Kingdom of Saudi Arabia Ministry of higher Education Al-Imam Mohammad Ibn Saud Islamic University --- College of Science ---

Department: Mathematics & Statistics Semester/Year: First /1436-1437 Duration: 1 H





المملكة العربية السعودية وزارة التعليم العالي جامعة الإمام محمد بن سعود الإسلامية كلية العلوم قسم الرياضيات و الإحصاء

CourseElements of sets and structuresCourse Code:MAT 220

Midterm 2 (A)

QUESTION 1 [10=5+3+2 marks]

1. Let the universe set be the set $U = \{1, 2, 3, a, b, c, m\}$, $A = \{1, a, 2, m\}$, $B = \{2, b, c\}$ and $C = \{1, 2\}$. Determine (a) $A \cup B$ (b) $A \cap B'$ (c) A - C (d) $A \times C$ (e) All proper subsets of the set B

2. Let A and B be subsets of the universal set U. Prove the following statement using only the stated laws: $(A - B) \cup (B - A) = (A \cup B) - (A \cap B)$. (Hint: You may use $A - B = A \cap B'$).

3. Let $A = \{1, \{2\}\}$ and $B = \{\{1\}, 2\}$. Which of the following statements are true? (i) A = B. (ii) $\{2\} \subseteq A$. (iii) $1 \in B$ (iv) $(\{2\}, \{1\}) \in A \times B$.

<u>QUESTION 2</u> [10=(2+4)+2+2 marks]

1. Let R and S be two relations defined on the set $A = \{1, 2, 4, 6\}$ as follows $R = \{(x, y) | x + y \text{ is an odd int eger}\}, S = \{(x, y) | x < y \}$. Determine (a)Dom (R) and Rng(S), (b) $R^{-1} \circ S^{-1}$

2. If R is an equivalence relation defined on \mathbb{Z} as follows $:(x, y) \in R \Leftrightarrow x - y = 10k$ for some $k \in \mathbb{Z}$. Find the equivalence classes [1] and [-1].

3. Is $R = \{(x, y) \in \mathbb{N} \times \mathbb{N} \mid \frac{x}{y} \in \mathbb{N} \}$ an equivalence relation on \mathbb{N} ? Justify your answer.

Extra exercise (bonus) [2 marks]:

Let A and B be subsets of the universal set U. Prove that $A \cap B = \phi$ if and only if $B \subseteq A'$