King Saud University

Department of Mathematics

1st semester 1446 H.

MATH 132

2st midterm exam

Duration: 75 Minutes

Question Number	I	II	III	IV	V	VI	Total
Mark							
	3	3	4	2	3	5	20

I. **Let $R = \{(a,b): b \geq 2a\}$, and $S = \{(x,y): x - 2y = 0\}$. Where R and S are defined on $\mathbb{Z}$.**

a. Find:

i. $R \circ S$.

ii. S^{-1}.

iii. $\overline{R}$

iv. **Symmetric closure of S.**

b. Is S an equivalence relation? Justify your answer.

II. **Let T be a partial order relation defined on $A = \{1, 2, 3, 4, 5, 6\}$ defined by $T = \{(a, b): a - b = 2k,$ where k is a nonnegative integer$\}$.**

a. List all ordered pairs.

b. Give an example of comparable elements and not comparable elements.

c. Drow the Hass diagram of T.

d. Is T a total order relation? Justify your answer.

III. **Let T be a relation on $\mathbb{Z}^+$ defined by $aTb \Leftrightarrow \frac{a}{b} \in \mathbb{Z}^+$. Is this relation**

a. **Reflexive?**

b. **Symmetric?**

c. **Antisymmetric?**

d. Transitive?

IV. Let A be a set, R and S be relations on A. Prove that :

a. $R \cup R^{-1}$ is symmetric.

b. If both R and S reflexive relations on A, then $R \cap S$ is reflexive.

V. Let $R = \{(1,1),(2,1),(3,1),(3,2),(4,1),(4,2),(4,3)\}$ be a relation on $A = \{1,2,3,4,5\}$.

i) Represent R using a directed graph.

ii) Is R reflexive, symmetric, transitive? Justify your answer in each case.

1. **Prove that the relation $\equiv \quad (mod\ 5)$ is an equivalence relation and <u>find all equivalent classes</u>.**

Good Luck