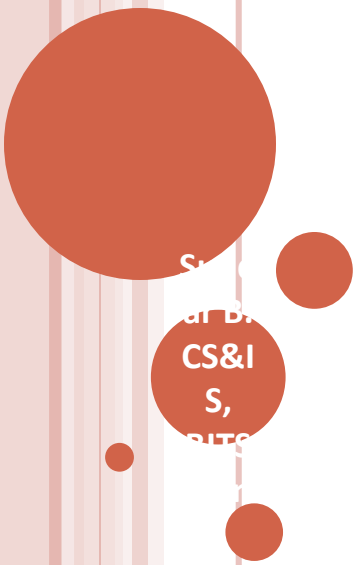
CS F364
Design & Analysis of Algorithms



DYNAMIC PROGRAMMING

Graph Problems:

- Transitive Closure

Graphs – Transitive Closure

- A graph G = (V,E) captures a binary relation R on a set S:
  - i.e. V = S and E = R $\subseteq$ S x S
  - i.e. the edge relation of G models R
- The transitive closure of R, denoted R* is defined as:
  - x R* x for any x in S
  - x R y ==> x R* y for any x and y
  - x R y and y R z ==> x R* z for any x, y, and z
  - i.e. the path relation in G models R*

Graphs – Transitive Closure

- Question:
  - How similar is this problem to All Pairs Shortest Paths (APSP)?
  - Note :
    - This is not an optimization problem!

Graphs – Transitive Closure

- Exercise:
  - Rewrite the recurrence for APSP to suit this problem:

D[0,i,j]

= 0 if i=j;

= w(v_i , v_j) if there is an edge (v_i , v_j) in E;

= INFINITY otherwise

What will these values be?

D[k,i,j] = min(D[k-1,i,j], D[k-1,i,k] + D[k-1,k,j])

for k>0

What will these operators be?