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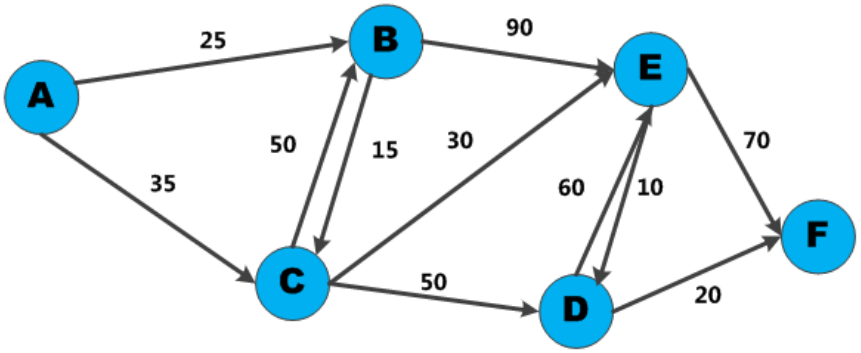
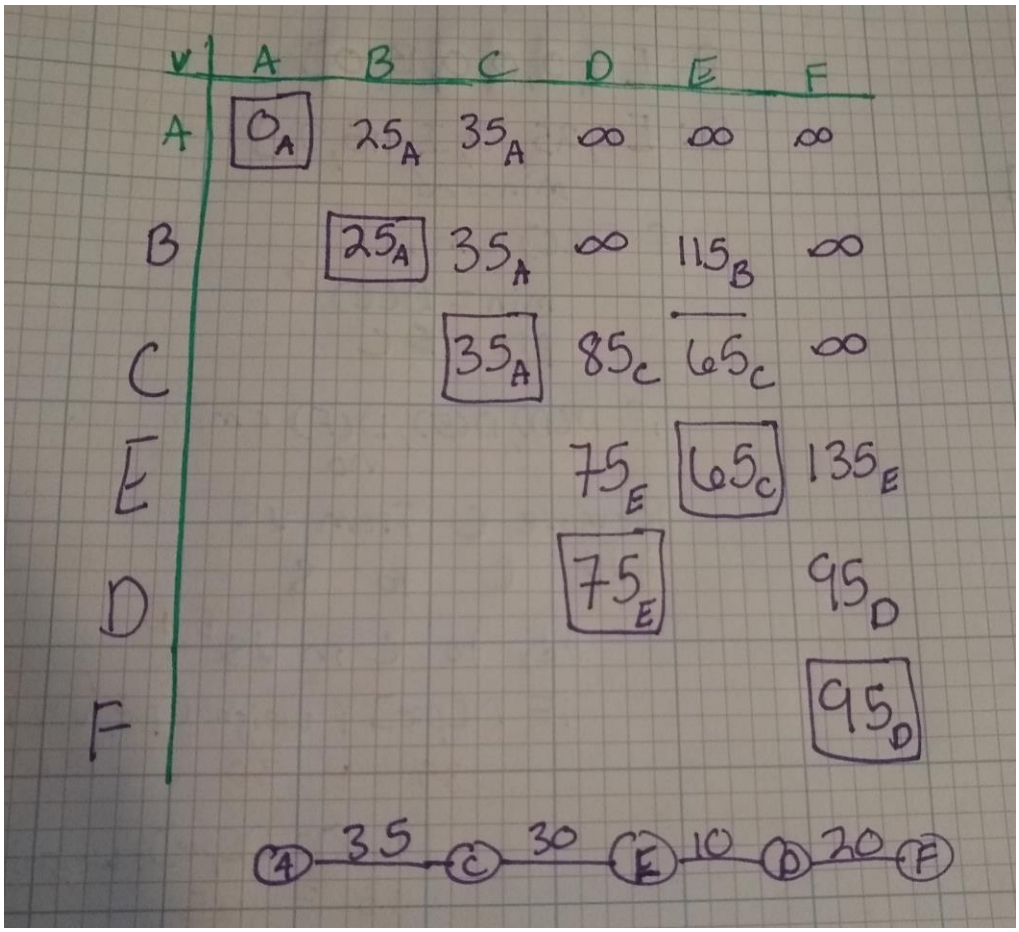
Comp311
March 28, 2019
Week 9 Homework

Problem 1 [10 points]

Apply Dijkstra's algorithm to the graph below starting from vertex A. Show the predecessor and distance arrays after each pass of the algorithm.





