National University of Computer and Emerging Sciences, Lahore Campus



Course Name:	Discrete Structures	Course Code:	CS-1005
Degree	Bachelor of CS & DS	Semester:	Spring 2022
Program:	,		
Exam Duration:	1 Hour	Total Marks:	45
Paper Date:	November 11, 2022	Weight	20%
Section:	All	Page(s):	10
Exam Type:	MID-II		

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1. Verify at the start of the exam that you have a total of four (4) questions printed on ten (10) pages including this title page.

2. Attempt all questions on the question-book and in the given order.

3. The exam is closed books, closed notes. Please see that the area in your threshold is free of any material classified as 'useful in the paper' or else there may a charge of cheating.

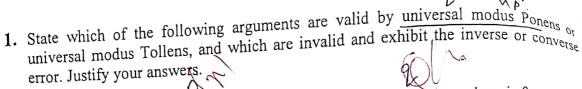
4. Read the questions carefully for clarity of context and understanding of meaning and make assumptions wherever required, for neither the invigilator will address your queries, nor the teacher/examiner will come to the examination hall for any assistance.

5. Fit in all your answers in the provided space. You may use extra space on the last page if required. If you do so, clearly mark question/part number on that page to avoid confusion.

6. Use only your own stationery and calculator. If you do not have your own calculator, use manual calculations.

7. Use only permanent ink-pens. Only the questions attempted with permanent ink-pens will be considered. Any part of paper done in lead pencil cannot be claimed for rechecking.

	Q-1	Q-2	Q-3	Q-4	Total
Total Marks	6	7	12	20	45
Marks Obtained	04	07	12	09	32



a) If a product of two numbers is 0, then at least one of the numbers is 0.

For a particular number x, neither (2x + 1) nor (x - 7) equals 0.

.. The product (2x + 1)(x - 7) is not 0.

b) If an infinite series converges, then the terms go to 0.

The terms of the infinite series $\sum_{n=1}^{\infty} \frac{1}{n}$ go to 0.

 $\bigcap \quad \therefore \text{ The infinite series } \sum_{n=1}^{\infty} \frac{1}{n} \underline{\text{converges}}.$

c) If n is a real number with n > 2, then $n^2 > 4$.

 $\vee \rho \cdot n$ is real number and $n \leq 2$.

 $\vee q \quad \therefore n^2 \leq 4.$

[2+2+2]

a) Valid

q: at least one of no. 18 0 ~q: neither of no. is Zeto p→ q Universal Modus Ponens

L'onverse error

because

p: infinite series converge q: term goes to zero.

(c) . Inverse Error.

Prror

n is a real no. n> 2

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- 2. Check whether the following statement is true or not. If true then prove it and if false then find a counterexample
 - a) If 3|(x + y) then 3|(x y).
 - b) For every real number $x, x \lfloor x \rfloor < \frac{1}{2}$ then $\lfloor 2x \rfloor = 2 \lfloor x \rfloor$.

3.

- a) Use method of contraposition to prove that, for all integers a, b, and c, if $a \nmid bc$
- b) Use method of contradiction to show that, for all odd integers a and b, a^2 –

(a) For all integers, a, b, and c if a / bc then a / b [5+7]

Contrapositive: For all integers a, b and c if a / b then a | bc

if all if alb b = at (r is some integer).

> multiply both sides by C bc = arc

both r and c are integers and product of integers is integer integer

hence proved a | bc

So the statement is true as contrapositive is true.

Negation. Suppose not. b) There is an integer odd integer a & b so $a^2-b^2=4$ $a^2 - b^2 = (a+b)(a-b) = 4$ unique factorization theorem 2.2 = 4 or 4.1 = 4. Case I: $\alpha = b = 2$ 876=0-8 M 8/12 = a-b=2 a=a+ba + b = 2 $Q_{1} = 2 - 1_{2}$ -b=b so b=0 which is not odd Case II a+b=4 & a-b=1b=4-a a-1=6 a = 4-b a = 1+64-a = a-1 4-6 = 1+6 4+1=20 4-1 = b+b 3/2 = b 3/2 is not an odd integer. Case $\pm t = 1 = 4 = 4$ a = 4+ b a = 1-6 1-6=4+6 1-84 = 6+6 b is not an odd Mteger.

Page 7 of 10 ₹ -3=2b MID-II Exam b = -3/1

4.

a) Prove by mathematical induction that for every integer $n \ge 2$,

$$\sqrt{n} < \frac{1}{\sqrt{1}} + \frac{1}{\sqrt{2}} + \frac{1}{\sqrt{3}} + \dots \dots \frac{1}{\sqrt{n}}$$

Use strong mathematical induction to prove that every integer greater than 1 is either a prime number or a product of prime numbers

Base Case:
$$n=2$$
. This O westion is continued on $\sqrt{2}$. This O westion is continued on $\sqrt{2}$. $\sqrt{2}$ $\sqrt{$

1.41 < 1.707 True base case true nductive Step! for $K \ge 2$ if P(K) is true then P(K+1) is true. $P(K) : \sqrt{K} < \frac{1}{\sqrt{1}} + \frac{1}{\sqrt{2}} + \frac{1}{\sqrt{3}} + \frac{1}{\sqrt{K}}$ True.

$$P(K+1)$$
: $\sqrt{K+1} < \frac{1}{\sqrt{1}} + \frac{1}{\sqrt{2}} + \frac{1}{\sqrt{3}} + \frac{1}{\sqrt{K+1}}$

$$\sqrt{K+1} < \frac{1}{\sqrt{1+1}} + \frac{1}{\sqrt{1+1}} + \frac{1}{\sqrt{1+1}} = \frac{1}{\sqrt{1+1}} + \frac{1}{\sqrt{1+1}} = \frac{1}{\sqrt{1+1$$