Kingdom of Saudi Arabia
Ministry of higher Education
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--- College of Science ---

بسم الله الرحمن الرحيم

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

Department: Mathematics & Statistics
Semester/Year: First /1435-1436
Duration: 75 minutes

Course Elements of sets and structures
Course Code: MAT 220

Midterm 2

QUESTION 1 [10=4+4x1.5 marks]

1. Let $U=\{1,2,3,...,10\}$, $A=\{x\in U \mid x \text{ is even}\}$, $B=\{x\in U \mid x \text{ is odd}\}$ and $C=\{1,2,4\}$,
Determine (a) $(A\cap C)'$ (b) $(A\cup B)'$ (c) $A-C$ (d) $P(C)$, the power set of C

2. Prove or disprove the following, where A, B,C and D are subsets of the universal set U:
(i) If $A\cap C\subseteq B\cap C$, then $A\subseteq B$.
(ii)If $A\subseteq B$, then $B'\subseteq A'$.
(iii)If $A\times C=B\times C$, then $A=B$.
(iv)If $A\subseteq B$ and $C\subseteq D$, then $A\cup C\subseteq B\cup D$.

QUESTION 2 [5=5+5 marks]

1. Let R and S be two relations defined on the set $A=\{1,2,3,4,5\}$ as follows $R=\{(x,y) \mid x<y\}$,
$R=\{(x,y) \mid x+y \text{ is prime}\}$. Determine (a)Dom (R) and Rng(S), (b) $S\circ R$ (c) $R^{-1}\circ S^{-1}$
(d) Which of R or S is symmetric? (e) Which of R or S is transitive?

2. Let R be a relation defined on $\mathbb{Z}$ as follows : $(x,y)\in R \Leftrightarrow x\equiv y(\text{mod } 3)$.
(i) Show that R is an equivalence relation on $\mathbb{Z}$
(ii)Find the equivalences classes of R and the partition of $\mathbb{Z}$ by R.
(iii)Is R a relation of order?.
3.

Extra exercise (bonus) [2 marks]:
Let A, B and C be subsets of the universal set U. Prove that $A-B=A\cap B'$ and use this to show that: $(A-B)-C=(A-C)-(B-C)$