**Assignment 15**

C-13.2 Show that every language L in P is polynomial-time reducible to the language M={5}, that is, the language that simply asks if the binary encoding of the input is equal to 5.

Answer:

Algorithm **reduceL2M**(x)

if **verifyL**(x) = yes then

return 5

else

return 0

1. Show that the MST decision problem is polynomial-time reducible to the Subset Sum problem.

Answer:

Algorithm **reduceSS2MST** (G,max)

if **verifyMST**(G, max, T) = yes then

return 5

else

return 0

Algorithm **verifyMST**(G, max, T)

S 🡨 MST(G) // S is edges in MST

sum 🡨 0

for each e in S.elements() do

sum 🡨 sum + weight(e)

if sum <= max then

return yes

else

return no

1. Show the shortest path decision problem is polynomial-time reducible to the MST decision problem. Hint: convert the shortest path problem to a decision problem, then reduce to MST problem.

Answer:

The decision problem converted should be: Is there a path between u and v with distance at most k.

Algorithm **reduceShortestPath2MST** (G, u, v, max)

G’ 🡨 new Graph

v🡨G’.insertVertex(v)

u🡨G’.insertVertex(u)

G’.insertEdge(u,v,2)

if **verifyShortestPath**(G, u, v, max, T) = yes then

return (G,2)

else

return (G’,1)

Algorithm **verifyShortestPath** (G, u, v, max, T)

path 🡨 shortestPath(G, u, v)

sun 🡨 distance(v)

if sum <= max then

return yes

else

return no