GC UNIVERSITY, LAHORE

SUBJECTIVE QUESTION PAPER

EXAMINATION: FINAL 2022 **SUBJECT: DISCRETE STRUCTURE** **COURSE CODE: CS1203**
TIME ALLOWED: 2 hrs 20 min **SEMESTER: BSCS 3rd** **MAX MARKS: 40**
NOTE: Attempt any FOUR questions from Q # 2 to Q # 6.

Q. No. 2 (a) Write each of these statements in the form "if p, then q" in English. (4)

i) I will remember to send you the address only if you send me an e-mail message.
ii) To be a citizen of this country, it is sufficient that you were born in the United States.
iii) If you keep your textbook, it will be a useful reference in your future courses.
iv) The Red Wings will win the Stanley Cup if their goalie plays well.

(b) State the converse and contrapositive of each of these conditional statements. (4)

a) I go to the beach whenever it is a sunny summer day.
b) When I stay up late, it is necessary that I sleep until noon.

Ask ---> (c) Define f: R →R by the rule f(x) = 4x-1 for all x ∈R. Is f onto function? (2)

Q. No. 3 (a) Prove by mathematical induction

$1+2+2^2 + \dots + 2^n = 2^{n+1} - 1$ for all integers $n \geq 0$ (5)

(b) Write each of these propositions in the form "p if and only if q" in English. (5)

a) For you to get an A in this course, it is necessary and sufficient that you learn how to solve discrete mathematics problems.
b) If you read the newspaper every day, you will be informed, and conversely.
c) It rains if it is a weekend day, and it is a weekend day if it rains.
d) You can see the wizard only if the wizard is not in, and the wizard is not in only if you can see him.
e) The train runs late on exactly those days when I take it.

Q. No. 4 a) Determine whether the following arguments are valid or invalid (6)

(i) If I got an Eid bonus, I'll buy a stereo.
If I sell my motorcycle, I'll buy a stereo.
∴ If I get an Eid bonus or I sell my motorcycle, then I'll buy a stereo.

(ii) Show that the following argument form is valid:

$p \rightarrow q$
p
$\therefore q$

Iii) Use diagrams to show the validity of the following argument:
All dogs are carnivorous.
Jack is not a dog.
∴ Jack is not carnivorous

b) For all subsets A and B of a universal set U, prove that by using set Identities. (4)

i) $(A - B) \cup (A \cap B) = A$ ii) $A - (A - B) = A \cap B$

Q. No. 5 a) Using Laws of Logic, verify the logical equivalence (2+2+2)

i) $\sim(p \vee q) = \sim p \wedge \sim q$
ii) $\sim(p \rightarrow q) \rightarrow p = t$
iii) $\neg(p \vee (\neg p \wedge q)) = \neg p \wedge \neg q$

b) Rewrite the statement forms without using the symbols → or ↔ (2+2)

1. $p \wedge \sim q \rightarrow r$
2. $(p \rightarrow r) \leftrightarrow (q \rightarrow r)$

Q. No. 6 (a) Construct a truth table for each of these compound propositions. (2)

a) $(p \vee q) \oplus (p \wedge q)$ b) $(p \leftrightarrow q) \oplus (\neg p \leftrightarrow q)$

b) if f (n) is defined recursively by f (0) = 3 and f (n + 1) = 3f (n) + 7 for n = 0, 1, 2,...

Find f (1), f (2), f (3), f (4) (4)

c) Let C(x) be the statement "x has a cat," let D(x) be the statement "x has a dog," and let F (x) be the statement "x has a ferret." Express each of these statements in terms of C(x), D(x), F (x), quantifiers, and logical connectives. Let the domain consist of all students in your class. (4)

a) A student in your class has a cat, a dog, and a ferret.
b) All students in your class have a cat, a dog, or a ferret.
c) Some student in your class has a cat and a ferret, but not a dog.
d) No student in your class has a cat, a dog, and a ferret.

******* Good Luck *******