① S: {A}

VS: {B, C, D, E, F}

P: [A, A, A, A, A, A]

D: [0, 25, 35, I, I, I]

min = ∞

if D(B) < min

min = D(B) 25

pre = B

if D(C) < min

no

if D(D) < min

no

if D(E) < min

no

if D(F) < min

no

Remove B from VS

Add B to S

All adjacent to B in VS C, E

if D[pre] + weight(pre, v) < D[v]

D[B] + weight(B, C) < D[C]

25 + 15 < 35

no

D[B] + weight(B, E) < D[E]

25 + 96 < I

D[v] = D[pre] + weight(pre, v)

I = 115

P[v] = pre

P[E] = B

② S: {A, B}

VS: {C, D, E, F}

P: [A, A, A, A, B, A]

D: [0, 25, 35, I, 115, I]

min = ∞

if D(C) < min

min = D(C) 35

pre = C

if D(D), D(E), D(F) < min

no

Remove C from VS

Add C to S

Adj to C in VS E, D

if D[pre] + weight(pre, v) < D[v]

35 + 30 < 115

D[v] = D[pre] + weight(pre, v)

115 = 65

P[v] = pre

P[E] = C

if D[pre] + weight(pre, v) < D[v]

35 + 50 < I

D[v] = D[pre] + weight(pre, v)

I = 85

P[v] = pre

P[D] = C

③ S: {A, B, C}
VS: {D, E, F}
P: [A, A, A, C, C, 0]
D: [0, 25, 35, 85, 65, ∞]
min = ∞
if D(D) < min
85
min = D(D)
pre = D
if D(E) < min
min = D(E) 65
pre = E
Remove E from VS
Add E to S
Adj to E in VS D, F
if D[pre] + weight(pre, F) < D[V]
65 + 70 < ∞
D(V) = D(pre) + weight
D(F): 65 + 70
135
P[V] = pre
P[F] = E
if D[pre] + weight(pre, D) < D[V]
65 10 < 85
D(V) = D(pre) + weight
85 = 75
P[V] = pre
P[D] = E

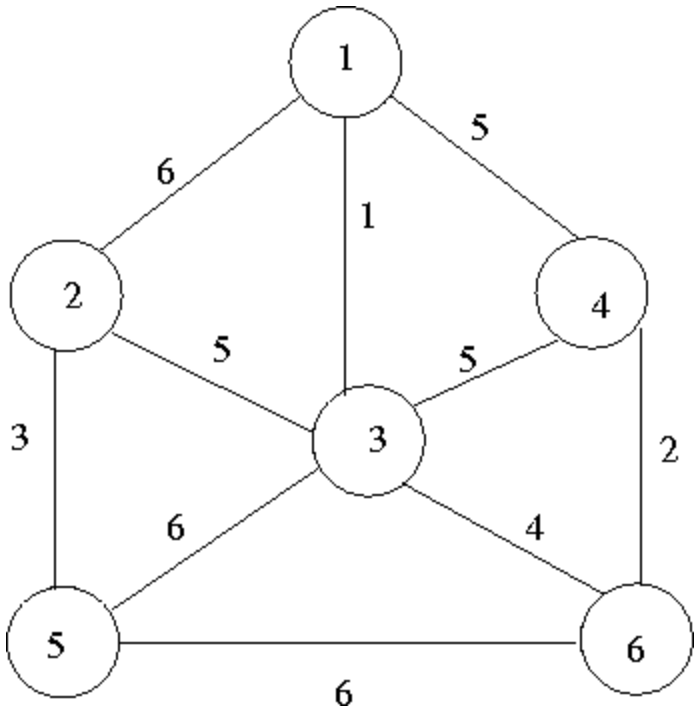
④ S: {A, B, C, E}
VS: {D, F}
P: [A, E, A, E, C, E]
DS: [0, 25, 35, 75, 65, 135]
min = ∞
if D(D) < min
75
min = D(D)
pre = D
if D(F) < min
no
Remove D from VS
Add D to S
All adj to D in VS F
if D[pre] + weight(pre, V) < D[V]
75 + 20 < 135
D(V) = D(pre) + weight
135 = 95
P[V] = pre
P[F] = D

⑤ S: {A, B, C, E, D}
VS: {F}
P: [A, A, A, E, C, D]
D: [0, 25, 35, 75, 65, 95]
min = ∞
if D(F) < min
min = D(F) 95
pre = F
Remove F from VS
Add F to S
VS is empty

S: {A, B, C, E, D, F} D: [0, 25, 35, 75, 65, 95]
P: [A, A, A, E, C, D]

Problem 2 [10 points]

Apply Prim's algorithm to the graph below starting from vertex 1. Show the spanning tree after each edge is added.



