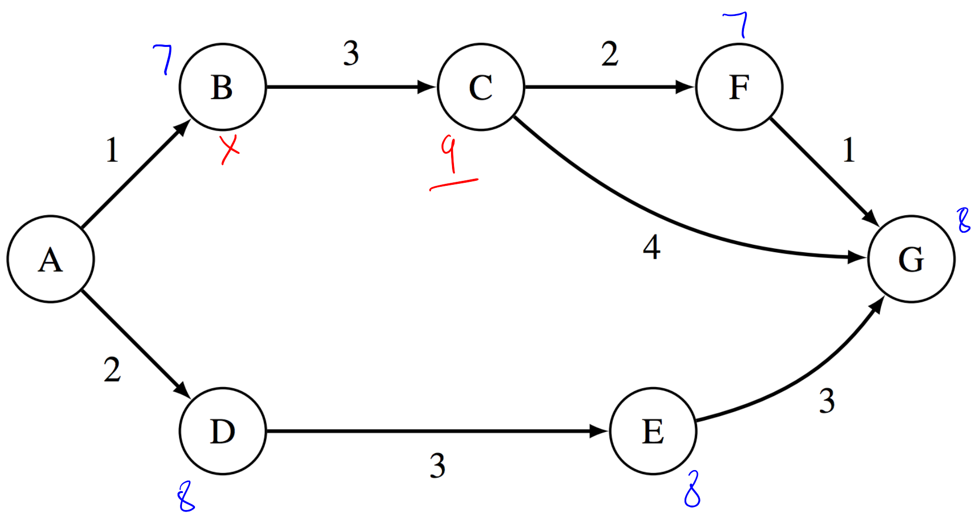
CS 61B Spring 2018 — Graphs & Sorting

Discussion 12: April 10, 2018

1 Dijkstra's Algorithm

For the graph below, let `g(u, v)` be the weight of the edge between any nodes `u` and `v`. Let `h(u, v)` be the value returned by the heuristic for any nodes `u` and `v`.



Edge weights	Heuristics
$g(A,B) = 1$	$h(A,G) = 8$
$g(B,C) = 3$	$h(B,G) = 6$
$g(C,F) = 4$	$h(C,G) = 5$
$g(C,G) = 4$	$h(F,G) = 1$
$g(F,G) = 1$	$h(D,G) = 6$
$g(A,D) = 2$	$h(E,G) = 3$
$g(D,E) = 3$	
$g(E,G) = 3$	

1.1 Run Dijkstra's algorithm to find the shortest paths from A to every other vertex. You may find it helpful to keep track of the priority queue and make a table of current distances.

A → B → C → F → G

A → D → E

B: 1
C: 4
D: 2
E: 5
F: 6
G: 7

1.2 Given the weights and heuristic values for the graph below, what path would A* search return, starting from A and with G as a goal?

A → B → ~~C~~ → F → G
A → D

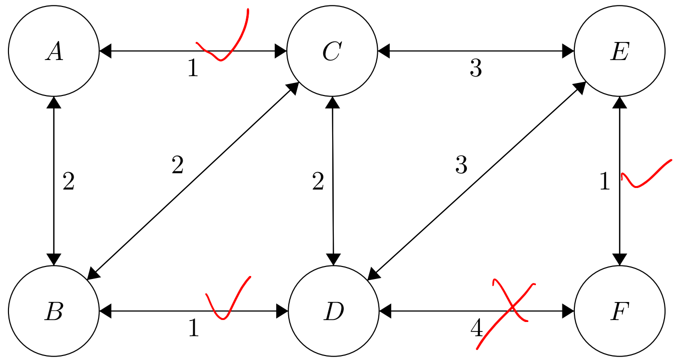
A → D → E → G

1.3 Is the heuristic admissible? Why or why not?

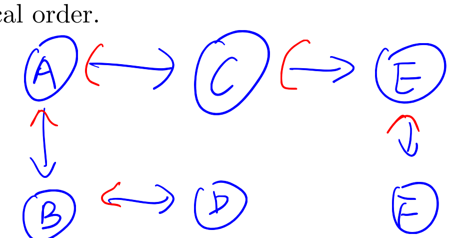
No, h(C,G) greater than g(C,G)

h(A,G) greater than the shortest paths

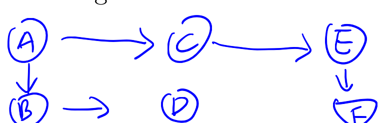
2 Minimum Spanning Trees



2.1 Perform Prim's algorithm to find the minimum spanning tree. Pick A as the initial node. Whenever there is more than one node with the same cost, process them in alphabetical order.



2.2 Use Kruskal's algorithm to find a minimum spanning tree.



2.3 There are quite a few MSTs here. How many can you find?

~~two~~

~~use B → D~~

~~or C → D~~

three choice of 2, only can choose one

two choice of three. only can choose one

total 2*3 =6

3 Mechanical Sorting

3.1 Show the steps taken by each sort on the following unordered list:

```
0, 4, 2, 7, 6, 1, 3, 5
```

(a) Insertion sort

0 | 4 2 7 6 1 3 5
0 4 | 2 7 6 1 3 5
0 2 4 | 7 6 1 3 5
0 2 4 7 | 6 1 3 5
0 2 4 6 7 | 1 3 5
0 1 2 4 6 7 | 3 5
0 1 2 3 4 6 7 | 5
0 1 2 3 4 5 6 7 |

(b) Selection sort

0 | 4 2 7 6 1 3 5
0 1 | 4 2 7 6 3 5
0 1 2 | 4 7 6 3 5
0 1 2 3 | 4 7 6 5
0 1 2 3 4 | 7 6 5
0 1 2 3 4 5 | 7 6
0 1 2 3 4 5 6 | 7

(c) Merge sort

0 4 2 7 1 6 1 3 5

0 4 27 1 6 5 3

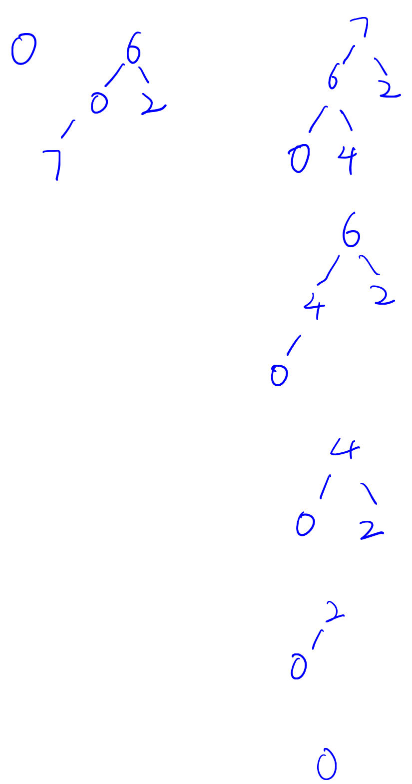
0 2 4 7 1 3 5 6

0 1 2 3 4 5 6 7

(d) Use heapsort to sort the following array (hint: draw out the heap). Draw out the array at each step:

```
0, 6, 2, 7, 4
```

heap



7 6 2 0 4

6 4 2 0 7

4 0 2 6 7

2 0 4 6 7

0 2 4 6 7