

Math 210

Fourth Hour Exam

Name _____

Friday Dec. 1
100 pts

I. Relations

1. Definitions and short answer questions (5 pts. each)

a. What is a binary relation on a set A ?

b. What is a transitive relation on a set A ?

c. What is an symmetric relation on a set A ?

d. What is an equivalence relation?

3. (15 pts.) Identify each of the following relations as reflexive, symmetric, anti-symmetric, transitive, an equivalence (all that apply): For equivalence relations describe the equivalence classes.
- a. $A \subset B$ (for subsets of some sizable set X where this is to be read as A is a proper subset of B)
- b. $A \cap B = \emptyset$ (A and B are disjoint, a relation amongst subsets of some sizable set X)
- c. $a \equiv b \pmod{3}$ (a is congruent to $b \pmod{3}$).

II. Graph theory (all graphs are to be simple graphs)

1. Some definitions (5 pts. each)

a. A graph

b. Degree of a vertex

c. Path in a graph

d. K_4 (draw a picture)

2. (10 pts.) What does it mean to say that two graphs are isomorphic? Give a precise (i.e. mathematical) definition and give examples of a pair of non-isomorphic graphs and a pair of isomorphic graphs (you do not need to prove that they are isomorphic or not)
- 3 (5 pts.) Why is it not possible to have a graph with just one vertex of odd degree?

4. (10 pts.) Consider the following graph. Label edges and vertices and provide both an adjacency matrix and an incidence matrix.

