

CS 228, Transitive Closure Exercises

Name:

Some questions are from **Discrete Mathematics and It's Applications 7e** by Kenneth Rosen.

- Write the 0–1 matrix that corresponds to the following relation on $S = \{1, 2, 3, 4\}$?
 $R = \{(1, 2), (2, 1), (2, 3), (3, 4), (4, 1)\}$

- Use the following transitive closure algorithm to find the transitive closure of the relation from the previous question. Show the value of \mathbf{B} after each iteration.

```
procedure TRANSITIVE CLOSURE( $\mathbf{M}_R$  : 0-1  $n \times n$  matrix)
   $\mathbf{A} := \mathbf{M}_R$ 
   $\mathbf{B} := \mathbf{A}$ 
  for  $i := 2$  to  $n$ 
     $\mathbf{A} := \mathbf{A} \odot \mathbf{M}_R$ 
     $\mathbf{B} := \mathbf{B} \vee \mathbf{A}$ 
  return  $\mathbf{B}$ 
```

- Use Warshall's algorithm to find the transitive closure of the relation from the first question. Show the value of \mathbf{W} after each iteration.

```
procedure WARSHALL( $\mathbf{M}_R$  : 0-1  $n \times n$  matrix)
   $\mathbf{W} := \mathbf{M}_R$ 
  for  $k := 1$  to  $n$ 
    for  $i := 1$  to  $n$ 
      for  $j := 1$  to  $n$ 
         $w_{ij} := w_{ij} \vee (w_{ik} \wedge w_{kj})$ 
  return  $\mathbf{W}$ 
```