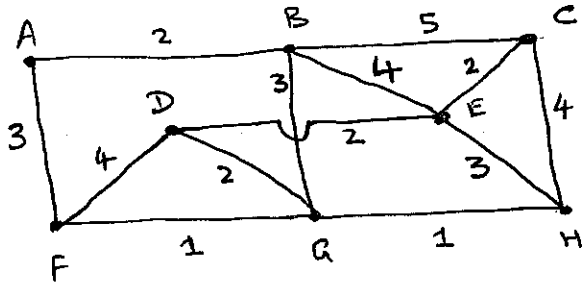
CS 4413 ALGORITHM ANALYSIS

TAKE HOME EXAM. DUE ON NOV, 22, 2016

① CONSIDER THE GRAPH: (20-POINTS)



(a) Starting from node A, find a Depth-first and Breadth-first spanning trees (ignore the weights)

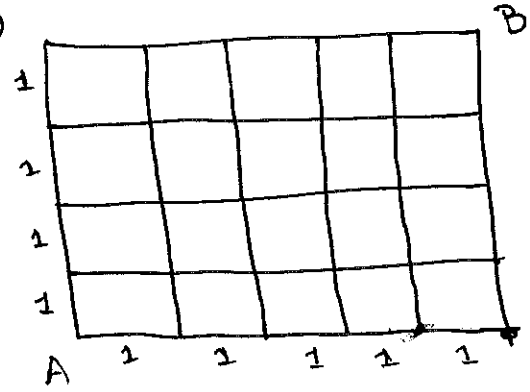
(b) Find a Minimum Spanning tree (MST) using Kruskal's and Prim's algorithm. What is the total cost of MST by each method

(c) Find a shortest path from A to H. What is the path and its length

(d) Find all pair shortest paths for the above graph

(e) Find the length of the path from A to H in the MST found in (b). How does it Compare with the shortest path in (c)?

② Consider a grid as follows: Assume all are unit square. (10-POINTS)



· COUNT THE NUMBER of distinct paths from A to B. Explain how you found your result.

(3) Generate $N = 10,000$ pairs (u, v) where u and v are uniformly distributed random numbers in $[0, 1)$.

(a) Plot the 10,000 pairs as 10,000 points in the unit square

(b) Count the # of points that lie inside the quadrant of the unit circle

(c) Estimate the area of the quadrant of the unit circle

(d) Plot the area Vs N when you change $N = 10^5, 10^6, 10^7$

(4) Describe the LAS VEGAS ALGORITHM for electing a leader. Derive an expression for the number of rounds $l(n)$ needed to elect a leader among n people. This expression is a recurrence relation. Plot $l(n)$ Vs n for $n = 3$ to 20.

Note: All plots must be accurately done using computer plot routines