College of Computer Science & Engineering at Yanbu.

جامعة طيبة
TAIBAH UNIVERSITY

كلية علوم وهندسة الحاسبات بينبع

Department of Computer Science.

قسم علوم الحاسبات

Midterm. Exam 01

Academic Year 1448 - First Semester

Exam Information معلومات الامتحان			
Course name	**تمثيل المعرفة والاستدلال**		**اسم المقرر**
Course Code	**AI 212 – AI 225**		**رمز المقرر**
Exam Date	11 / 10 / 2026	**الأحد**	**تاريخ الامتحان**
Exam Time	12:00 – 13:00		**وقت الامتحان**
Exam Duration	1 Hour		**مدة الامتحان**
Classroom No.	**GF 1**		**رقم قاعة الاختبار**
Instructor Name	**Prof. Dr. Mostafa Elhosseini**		**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 4 PAGES (except this paper)
- Phones and smart devices are forbidden inside the hall.

- عدد صفحات الامتحان 4 صفحة. (بإستثناء هذه الورقة)
- يمنع استخدام الهواتف والأجهزة الذكية داخل القاعة.

هذا الجزء خاص بأستاذ المادة

This section is ONLY for instructors.

#	Course Learning Outcomes (CLOs)	Related Question (s)	Points	Final Score
1	Recognize ideas and techniques underlying the design of knowledge-based systems.	Q1	10	
2	Describe mathematical and logical representations of knowledge-based systems.	Q2	10	

Question 1: Points: 10		CLO #1

Choose the most appropriate answer for each of the following questions.

1. A hospital system stores **DrugAllergy(Ahmed, Penicillin)** and the rule **DrugAllergy(x, Penicillin)** → **Avoid(x, Penicillin)**. The statement **Avoid(Ahmed, Penicillin)** is best described as:
   A. Raw data
   B. Implicit knowledge derived by reasoning
   C. A syntax error
   D. A second-order predicate
2. Which statement is a **proposition**?
   A. Close the warehouse door.
   B. Is lane 3 congested?
   C. The robot battery is below 20%.
   D. x + 2 = 7
3. Let $\boldsymbol{p}$ = 'the soil is dry' and $\boldsymbol{q}$ = 'the irrigation valve is open.' Which **expression** means 'the soil is dry and the irrigation valve is not open'?
   A. $p \lor \neg q$
   B. $p \land \neg q$
   C. $\neg p \land q$
   D. $p \rightarrow q$
4. In the rule 'If a vehicle exceeds the speed limit, then the ITS system issues an alert,' **exceeding the speed limit** is:
   A. Necessary for issuing an alert
   B. Sufficient for issuing an alert
   C. Equivalent to issuing an alert
   D. The converse of issuing an alert
5. A warehouse access rule says 'A worker enters the hazardous zone **if and only if** the worker has authorization.' Which expression represents it?
   A. p → q
   B. q → p
   C. p ↔ q
   D. p ⊕ q
6. A smart farm alarm is defined as **A = moisture_low ∨ temperature_high**. Which expression means **'the alarm condition is not present'**?
   A. ¬moisture_low ∨ ¬temperature_high
   B. moisture_low ∧ temperature_high
   C. ¬moisture_low → temperature_high
   D. ¬moisture_low ∧ ¬temperature_high
7. Why is a truth table usually impractical for a large SAT problem?
   A. Truth tables cannot represent negation
   B. The number of rows grows as 2^n
   C. SAT problems have no Boolean variables
   D. Truth tables work only for FOL
8. A system stores many correct facts but has no rules linking them and cannot derive anything new. Which course idea best diagnoses the limitation?
   A. Facts alone equal intelligence
   B. Representation without useful structure limits reasoning
   C. Every KB must be second-order
   D. All reasoning should be hard-coded
9. Which of the following is a function (not a predicate)?
   A. `Pedestrian(x)`
   B. MarriedTo(x, y)
   C. MustStop(x)
   D. ceoOf(x)
10. Let p = "the gripper is closed" and q = "the part is detected". **When is $\boldsymbol{p} \land \boldsymbol{q}$ true**?
   A. When at least one of p, q is true
   B. Only when both p and q are true
   C. When exactly one of p, q is true
   D. Only when both p and q are false

Question 2: Points: 10		**CLO #2**

A. Consider the following propositional logic formula: **Points: 5**

$[(p \rightarrow q) \wedge \neg q] \rightarrow \neg p$

i. Construct a complete truth table for the formula, including all intermediate columns

ii. Based on your completed truth table, determine whether this formula is a tautology, a contradiction, or a contingency. Justify your answer clearly by referencing the truth values in the final column.

B. To **prevent collisions at an intersection**, the safety interlock requires that the North and East signals cannot be green simultaneously, nor can both be red when traffic is flowing — meaning exactly one signal is active $(\boldsymbol{N} \oplus \boldsymbol{E})$. An engineer proposes replacing the dedicated XOR gate with an equivalent network of standard AND, OR, and NOT gates $(\boldsymbol{N} \vee \boldsymbol{E}) \wedge \neg(\boldsymbol{N} \wedge \boldsymbol{E})$.

Prove or disprove the engineer's design by providing a comparative truth table evaluation.

(Points: 5)

Best Wishes

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