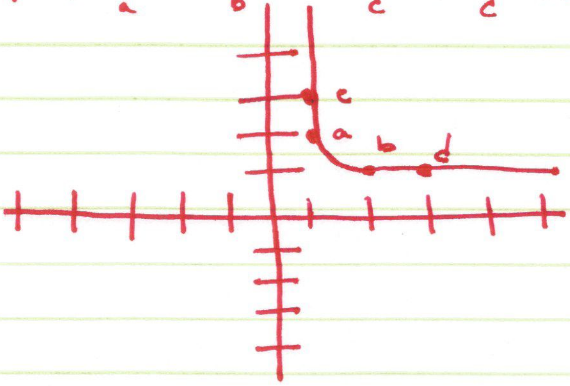
Robert Malony
15 Nov 2017
MAD 2104, Section 2

Discrete Mathematics HW – 8.2-8.3

8.2 #4. A number of relations are defined on the set $A = \{0, 1, 2, 3\}$.

#4a. $R_4 = \{\underset{a}{(1,2)}, \underset{b}{(2,1)}, \underset{c}{(1,3)}, \underset{d}{(3,1)}\}$



#4b. No, the relation is not reflexive – There does not exist overlapping x-only values

#4c. The relation is symmetrical, as $\forall$ x, y in R_4 are relative to each other in the inverse. $(x,y) \in R_4$, $(y,x) \in R_4$.

#4d. The relation is not transitive, as there is no instance where a 'z' variable exists, thus invalidating the premise $(x,y) \in R_4$, $(x,z) \in R_4$, $(y,z) \in R_4$.

#8.2 #7. $R_7 = \{\underset{a}{(0,3)}, \underset{b}{(2,3)}\}$

#7a.

#7b. It is not reflexive, as there is not an existing loop in this graphical representation. So, it cannot be reflexive.

#7c. It is not symmetrical, as (3,0) and (3,2) ~~cannot~~ $\notin R_7$, thus nullifying a symmetrical relation impossible.

#7d. It is transitive as it moves directly from one point to another without any other actions. It is transitive by default.

8.2 #10 C is the circle relation on the set of $\mathbb{R}$.

$\forall\ x, y \in \mathbb{R},\ x\,C\,y \Leftrightarrow x^2+y^2 \pm 1$

This relation is ~~symmetric~~ symmetric. Since in order for a value x, y to be $x\,C\,y$, $x^2+y^2=1$— since under reflexive property, $1\,C\,1$ would be an example of (x, x)— $1^2+1^2=2$— so it cannot be reflexive.

It cannot be transitive because while $1\,C\,0$ and $0\,C\,1$ are true, $1 \not\mathrel{C} 1$, as proven above by the failure of the reflexive property.

What makes it symmetric is that $x^2+y^2=1$ and $y^2+x^2=1$ are the same function. Thus meaning that no matter what, $y\,C\,x$, as $x\,C\,y$.

8.3 #6 Find the distinct equivalence classes of R.

$A=\{-4, -3, -2, -1, 0, 1, 2, 3, 4, 5\}$.

R is defined on A as follows:

$$\forall\ x, y \in A,\ x\,R_y \Leftrightarrow 3\,|\,(x-y)$$

(3 divides $(x-y)$)

[illegible] [illegible]

[illegible] $\{-4, -1, 1, 4\}, \{-3, 0, 3\}, \{-2\},$ [illegible]
$\{2, 5\},$

#14 A is the set of all strings of length 2 in 0's, 1's and 2's.

$sRt \Leftrightarrow$ sum of characters in s = sum of characters in t

$sRt \Leftrightarrow s \doteq t$

~~{00, 01, 02}~~
~~{10, 11, 12}~~
~~{20, 21, 22}~~

{00}
{01, 10}
{02, 11, 20}
{12, 21}
{22}