

This sheet is about a major writing assignment. A significant portion of the writing grade (25% of the course grade) is based on this assignment, so do a thorough job and do not wait until the last minute. I will be happy to review a draft if you bring it to office hours.

Due date: 19 November 2007

Rules on collaboration: You may ask questions about this project in class. Otherwise, you may only discuss it with Mike Ward.

1. Read Definition 4.3.2 on page 184 and then read Section 4.6 on pages 213-222. The most important pages are 213-217.
2. Write an essay on Equivalence Relations which includes at least the following:
 - the stipulated definition;
 - your concept image¹ of equivalence relations, including, if possible, non-mathematical analogies;
 - an original example of an equivalence relation with proof;
 - the assigned example from the item 3 below;
 - original nonexample(s).²

(If you type the essay, it is OK to write the mathematical parts by hand so as not to use up a lot of precious time trying to type symbols and formulas.)

The essay will be graded using the following rubric.

	unacceptable	sketchy or wrong	partial or adequate	complete; correct	uncommonly thorough	weight factor
	1	2	3	4	5	
Definition						1
Concept Image						2
Original Example						3
Assigned Example						3
Non-example(s)						3
Writing Style						3
Creativity						1

(Missing items get a zero of course. For instance, if you do not give an example, then you get a zero in that category.)

3. You will be assigned one of the following. Prove it is an equivalence relation and then list three different elements of the equivalence class of the specified element, two elements *not* in that equivalence class, a set-builder notation description of the equivalence class having the “best” elementhood test that you can find, and a picture of the equivalence class (if possible).

¹Technically, this is impossible, because our concept images often contain nonverbal elements. What I really mean is to give me as much insight into your concept image as possible. You might include pictures.

²Relations that satisfy all but one of the requirements of an equivalence relation make interesting non-examples

- Relation: $S = \{(a, b) \in \mathbb{R} \times \mathbb{R} : a - b \in \mathbb{Q}\}$. Specified element: $\sqrt{2}$
- Relation: $T = \{(a, b) \in \mathbb{R} \times \mathbb{R} : a^2 - b^2 \in \mathbb{Z}\}$. Specified element: $\sqrt[4]{2}$
- Relation: $V = \{((x, y), (w, z)) \in \mathbb{R}^2 \times \mathbb{R}^2 : x^2 + y^2 = w^2 + z^2\}$. Specified element: $(0, 1)$
- Relation: $W = \{((x, y), (w, z)) \in \mathbb{R}^2 \times \mathbb{R}^2 : x = w\}$. Specified element: $(0, 1)$
- Relation: $G = \{(a, b) \in \mathbb{Z} \times \mathbb{Z} : 3|(a - b)\}$. Specified element: -8
- Relation: $I = \{((a, b), (c, d)) \in \mathbb{N}^2 \times \mathbb{N}^2 : a + d = c + b\}$. Specified element: $(3, 5)$.

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