

# Lecture 24

CSE 331

Oct 24, 2014

# Graded Mid-terms

Will be handed out at the end of the lecture

Posts with solutions/grading details over the weekend

Will assign a temp letter grade over the weekend

# HW stuff

Delay in handing out graded HW 5

HW 6 posted on piazza

# Mini Project report Due Nov 5

note ☆

stop following 1 views

## Mini Project Report due Nov 5

A gentle reminder about the upcoming deadline of 11:59pm to email me your group's project report. For more details see:

<http://www.cse.buffalo.edu/~atri/courses/331/handouts/mini-project.pdf>

(The link is also available from the "Resources" tab.)

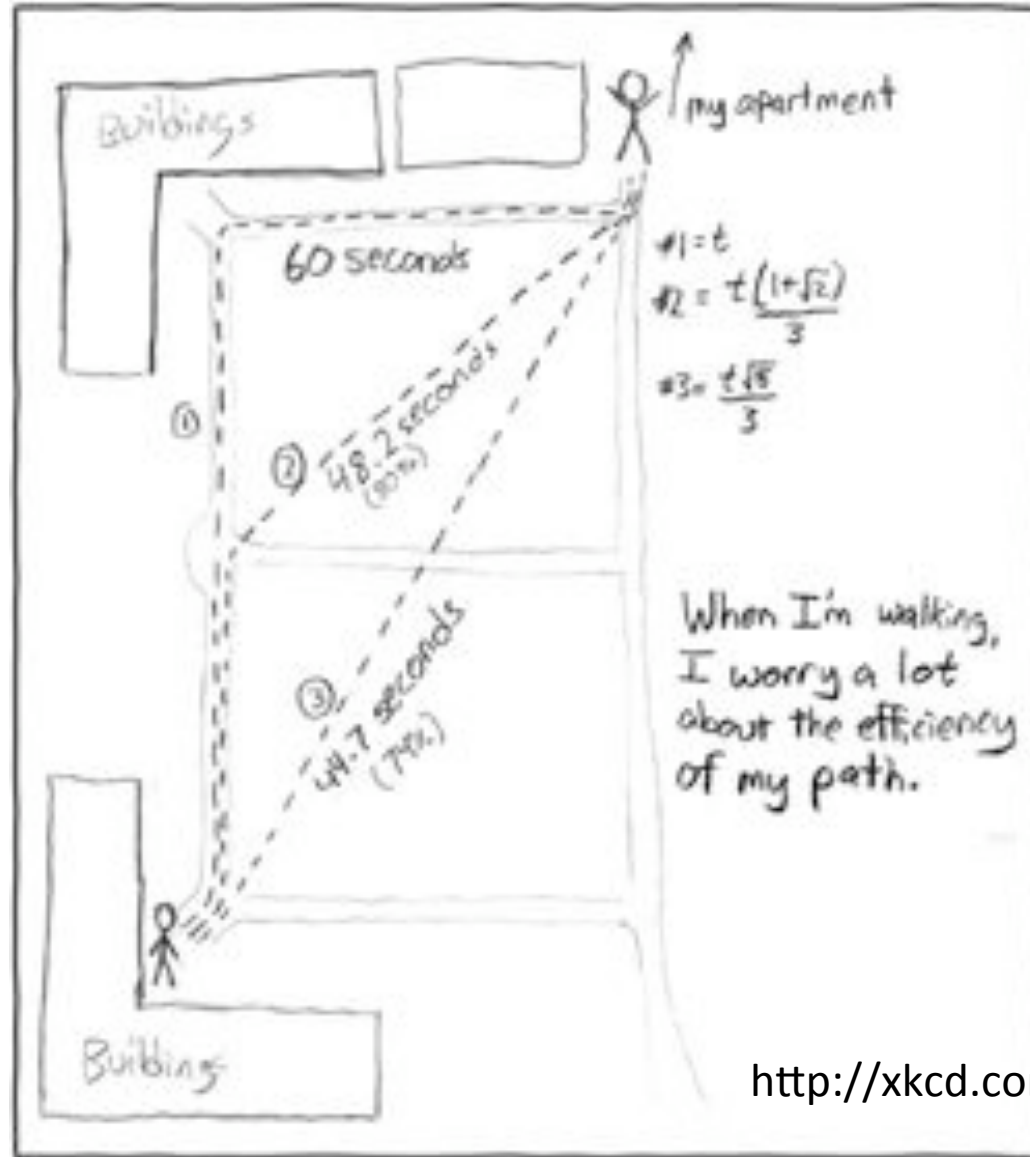
#pin

mini\_project

edit good note 0

Just now by Atri Ratra

# Shortest Path Problem



# Another more important application

Is BGP a known acronym for you?



