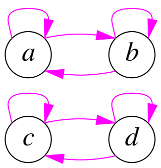
Solution Long Quiz #3.2 (16-Apr): CSC-2259: Discrete Structures, Sp 2020
Your answers must be to the point. Total = 50; marks for each question is shown in [ ].

LastName: FirstName

1. Complete the digraph below on the left for the equivalence relation R on $X = \{a, b, c, d\}$ with the equivalence classes $\{a, b\}$ and $\{c, d\}$. Also, answer the questions on the right below. [4+2+4]



(a) For the equivalence relation R on X above, $[a] = \{a, b\}$.

(b) Show the partition of X for each of the other equivalence relations on X with 2 equivalence classes of size 2 each:
$\{\{a,c\}, \{b, d\}\}, \{\{a,d\}, \{b, c\}\}$

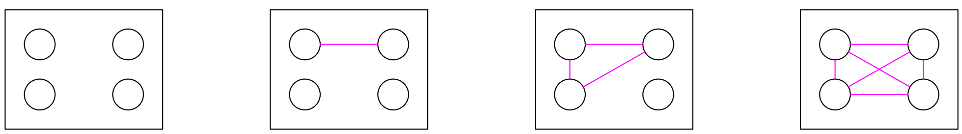
Give the three properties of an equivalence relation. [3] Reflexive, symmetric, and transitive.

Define the equivalence class $[x]$ for a general equivalence relation R. [2] $\{y: (x, y)\in R\} = \{y: (y, x)\in R\}$

For each equivalence class $[x]$, we know $x\in[x]$. State another important property of $[x]$. [2]

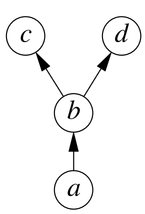
$y\in[x]$ implies $[y] = [x]$; another property is that two equivalene classes $[x]$ and $[y]$ are either equal or disjoint

2. Give the unlabeled digraph (or the undirected graph, to save time and simplify the diagrams) for the other possible structures of equivalence relations on 4 items than the one in Problem 1. [8]

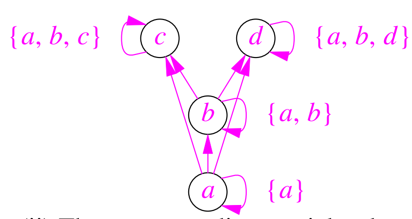


3. State the property of partial orders that makes them different from equivalence relations. [2] Anti-symmetric

Given below is the Hasse-diagram of a partial order. Show the digraph for the related partial order, the sets $N^{-}(x)$ next to each node of the partial order, and the matrix form for the partial order. [2+4+4]



(i) An Hasse-diagram



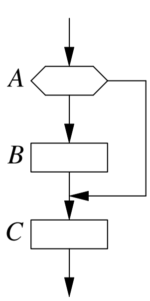
(ii) The corresponding partial order

	a	b	c	d
a	1	1	1	1
b	0	1	1	1
c	0	0	1	0
d	0	0	0	1

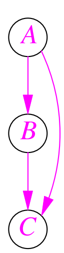
(iii) Matrix form of partial order.

Give the maximal and minimal items in the partial order above. [3] Maximal = $\{c, d\}$, Minimal = $\{a\}$

Show the digraph of the "immediately-precedes" IP-relation for the flowchart below to its right. Answer the questions (a)-(d) below on the rightside. [2+2+2+2+2]



(i) A flowchart.



(ii) Its IP-relation.

(a) When does the IP-relation of the flowchart of a code have cycles?
When the flowchart has for-loops or other kinds of loops

(b) State the properties (reflexive, anti-reflexive, etc) of the IP-relation of (i).
Anti-reflexive, anti-symmetric, transitive

(c) Is the IP-relation of a flowchart without cycles always a partial order?
No

(d) Is the transitive closure IP^{+} of a flowchart without cycles always a partial order?
No