Roll No.

26-3-18

DOON UNIVERSITY, DEHRADUN

Mid Semester Examination, 2018
Academic Year 2017-18 (Even Semester)

DEPARTMENT OF COMPUTER SCIENCE, SCHOOL OF PHYSICAL SCIENCES

Integrated M.Sc. (Computer Science), Fourth Semester
CSC-153: Discrete Mathematical Structures
[*Back paper* – II *semester*]

Time Allowed: *2 hours* — *Maximum Marks:* *30*

SECTION A — (Total Marks: $6 \times 1 = 6$)

1 Give the converse, and inverse of the following statement:
"If it rains today, I will go to market tomorrow."

2 Determine whether the following argument is correct or incorrect.
"Every CS student takes Discrete Mathematics. Mr. Z is taking Discrete Mathematics. Therefore, Mr. Z is a CS student."

3 a) $\sum_{k=1}^{100}\binom{100}{k}$ = ____.
b) A – (B ∩ C) = (A – B) ∩ (A – C). (True/False)?

4 Your Discrete Mathematics professor decide the grading policy on the basis of two exams as follows:
A student will get an 'A' grade if she did well in both the exams, will get a 'B' if she did well in one of the two exams, and will get a 'C' if she did poorly in both the exams.
Let X be the set of students who did well in the first exam, and Y be the set of students who did well in the second exam. Answer the following in terms of X and Y.
a) What set of students will get 'A'? b) What set of students will get 'B'?

5 Define countable and uncountable sets. Give an example of each type.

6 How many bit strings of length 10 contain an equal number of 0s and 1s?

SECTION B — (Total Marks: $4 \times 3 = 12$)

1 Consider the predicates **F(x):** x is your friend and **S(x):** x can keep secret.
a) Express the statement "At least one of your friends can keep secret" using First Order Logic.
b) Form the negation of the formula obtained in a) above.
c) Translate the formula obtained in b) in English.

2 Prove that for an integer n, if $3n + 2$ is even, then n is even using
a) a proof by contraposition.
b) a proof by contradiction.

3 a) Prove by the first principle of induction that for any $n \geq 1$,
$1.1! + 2.2! + 3.3! + \ldots + n.n! = (n + 1)! - 1$
b) State the second principle of induction.

4 Find the number of outcomes when three dice are rolled, if
a) all three dice are distinct.
b) all three dice are identical.

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SECTION C **(Total Marks: 3 × 4 = 12)**

1 a) State the inclusion-exclusion principle. Obtain the formula for the cardinality of the union of three finite sets.

b) How many integers between 1 and 250 are divisible by any of the integers 2, 3, and 7?

2 a) Prove that if any 14 numbers from 1 to 26 are chosen, then one of them must be a multiple of another.

b) A bag contains a dozen blue socks and a dozen black socks, all unmatched. You take socks out at random in the dark.

i) How many socks you must take out to be sure that you have at least two socks of the same colour?

ii) How many socks you must take out to be sure that you have at least two blue socks?

3 a) Obtain PCNF and PDNF of the wff $(\neg p \vee \neg q) \rightarrow (p \leftrightarrow \neg q)$.

b) "Everyone has exactly one favourite subject."

Symbolize the above statement, and transform it into Prenex Normal Form.