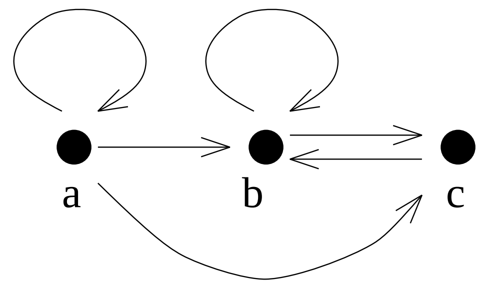
MAD 3104 Discrete Math 1 **Test 1** 20 Sep 1995

Show **ALL** work for credit; be neat; and use only **ONE** side of each page of paper.

1. Use De Morgan's and/or the distributive laws to simplify:
 A. $\overline{A} \cap (A \cup B)$
 B. $\overline{(A - B)} \cap A$

2. Give counterexamples to the statements below. The relation R is the one given by the digraph below.
 A. R is reflexive.
 C. R is symmetric.
 D. R is anti-symmetric.
 E. R is transitive.



3. Solve for m in Z_{13}. Write your answer so that $0 \leq m < 13$.
 A. $[5] + [12] = [m]$
 B. $[5][9] = [m]$
 C. $[5][m] = [3]$
 D. $[7]^{101} = [m]$

4. Construct a truth table for $(p \wedge q) \rightarrow (\sim p \vee q)$.

5.For each part, decide whether the logic is valid or invalid and draw a Venn diagram to support your answer.
 A. If $x + 2 = x$, then x is blue. $x + 2 = x$. Therefore, x is blue.
 B. If T is a rectangle, then T is a square. T is a square. Therefore, T is a rectangle.

6. Negate the following statements and re-write them so that words like "not" or "no" are not used.
 A. For all triangles T, the area$(T) \geq$ perimeter(T).
 B. For some integers x, x is odd and x^2 is even.

7. Draw the digraph fot the relation R on the set $A = \{2, 3, 4, 5, 6\}$ where the relation R is defined by $aRb \iff a = 3$ or $b = 5$.

8. Equivalent classes. For the given set A, the relation R is an equivalence relation, describe the the equivalence class $[p]$, for the given p.
 A. A is the set of reals, $aRb \iff a^2 = b^2$, and $p = 4$.
 B. A is the points in the plane, $(a, b)R(c, d) \iff a^2 + b^2 = c^2 + d^2$, and $p = (3, 4)$.
 C. $A = \{1, 2, 3, 4, 5, 6\}$, $aRb \iff a = b$ or both $a \geq 3$ and $b \geq 3$, and $p = 4$.

9. A is the set of reals and $aRb \iff a + 10 \leq b$.
 A. Give counter-examples to show R is not reflexive and not symmetric.
 B. Give proofs to show R is anti-symmetric and transitive.

10. Proof or disprove. Let A be the set of points in the plane and let R be the relation defined by $(a, b)R(c, d) \iff |a - c| \leq |b - d|$.
 A. R is reflexive.
 B. R is symmetric.
 C. R is anti-symmetric.
 D. R is transitive.

Keep this sheet. Graded tests will be ready 1:30 Friday 22 Sep in 002B LOV.