

**CS2022/ MA 2201 Homework #6**  
**Due Monday, 5/1**  
**(at the beginning of class)**

This homework is the sole work of: \_\_\_\_\_ whose conference section is at:

\_\_\_\_\_ whose conference section is at:

Sources (People, URL's, Books etc.) consulted:

Source \_\_\_\_\_ for Problem # \_\_\_\_\_

Source \_\_\_\_\_ for Problem # \_\_\_\_\_

Source \_\_\_\_\_ for Problem # \_\_\_\_\_

Date: \_\_\_\_\_

Reference (if any):

In all of these show your work. They all use techniques covered in the sections indicated.

Each question is worth 5 points.

**#1. (Section 8.2) Is it possible in a group of 9 people for each to be friends with exactly 5 others? Why or why not**

**#2. (Section 4.1)**

**a) How many integers from 1 – 1000 are multiples of 3 or multiples of 5?**

**#3. (Section 4.2) Explain how the Pigeonhole principle guarantees that in a group of 85 people, at least 4 must have the same last initial. Identify the Pigeons and the Pigeonholes.**

**#4. (Section 4.3)**

**a) Suppose a set A has 5 elements. How many subsets are there with 3 elements?**

b) How many ways can 3 of the letters of the word **BLOGS** be chosen if the first letter must be **B**

#5. (Section 5.1) What is the probability of getting four of a kind in 5-card poker?

#6. (Section 7.1) Let  $R_1$  and  $R_2$  be relations on  $A = \{1, 2, 3\}$  and  $B = \{1, 2, 3, 4\}$  respectively, where  $R_1 = \{(1,2), (2,3), (3,4)\}$  and  $R_2 = \{(1,1), (1,2), (2,1), (2,2), (2,3), (3,1), (3,2), (3,3), (3,4)\}$ .

a) Show  $R_1 \subseteq R_2$

b) Show  $R_1 \cup R_2$

c) Show  $R_1 \cap R_2$

d) Show  $R_1 - R_2$

e) Show  $R_2 - R_1$

d) Show  $R_1^{-1}$

e) Show  $R_1 \circ R_1 = R_1^2$

f) Show  $R_1^2 \circ R_1 = R_1^3$

#7. (Section 7.4) Let  $R$  be a relation on  $A = \{0, 1, 2, 3\}$  defined by  $R = \{(0, 1), (1, 1), (1, 2), (2, 2)\}$

a) Compute the Reflexive closure

b) Compute the Symmetric closure

c) Compute the Transitive closure

#8. (Section 7.1) Do #5 where  $A = \text{Integers}$  and  $R = \{(a,b) \mid a \text{ divides } b\}$

#9. (Section 7.3, 7.5)

a) Consider the relation on  $\{2, 3, 4, 6, 7, 9\}$  where

$$x R y \Leftrightarrow 3 \mid (x - y)$$

a) Draw a graph which shows this relation

b) Show the matrix representation of the relation

c) (i) What about the graph tells you that this relation is reflexive, Symmetric and Transitive and about the equivalence classes (show the equivalence classes)?

(ii) What about the matrix tells you that the relation is reflexive and Symmetric

#10. a) Suppose a graph has vertices of degrees 0, 2, 2, 3, and 9. How many edges does the graph have? Why

b) Draw a *simple* graph with degrees of 1, 2, 3, and 4 or state why it is not possible.