MATH 300 (2028) Test 3 2001 Apr 23

Name________________________________ ___points of 127

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Write answers and show all work on these sheets. Since partial credit will be given, show sufficient detail. The number of points for each question is shown in parentheses after the number of the question.

1. (12) Tell whether the following relations are (1) reflexive, (2) symmetric, (3) transitive, (4) antisymmetric.

a. A≡Humanity; aRb ≡ a is younger than b.

b. $A \equiv \mathbb{R}$; aRb ≡ $a \neq b$.

c. A≡bitstrings of length 10; aRb ≡ a agrees with b in the first two places.

2. (8) If A≡humanity, aRb ≡ a is younger than b, what is

a. $a\overline{R}b \equiv$

b. $aR^{-1}b \equiv$

3. (14) For $M_R = \begin{pmatrix} 1 & 0 & 1 & 0 \\ 1 & 1 & 0 & 1 \\ 1 & 1 & 1 & 0 \\ 1 & 1 & 0 & 1 \end{pmatrix}$

a. (8) determine whether or not R is (1) reflexive, (2) symmetric, (3) transitive, (4) antisymmetric. (Give reasons.)

b. (6) Represent R by a digraph.

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4. (8) The digraph of relation R is shown below. Determine whether R is (1) reflexive, (2) symmetric, (3) transitive, (4) antisymmetric. (Give reasons.)

5. (20) For $\begin{pmatrix} 0 & 1 & 0 \\ 0 & 1 & 0 \\ 0 & 1 & 0 \end{pmatrix}$ form the

a. (5) reflexive closure

b. (5) symmetric closure

c. (10) transitive closure

6. (15) For the digraph of relation R shown below form the

a. reflexive closure

b. symmetric closure

c. transitive closure

7. (12) Let A≡set of all bitstrings of finite length; aRb ≡ a has the same number of zeroes as b.

a. (6) Show that R is an equivalence relation on A.

b. (6) What is the equivalence class of 1? of 00? of 101?

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8. (8) A poset has the following Hasse diagram. What are the
a. minimal elements?

b. maximal elements?

c. greatest element?

d. least element?

9. (10) For the poset {2,4,6,9,12,18,27,36,48,60,72} under division | draw the Hasse diagram.

10. (12) Using A≡{a,b,c} draw digraphs for relations that are
a. not symmetric, but antisymmetric;
b. symmetric, but not antisymmetric;
c. neither symmetric nor antisymmetric;
d. both symmetric and antisymmetric.

11. (8) Prove: Relation R is transitive if and only if $R \circ R \subseteq R$.

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