S=958/959
C=125

Air University

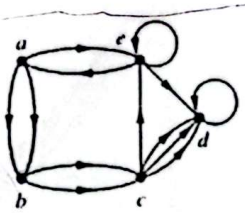
(End Semester Examination: Fall-2024)

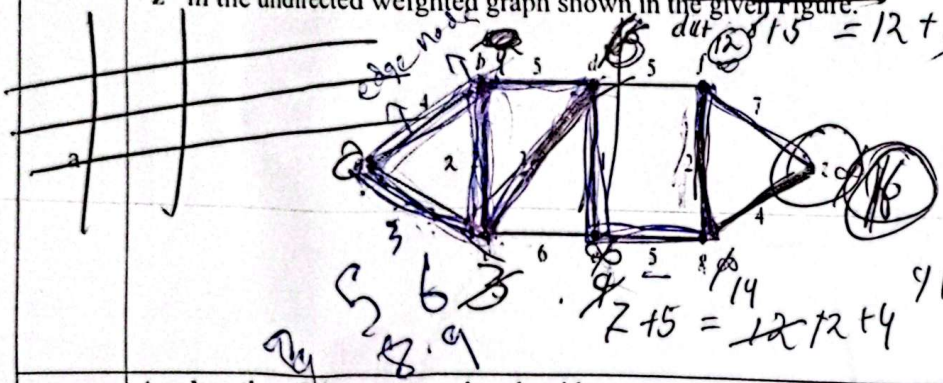
Subject:	**Discrete Structures**	Total Marks:	100
Course Code:	**MA-216**	Date:	
Class:	**BS-CYS**	Time:	
Semester:	**I**	Duration:	3 Hours
Section:	**A, B (Morning Session)**	FM Name:	Mr. Amir Shahzad

HoD's Signature: _____ FM's Signature: _____

Instructions:

- **Attempt all questions. Understanding the question is part of the examination.**
- **This examination carries 45% weight towards the final grade.**
- **Scientific calculator is allowed. Exchange of calculators is not allowed.**
- **Return the question paper with the answer sheet.**

Q. No. 1 (CLO-1) (PLO-2)		**25 Marks**
a	**Describe** a simple formula or rule that generates the terms of an integer sequence that begins with the given list. How can we produce the formula of a sequence if the first 10 terms are 5, 11, 17, 23, 29, 35, 41, 47, 53, 59?	7
b	Let R be the relation on the set {1,2,3,4,5} containing the ordered pairs {(1,1), (1,2), (2,3), (2,4), (3,1), (3,4), (3,5), (4,2), (4,5), (5,1), (5,2)}. **Interpret** R^2 as the composition of relations.	6
c	Let $A = \{1, 2, 3, 4\}$. Draw the directed graph that **describes** the relation on the set A where $R = \{(a, b) \mid a + b \geq 6\}$.	6
d	List the ordered pairs in the relation represented by the directed graph in the given figure. 	6
Q. No. 2 (CLO-2) (PLO-3)		**25 Marks**
a	Construct a combinatorial circuit using Inverters, OR gates, & AND gates that produce the output $E = abc + a\,\bar{b}\,\bar{c} + \bar{a}\,b\,\bar{c} + \bar{a}\,\bar{b}\,c$	10
b	***Apply*** a direct proof that if n is an integer and $3n + 2$ is odd, then n is odd.	7
c	**Apply** the series of logical equivalences steps to prove that: $\sim(p \vee (\sim p \wedge q))$ and $(\sim p \wedge \sim q)$ are logically equal.	8

Q. No. 3 (CLO-3) (PLO-3)		25 Marks
a	Use Chinses Reminder theorem to find the unknown from the following linear equations $X \equiv 2 \ (mod\ 3)$ $X \equiv 3 \ (mod\ 5)$ $X \equiv 3 \ (mod\ 7)$	10
b	Find the Bezout's Coefficients corresponding to the numbers 288 & 177.	8
c	Use the Sieve of Eratosthenes to find all primes less than **100.** Explain your answer.	7
Q. No. 4 (CLO-4) (PLO-3)		**25 Marks**
a	Apply Dijkstra's algorithm to find the length of the shortest path between "a" and "z" in the undirected weighted graph shown in the given Figure: 	15
b	**Apply** the Binary search algorithm to search for "40" in the list 1, 2, 4, 6, 8, 13, 17, 21, 24, 28, 30, 40, 43, 48, 50, 59.	10

**********End**********