College of Science.
Department of Mathematics

كلية العلوم
قسم الرياضيات

First Midterm Exam
Academic Year 1445-1446 Hijri- First Semester

Exam Information معلومات الامتحان			
Course name	Discrete Mathematics الرياضيات المحددة		اسم المقرر
Course Code	151 ريض		رمز المقرر
Exam Date	2023-10-26	1445-04-04	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:

- Your Exam consists of 6 PAGES (except this paper)
- Keep your mobile and smart watch out of the classroom.
- Calculators are not allowed.

تعليمات عامة:

- عدد صفحات الامتحان 6 صفحة. (بإستثناء هذه الورقة)
- يجب إبقاء الهواتف و الساعات الذكية خارج قاعة الامتحان.
- يمنع استخدام الآلات الحاسبة.

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 2.1	II+III+IV		
3				
4				
5				
6				
7				
8				

EXAM COVER PAGE

Question	I	II	III	IV	Total
Mark					

Question I: (8points)

Question	1	2	3	4	5	6	7	8
Answer								

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

(1) If the statement $\boldsymbol{P} \leftrightarrow \boldsymbol{Q}$ **i**s false, where $\boldsymbol{P}$ is true, then the truth value of $\boldsymbol{Q}$ is:

(a) True.
(b) False

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(2) The **converse** of the conditional statement $p \rightarrow q$ is

(a) equivalent to the inverse of $p \rightarrow q$.
(b) equivalent to $p \rightarrow q$.
(c) equivalent to the contrapositive of $p \rightarrow q$.
(d) None of the previous.

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(3) The statement $\boldsymbol{p} \leftrightarrow \boldsymbol{q}$ is equivalent to:

(a) $\neg\boldsymbol{p} \leftrightarrow \boldsymbol{q}$.
(b) $\neg\boldsymbol{q} \leftrightarrow \boldsymbol{p}$.
(c) $(\neg\boldsymbol{p} \rightarrow \neg\boldsymbol{q}) \wedge (\neg\boldsymbol{q} \rightarrow \neg\boldsymbol{p})$.
(d) None of the previous.

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(4) The statement "$(\boldsymbol{p} \vee \boldsymbol{q}) \wedge (\neg\boldsymbol{p} \wedge \neg\boldsymbol{q})$ " is a

(a) Tautology.
(b) Contradiction.
(c) Contingency.

(5) The truth value of the statement $\exists! \boldsymbol{x} \in \mathbb{Z}$ $\textbf{such that } \boldsymbol{x^2 - 4 = 0}$ is:

(a) True.

(b) False

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(6) The inverse of the proposition "$\boldsymbol{if\ x^2 < 2x\ then\ x \leq 1}$" is:

(a) if $x^2 > 2x\ then\ x \geq 1$.

(b) if $x \leq 1\ then\ x^2 < 2x$.

(c) if $x^2 \geq 2x\ then\ x > 1$.

(d) None of the previous.

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(7) If the domain of the propositional function $P(x)$ consists of the integers $1, 2, 3\ and\ 4$, then the following is equivalent to the statement $\neg\exists \boldsymbol{xP(x)}$:

(a) $\neg P(1) \wedge \neg P(2) \wedge \neg P(3) \wedge \neg P(4)$.

(b) $\neg P(1) \vee \neg P(2) \vee \neg P(3) \vee \neg P(4)$.

(c) $\mathrm{P}(1) \wedge P(2) \wedge P(3) P \wedge (4)$.

(d) None of the previous.

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(8) Let $P(m, n)$ be the statement " $\boldsymbol{m = 2n - 1}$ " then

(a) $P(4,2)$ is true.

(b) $P(1,1)$ is false.

(c) $P(4,2)$ is false.

(d) None of the previous

<u>Question II</u>: (2+2=4 points)

A. **<u>Without using truth tables</u>** prove the following:

$$[\neg p \wedge (p \rightarrow q) \rightarrow \neg \text{q}] \equiv q \rightarrow p$$

B. Prove by **contradiction**: "$If\ m^2\ is\ irrational\ then\ m\ is\ irrational$".

<u>Question III</u>: (5+1=6 points)

A. For every integer n, prove that: " n is odd if and only if $5n^2 + 6$ is odd".

B. Prove that the statement "$for\ every\ n \in \mathbb{Z}$, $(n-4)(n-6) > 0$" is **false.**

Question IV: (5+2=7 points)

A. Let $\{a_n\}$ be a sequence defined inductively as:

$$a_0 = 1, \qquad a_1 = 3, \; a_n = 2a_{n-1} - a_{n-2} \; , \; \forall\, n \geq 2.$$

Using **Strong Induction** prove that:

$$a_n = 2n + 1, \text{ for all nonnegative integers } n.$$

B. Prove that: $(n + 2)^2 + 2 \geq 3^n$, for all nonnegative integers n less than 4.

Good Luck 😊