MAD 3105 Assignment 02 **NAME:**________________________________
Closure of Relations **DUE: Thursday, January 26th (11:59pm EST)**

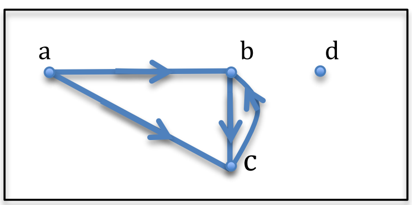
Directions: See Canvas.
Complete all work individually without outside help. **50 points total.**

(1) (5 points each)
If possible, give an example of a *nonempty relation* R on the set $A = \{0,1\}$ that satisfies the following. Give the *Matrix representation.*
(a) R is reflexive and symmetric. Explain why you chose this matrix.
(b) R is irreflexive, but R^2 (i.e. $R \circ R$) is reflexive. Explain why you chose this matrix.
(c) R is asymmetric and irreflexive. Explain why you chose this matrix.

(2) (5 points)
Find the transitive closure of the given relation, R, on $\{a, b, c, d, e\}$, *using either algorithm presented* in Section 9.4 of the Rosen textbook (i.e., using a series of matrices). Please state what method you are using and label your matrices. Do not use a digraph.

$$R = \{(e, d), (d, b), (c, a), (b, d), (a, c)\}$$

(3) (5 points each)
Given the directed graph in the box below, *draw the directed graph* of



(a) The reflexive closure of the relation.
(b) The symmetric closure of the relation.
(c) The transitive closure.

(4) (5 point each)

Let R be represented by the matrix $\boldsymbol{M}_R = \begin{bmatrix} 0 & 0 & 0 \\ 1 & 1 & 0 \\ 1 & 0 & 0 \end{bmatrix}$

(a) Give the *matrix* that represents the *reflexive closure of R*, $r(R)$:
(b) Give the *matrix* that represents the *symmetric closure of R*, $s(R)$:

(5)(5 points)
Prove directly that if the relation R is symmetric, then its transitive closure, $t(R) = R^*$, is also symmetric.