College of Science.
Department of Mathematics

كلية العلوم
قسم الرياضيات

Second Midterm Exam
Academic Year 1445 Hijri- SecondSemester

Exam Information معلومات الامتحان			
Course name	Discrete Mathematics الرياضيات المحددة		اسم المقرر
Course Code	151 ريض		رمز المقرر
Exam Date	2024-05-01	1445-10-22	تاريخ الامتحان
Exam Time	03: 00 PM		وقت الامتحان
Exam Duration	2 hours	ساعتان	مدة الامتحان
Classroom No.			رقم قاعة الاختبار
Instructor Name			اسم استاذ المقرر

Student Information معلومات الطالب		
Student's Name		اسم الطالب
ID number		الرقم الجامعي
Section No.		رقم الشعبة
Serial Number		الرقم التسلسلي

General Instructions: **تعليمات عامة:**

- Your Exam consists of 7 PAGES (except this paper)
- Keep your mobile and smart watch out of the classroom.
- Calculators are not allowed.

- عدد صفحات الامتحان 7 صفحة. (بإستثناء هذه الورقة)
- يجب إبقاء الهواتف والساعات الذكية خارج قاعة الامتحان.
- الآلة الحاسبة ممنوعة.

هذا الجزء خاص بأستاذ المادة

This section is ONLY for instructor

#	Course Learning Outcomes (CLOs)	Related Question (s)	Points	Final Score
1	C.L.O 1.1	I		
2	C.L.O 1.2	II		
3	C.L.O 2.2	III		
4	C.L.O 2.3	IV		
5				
6				
7				
8				

EXAM COVER PAGE

Question	I	II	III	IV	Total
Mark					

Question I: (0.5×8=4points)

Question	1	2	3	4	5	6	7	8
Answer								

Choose the correct answer, then fill in the table above:

(1) If a relation R is defined on $\mathbb{Z}$, by $aRb \leftrightarrow a + b \; is \; prime$, then the following pair belongs to R

(a) $(1,3)$.
(b) $(3,4)$.
(c) $(2,7)$.
(d) None of the previous.

(2) If $R = \{(a,b)|a > b^2\}$ is a relation defined on the set on real number, then $\bar{R} =$

(a) $\{(a,b\}|a \leq b^2\}$.
(b) $\{(a,b\}|a > b^2\}$.
(c) $\{(a,b\}|a^2 \leq b\}$.
(d) None of the previous.

(3) In the set of positive integers with division relation $(\mathbb{Z}^+, |)$, the following pairs are comparable:
(a) $2, 31$.
(b) $21, 14$.
(c) $4, 12$.
(d) None of the previous.

(4) If $R \; and \; S$ are relations on a set A represented by the matrices

$$M_R = \begin{bmatrix} 1 & 1 \\ 1 & 1 \end{bmatrix} \text{ and } M_S = \begin{bmatrix} 0 & 1 \\ 0 & 1 \end{bmatrix}, \text{ then } M_{S \circ R} =$$

(a) $\begin{bmatrix} 0 & 1 \\ 0 & 1 \end{bmatrix}$.

(b) $\begin{bmatrix} 1 & 0 \\ 1 & 1 \end{bmatrix}$.

(c) $\begin{bmatrix} 1 & 1 \\ 0 & 0 \end{bmatrix}$.

(d) None of the previous.

(5) Let $A = \{a, b, c\}$ and the relation R on A be represented by the matrix

$$M_R = \begin{bmatrix} 1 & 0 & 1 \\ 1 & 0 & 0 \\ 0 & 1 & 0 \end{bmatrix}.$$

Then the relation R is

(a) Reflexive.

(b) Antisymmetric.

(c) Symmetric.

(d) None of the previous.

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(6) Let $A = \{1, 2, 3, 4\}$. The equivalence relation produced by the partition $A_1 = \{1, 4\}$, $A_2 = \{2\}$, $A_3 = \{3\}$ is given by:

(a) $\{(1,1), (1,4), (2,2), (3,3), (4,4)\}$.

(b) $\{(1,1), (1,4), (4,1), (2,2), (3,3), (4,4)\}$.

(c) $\{(1,1), (1,4), (4,1), (2,2), (2,3), (3,2), (3,3), (4,4)\}$.

