

## CSci 1302 Assignment 10

Due Wedn., December 7th

**Problem 1 (6 points).** Exercises 4, 6 ( $|$  is defined on p. 148), 11 p. 608.

**Problem 2 (6 points).** Exercises 19, 20, 21 p. 609.

**Problem 3 (5 points)** You are given relation  $R = \{(a, b), (b, c), (c, b), (d, c)\}$  on the universal set  $U = \{a, b, c, d, e\}$ . Please construct the following:

- the reflexive closure of  $R$ .
- the symmetric closure of  $R$ .
- the transitive closure of  $R$ .
- the “equivalence closure” of  $R$  (i.e. the smallest equivalence relation that contains  $R$ ).

You may list pairs included in the resulting relations or draw them (each on a separate diagram).

**Problem 4 (6 points)** You are given a relation  $R = \{(m, n) \mid m - n = 5\}$  on the set of integers. Please construct the following:

- the reflexive closure of  $R$ .
- the symmetric closure of  $R$ .
- the transitive closure of  $R$ .
- the “equivalence closure” of  $R$  (i.e. the smallest equivalence relation that contains  $R$ ). How many classes are in the partition induced by this equivalence relation? What are they?

**Problem 5 (2 points).** Is symmetric closure of a transitive relation transitive? If yes, please prove it. If not, please give a counterexample.

**Problem 6 (6 points).** You are given three sets,  $A = \{a, b, c\}$ ,  $B = \{1, 2, 3\}$ , and  $C = \{red, white, blue\}$ , and the following relations:

- $R \subseteq A \times B = \{(a, 1), (b, 1), (c, 3)\}$ ,
- $S \subseteq B \times C = \{(2, red), (2, blue), (3, red)\}$ ,
- $T \subseteq C \times A = \{(red, a), (white, c)\}$ .

For each of the following operations compute the result if the operation makes sense, or, if it doesn't make sense, please explain why.

1.  $S \circ R$

2.  $T \circ S$

3.  $R^{-1} \circ R$

4.  $R \circ R^{-1}$

5.  $T^{-1} \circ R^{-1}$

6.  $T \circ R$

**Problem 7 (3 points).** Exercises 6, 7, 9 p. 647.

**Problem 8 (2 points).** Exercise 11 p. c, e, f, g (not d!) p. 647.

**Problem 9 (4 points).** Exercise 41 b, 42 a,b, 44 p. 648.