Floyd-Warshall and Review
Floyd-Warshall Algorithm

shortestPaths(G):

let $d[][]$ be a $|V|\times|V|$ matrix

$d[i][j] = w(i,j)$ or infinity if no edge ($w(i,i) = 0$ for all $i$)

for $k=0 \ldots |V| - 1$:

for $i = 0 \ldots |V| - 1$:

for $j = 0 \ldots |V| - 1$:

if $(d[i][k] + d[k][j] < d[i][j])$:

$d[i][j] = d[i][k] + d[k][j]$

return $d$
Example

if (d[i][k] + d[k][j] < d[i][j] ):
  d[i][j] = d[i][k] + d[k][j]
Example

if \( d[i][k] + d[k][j] < d[i][j] \):
\[
d[i][j] = d[i][k] + d[k][j]
\]

\[
\begin{array}{c|cccc}
\hline
k = 0 & 0 & 2 & 4 & \infty \\
\hline
i & 0 & 0 & 2 & 4 & \infty \\
& 1 & 2 & 0 & 1 & 3 \\
& 2 & 4 & 1 & 0 & 2 \\
& 3 & \infty & 3 & 2 & 6 \\
\hline
\end{array}
\]
Path Reconstruction

\[ \text{if } (d[i][k] + d[k][j] < d[i][j]): \]
\[ d[i][j] = d[i][k] + d[k][j] \]

\[ k = 1 \]

\[
\begin{array}{c|ccc}
  & 0 & 1 & 2 \\
\hline
i & 0 & 3 & 2 \\
   & 1 & \infty & 1 \\
   & 2 & \infty & \infty \\
\end{array}
\]

\[ k = \]

\[
\begin{array}{c|ccc}
  & 0 & 1 & 2 \\
\hline
i & 0 & 3 & 2 \\
   & 1 & -1 & -1 \\
   & 2 & -1 & -1 \\
\end{array}
\]

\[ 2 + \{0, 0, 1, 3\} \]

\[ \infty, 2, 3 \]
Path Reconstruction

shortestPaths(G):

let d[][] be a |V|x|V| matrix
let path[][] be a |V|x|V| matrix initialized to -1s

d[i][j] = w(i,j) or infinity if no edge (w(i,i) = 0 for all i)

for k=0 ... |V| - 1:
    for i = 0 ... |V| - 1:
        for j = 0 ... |V| - 1:
            if (d[i][k] + d[k][j] < d[i][j]):
                d[i][j] = d[i][k] + d[k][j]
                path[i][j] = k  // ALT: next[i][j] = next[i][k]

return d
Announcements

Poll for Kendra Yourtee - https://tinyurl.com/yay8m24s

Final on Friday – One sheet of notes
- Will be shorter than the midterm!

Review – Wednesday in class and Thursday in Section

Final Review HW due on Wednesday
- No late days – we will be posting solutions as soon as the dropbox closes.

Course Feedback Survey: https://uw.iasystem.org/survey/195884
- Super useful for me – this was my first time teaching, and I would really appreciate constructive feedback: what I did well, what I did poorly, and how the class could have been improved.
MST (Kruskal, Union By Height + Path C.)

B - D, E - F, A - B, C - F, D - E

A → B

D → E

E → F

H - Q tree