(d) None of the previous.

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(7) Let $G = (V, E)$ be an $r - regular$ graph with $|V| = |E|$. Then the value of r is

(a) 16.

(b) 4.

(c) 2.

(d) None of the previous.

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(8) Let H be a graph with 8 edges and degree sequence $1, 3, x, x$, then $x =$

(a) 6.

(b) 2.

(c) 1.

(d) None of the previous.

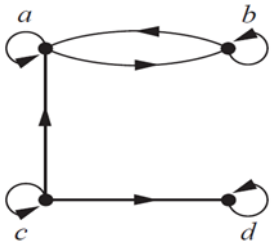
Question II: (2+4=6 points)

A. For the partial ordered set on $A = \{1, 2, 3, 4\}$, given by:

$$S = \{(1,1), (1,2), (1,3), (1,4), (2, 2), (2, 4), (3, 3), (4,4)\},$$

draw the **Hasse diagram** representing the relation S. Is the poset **a totally ordered set**? Justify your answer.

B. Let R be a relation on $A = \{a, b, c, d\}$, represented by the directed graph (digraph) below:



Then answer the following:

(i) List all ordered pairs of R.

(ii) Is the relation R reflexive? Justify your answer.

(iii) Is the relation R symemetric? Justify your answer.

(iv) Is the relation R antisymmetric? Justify your answer.

Question III: (4.5+1.5+1+1=8 points)

Let R be a relation defined on the set of integers $\mathbb{Z}$ by $R = \{(a, b) : a - b \ even\}$. Then answer the following:

(i) Prove that R is an equivalence relation on $\mathbb{Z}$.

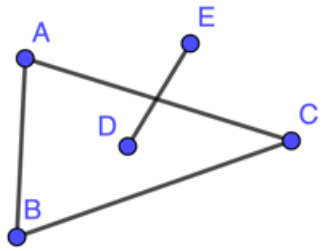
(ii) Find the equivalence classes [0] and [1].

(iii) Use (ii) to find a partition of $\mathbb{Z}$.

(iv) Is the relation R a partial ordered set on $\mathbb{Z}$? Justify your answer.

Question IV: (2.5+3+1.5=7points)

A. Answer the following questions about the graph G:



G

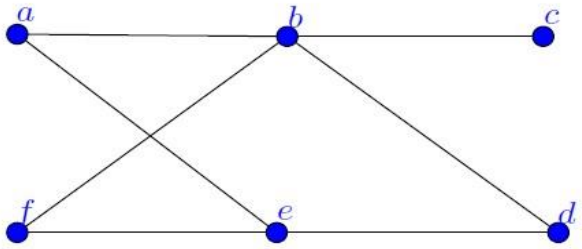
(i) Is the graph G connected? Justify your answer.

(ii) How many connected components are in the graph G?

(iii) Find a simple circuit. What is its length?

(iv) What is the degree of C.

B. Answer the following questions about the graph J below

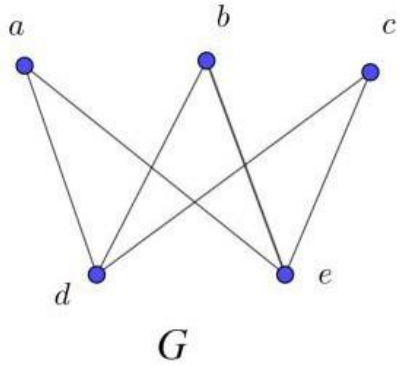


J

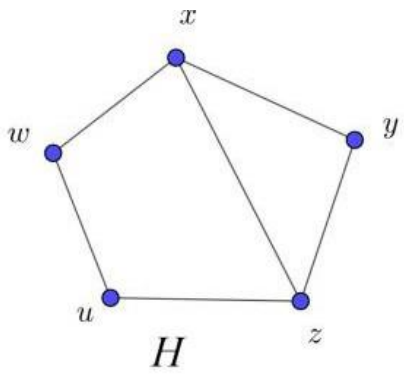
(i) Is the graph J bipartite? Justify your answer.

(ii) Represent the graph J in an **adjacency matrix**.

C. Are the graphs G and H below isomorphic? Justify your answer.



G



H

Good Luck 😊