CS2022/MA2201
HW#8

DUE: Friday, October 8

1. (8 points) Do **Exercise 4.5.26** from our text.

2. (3 points) Do **Exercise 4.5.32** from our text.

3. (14 points) Determine whether each of the following binary relations is:
(1) reflexive, (2) symmetric, (3) antisymmetric, (4) transitive.

(*a*) The relation *R* on Z^+ where *aRb* means *a*|*b* (*a* divides *b* evenly).
(*b*) The relation *R* on {*w*,*x*,*y*,*z*} where *R* = {(*w*,*w*),(*w*,*x*),(*x*,*w*),(*x*,*x*),(*x*,z),(*y*,*y*),(*z*,*y*),(*z*,*z*)}.
(*c*) The relation *R* on Z where *aRb* means $|a-b| \le 1$.
(*d*) The relation *R* on Z where *aRb* means $a^2 = b^2$.
(*e*) The relation *R* on {*a*,*b*,*c*} where *R* = {(*a*,*a*),(*b*,*b*),(*c*,*c*),(*a*,*b*), (*a*,*c*),(*c*,*b*)}
(*f*) The relation *R* on *A* = {*x*,*y*,*z*} where *R* = {(*x*,*x*),(*y*,*z*),(*z*,*y*)}.
(*g*) The relation R on Z where *aRb* means $a \ne b$
(*h*) The relation *R* on Z where *aRb* means that the units digit of *a* is equal to the units digit of *b*
(*i*) The relation *R* on Z^+ where *aRb* means that *a* has the same number of digits as *b*.
(*j*) The relation *R* on the set of all subsets of {1,2,3,4} where *SRT* means $S \subseteq T$.
(*k*) The relation *R* on the set of all people where *aRb* means that *a* is at least as tall as *b*.
(*l*) The relation *R* on the set of all people where *aRb* means that *a* is younger than *b*.
(*m*) The relation *R* on the set $\{(a,b) \mid a,b \in Z\}$ where (*a*,*b*)*R*(*c*,*d*) means *a* = *c* or *b* = *d*.
(*n*) The relation *R* on R where *aRb* means $a-b \in Z$.

4. (6 points) Suppose *R* and *S* are relations on {*a*,*b*,*c*,*d*} where
R ={(*a*,*b*),(*a*,*d*),(*b*,*c*), (*c*,*c*),(*d*,*a*)} and *S* ={(*a*,*c*), (*b*,*d*), (*d*,*a*)}. Find
(a)R^2 (b)R^3 (c) S^2 (d) S^3 (e) $R \circ S$ (f) $S \circ R$.

5. (6 points) Find the transitive closure of *R* if M_R is

(a) $\begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 1 \\ 1 & 0 & 1 \end{bmatrix}$ (b) $\begin{bmatrix} 1 & 0 & 1 & 0 \\ 1 & 0 & 0 & 1 \\ 0 & 1 & 1 & 0 \\ 0 & 1 & 0 & 0 \end{bmatrix}$