① S: {2, 3, 4, 5, 6}

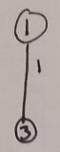
H: [{1,2}, {1,3}, {1,4}]

u: 1

start = u
for each edge(u,v) outgoing
  if v <> t
    add edge(u,v) to h

Extract an edge (lowest) (i,j) from h
while j is in t - Extract
  extract (i,j) from h
Remove j from S
add edge (i,j) to t
u = j

t:



② S: {2, 4, 5, 6}

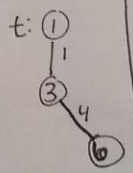
H: [{3,2}, {3,4}, {3,5}, {3,6}, {1,2}, {1,4}]

u: 3

start = u
for each edge(u,v)
  if v <> t
    add edge to h

Extract an edge (lowest) from h
while j is in t (3,6)
Remove j from S
add edge (i,j) to t
u = j

t:



③ S: {2, 4, 5}

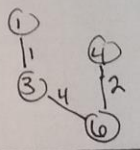
H: [{3,2}, {3,4}, {3,5}, {1,2}, {1,4}, {6,5}, {6,4}]

u: 6

start = u
for each edge(u,v)
  if v <> t
    add edge(u,v) to h

Extract an edge (6,4) (i,j) from h
while j is in t
Remove j from S
add edge (6,4) (i,j) to t
u = j

t:



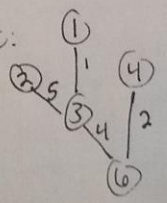
④ S: {2, 5}

H: [{3,2}, {3,4}, {3,5}, {1,2}, {1,4}, {6,5}]

u: 4

start = u
for each edge (u,v)
  if v <> t
    ~~if~~ (3,2)
Extract an edge (i,j) from h
while 2 is in t
Remove 2 from S
add edge (i,j) to t
u = j

t:



⑤ S: {5}3

H: [{3,4}5, {3,5}6, {1,2}6, {1,4}5, {6,5}6, {2,5}3]

u = 2

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Start=u
for each edge (u,v)
    if v<>t
        add edge(u,v)
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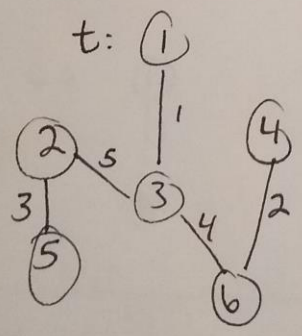
Extract an edge $(i,j)^{2,5}$ from h

while S is int

Remave j from S

add edge $(i,j)^{2,5}$ to t

u=j (5)



S is empty

Reflection [5 points]

In two to three paragraphs of prose (i.e. sentences, not bullet lists) using APA style citations if needed, summarize and interact with the content that was covered in the class "Meet" session (or face-to-face class) this week. In your summary, you should highlight the major topics, theories, practices, and knowledge that were covered. Your summary should also interact with the material through personal observations, reflections, and applications to the field of study. In particular, highlight what surprised, enlightened, or otherwise engaged you. Make sure to include at least one thing that you're still confused about. In other words, you should think and write critically not just about what was presented but also what you have learned through the session. Feel free to ask questions in this as well since it will be returned to you with answers.

This week I watched around 8 Cuckoo Hashing videos, including a 1.5 long Harvard Advanced Algorithm video. I feel like I have a good understanding of that this algorithm is designed to do now and am looking forward (though I should have already started) to this lab!

I will say that I enjoyed listening to Todd this week in course. Sometimes I feel like Tim is just way too smart for me and have a hard time understanding what the general concept is on assignments, but I feel like Todd "dumbed" it down for me – not saying anything bad or negative about Todd, just saying that I need things "dumbed" down for me sometimes. Walking through Dijkstra's and Prim's algorithm's one step at a time really helped.

My one question this week what other searching or sorting algorithm's would you suggest for us to read up on for the real-world?