**CSC175 Assignment 4 Spring 2019 Name \_\_\_\_\_\_\_\_Donald Tvedt\_\_\_\_\_\_\_\_\_\_\_\_   
Directions:** Download this file and save as lastnameAssignment4SP19. Type all solutions on this document. Use equation editor when necessary. Upload Word document to Blackboard by **Monday at 11:59 PM.**  
Points in [brackets]. Total: 60 points Show work and explain concepts thoroughly!  
  
[4] points for a professional looking document (organization, neatness, tables, etc.)  
  
1) [4] Let . Let be a relation on defined by if and only if . Are the following elements of Why or why not?

a) (3,3) **= yes, 3 is equal to itself** b) (4,1) **= no, 1 is not in the set A** c) (2,4) **= no, 2 is less than 4** d) (4,3) **= yes, 4 is greater then 3**

2) [9] Let . Let be a relation on defined by if and only if (a divides b).

1. List the elements of .  **{(1,1), (1,2), (1,3), (1,4), (1,5), (2,2), (2,4), (3,3), (4,4), (5,5)}**
2. Is reflexive? Why or why not? **= Yes, every vertex has a loop**
3. Is symmetric? Why or why not? **= No, there are single arrows**
4. Is antisymmetric? Why or why not? **= No, there are loop double arrows**
5. Is transitive? Why or why not? **= No, the data sets can ARB BRC do not work out**
6. Is a partial ordering? Why or why not? **= No, it’s not transitive and not antisymmetric**
7. Is an equivalence relation? Why or why not? **= No, it’s not symmetric and not transitive**

3) [10] Let , be a relation on such that if and only if , and be a relation on such that if and only if .

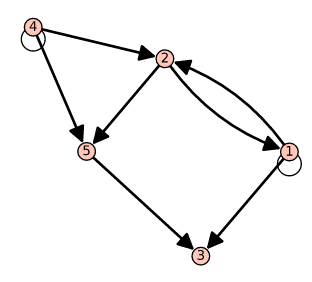
a) List the element of .  **{(0,-2), (1,-1), (2,0)}** b) List the element of .  **{(-2,-1), (-1,0), (0,1), (1,2)}** c) List the element of .  **{(0,-1), (1,0), (2,1)}** d) List the element of .  **{(-1,-2), (0,-1), (1,0)}** e) Is antisymmetric? Why or why not? **= Yes, no loops and no double arrow** f) Is transitive? Why or why not?  **= No, using the formula = false**

4) [4] Let and be relations on where and . Hint: write out some of the terms of and for insight into the problem.

**{…, (1,-2), (1,-1), (1,0), (1,1), (1,2), …} {…, (-2,1), (-1,1), (0,1), (1,1), (2,1), …}**

a) Find .  **{(1,1)}** b) Find .  **{…, (-2,-2), (-1,-1), (0,0), (1,1), (2,2), …}**

5) [7] Let be the relation on a set whose digraph is given to the right.   
a) List the elements of .

**{(1,1), (1,2), (1,3), (2,1), (2,5), (4,4), (4,2), (4,5), (5,3)}**  
****b) List the outdegree and indegree of each vertex of the digraph in a table.

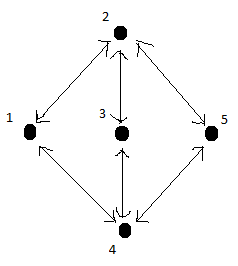
|  |  |  |
| --- | --- | --- |
|  |  |  |
| **1** | **2** | **3** |
| **2** | **2** | **2** |
| **3** | **2** | **0** |
| **4** | **1** | **3** |
| **5** | **2** | **1** |

6) [9] Let . Define the relation on by if and only if   
 is odd.

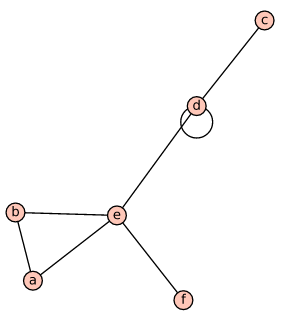
|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 1,1 | 0 | 2,1 | -1 | 3,1 | -2 | 4,1 | -3 | 5,1 | -4 |
| 1,2 | 1 | 2,2 | 0 | 3,2 | -1 | 4,2 | -2 | 5,2 | -3 |
| 1,3 | 2 | 2,3 | 1 | 3,3 | 0 | 4,3 | -1 | 5,3 | -2 |
| 1,4 | 3 | 2,4 | 2 | 3,4 | 1 | 4,4 | 0 | 5,4 | -1 |
| 1,5 | 4 | 2,5 | 3 | 3,5 | 2 | 4,5 | 1 | 5,5 | 0 |

**{(1,2), (1,4), (2,1), (2,3), (2,5), (3,2), (3,4), (4,1), (4,3), (4,5), (5,2), (5,4)}**

1. Use technology to create a digraph. (6 points)

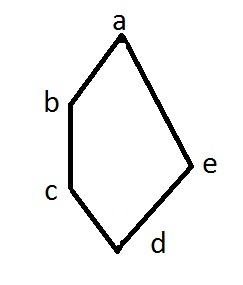


1. Is antisymmetric? Why or why not? **= No, all lines have double arrow**
2. Is transitive? Why or why not? **= No, using formula data is not odd**
3. Is reflexive? Why or why not? **= No, no vertices have a loop**

7) [6] Consider the undirected graph to the right.   
a) List the vertices.  **a, b, c, d, e, f**  
b) List the edges. **{{a,b}, {a,e}, {b,e}, {c,d}, {d,d}, {d,e}, {e,f}}**  
c) List the degree of each vertex in a table.

|  |  |
| --- | --- |
|  |  |
| **a** | **2** |
| **b** | **2** |
| **c** | **1** |
| **d** | **4** |
| **e** | **4** |
| **f** | **1** |

d) Is it a simple graph? Why or why not? **= No, vertex d has a loop**

8) [4] The partial ordering relation is shown with the Hasse diagram  
to the right. List the elements .

**{{a,b}, {a,e}, {b,c}, {c,d}, {d,e}}**

9) [3] Let . List the elements of relation (congruence mod 3) on .

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  |  |  |  |  |  |
| 2,2 | 0 | 4,2 | 2 | 6,2 | 4 | 8,2 | 6 | 10,2 | 8 |
| 2,4 | -2 | 4,4 | 0 | 6,4 | 2 | 8,4 | 4 | 10,4 | 6 |
| 2,6 | -4 | 4,6 | -2 | 6,6 | 0 | 8,6 | 2 | 10,6 | 4 |
| 2,8 | -6 | 4,8 | -4 | 6,8 | -2 | 8,8 | 0 | 10,8 | 2 |
| 2,10 | -8 | 4,10 | -6 | 6,10 | -4 | 8,10 | -2 | 10,10 | 0 |

**{(2,2), (2,8), (4,4), (4,10), (6,6), (8,2), (8,8), (10,4), (10,10)}**