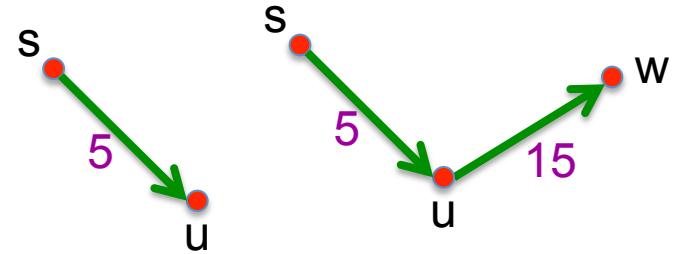
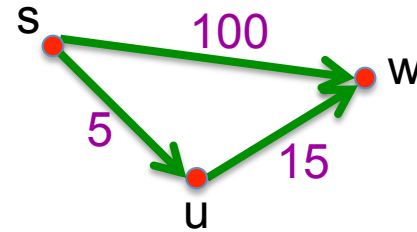
Routing uses shortest path algorithm

# Shortest Path problem

**Input:** *Directed* graph  $G=(V,E)$

Edge lengths,  $l_e$  for  $e$  in  $E$

“start” vertex  $s$  in  $V$



**Output:** All shortest paths from  $s$  to all nodes in  $V$

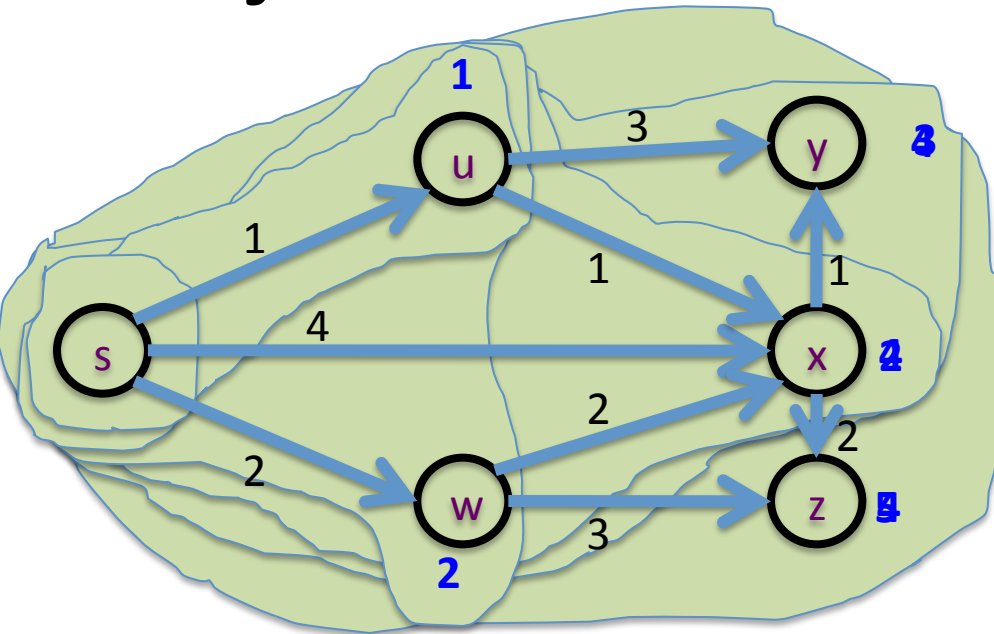
# Dijkstra's shortest path algorithm

E. W. Dijkstra (1930-2002)





# Dijkstra's shortest path algorithm



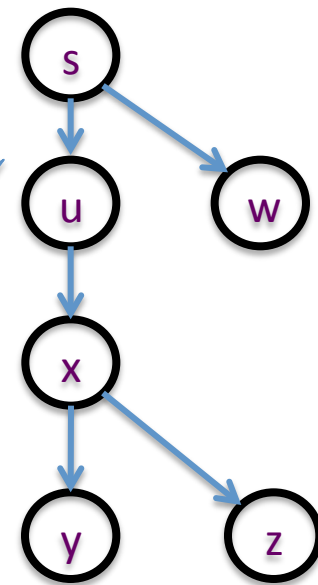
$$d'(w) = \min_{e=(u,w) \in E, u \in R} d(u) + l_e$$

$d(s) = 0$                        $d(u) = 1$   
 $d(w) = 2$                        $d(x) = 2$   
 $d(y) = 3$                        $d(z) = 4$

Input: Directed  $G=(V,E)$ ,  $l_e \geq 0$ ,  $s \in V$

$R = \{s\}$ ,  $d(s) = 0$   
 While there is a  $x$  not in  $R$  with  $(u,x) \in E$ ,  $u \in R$   
     Pick  $w$  that minimizes  $d'(w)$   
     Add  $w$  to  $R$   
      $d(w) = d'(w)$

Shortest paths



# Couple of remarks

The Dijkstra's algo does not explicitly compute the shortest paths

Can maintain “shortest path tree” separately

Dijkstra's algorithm does not work with **negative** weights

Left as an exercise

# Rest of Today's agenda

Prove the correctness of Dijkstra's Algorithm

Runtime analysis of Dijkstra's Algorithm

# Reading Assignment

Sec 4.4 of [KT]

