, 2), (3, 3)\}$

(b). $\{(0, 0), (0, 1), (0, 2), (1, 0), (1, 1), (1, 2), (2, 0), (2, 2), (3, 3)\}$.

Q10. Does there exist a simple graph with six vertices of the following degrees? If so, draw such a graph.

[Marks: 5

(a). 0, 1, 2, 3, 4, 5.

(b). 1, 2, 3, 4, 5, 5.

Good Luck!!