PAOLA TERRAZAS

CS2302

SOLVING A MAZE USING DIFFERENT SEARCH METHODS

DR. FUENTES

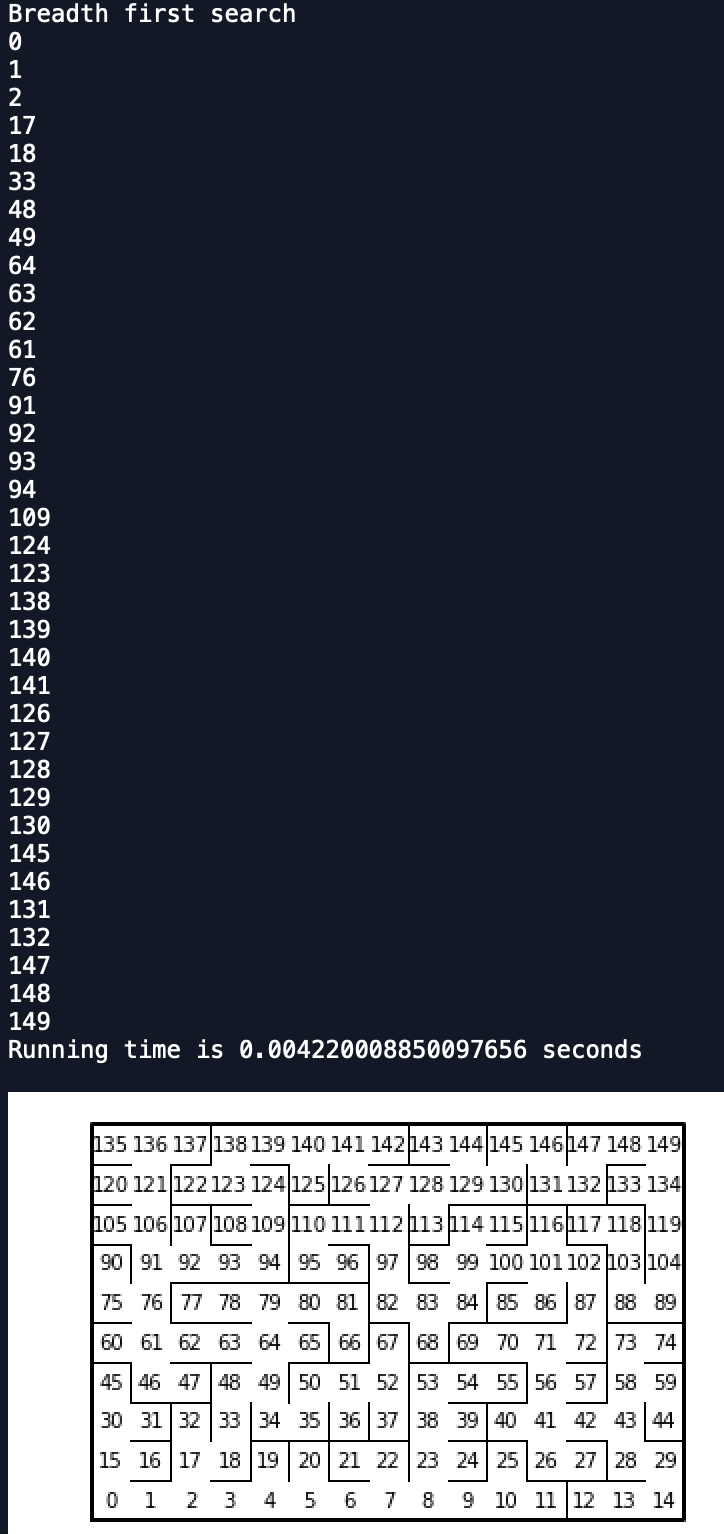
TA – ANINDITA NATH

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LAB 7 REPORT

In our seventh lab we were asked to modify our lab 6 to allow if removing less than n -1 walls, some cells will not be reachable from the start cells. Also, if you remove more than n-1 walls, you would have multiple paths from the source to the destination. We also needed to write a method to build the adjacency list representation of our maze as well as implement breadth-first search, depth-first search and depth-first search using recursion. This lab was very challenging for me. I was able to create the adjacency list, that part being very simple. Then, I went on to creating the breadth first search I found easiest. I used the code from my lab 6, using my normalMaze method. It begins by declaring q, an empty list. I also have a variable known as visited that is the length of G equal to False and my previous list all set to -1. There is a while loop that continues looping as long as the length of q is not 0 and the element q is popped and if the i in G is false then it is set to True because its visited and queue is added to previous and the i is then inserted in the first position of q, returning previous.

My results are as follows for breadth-first search:



The list that is printed is the path that was found using my printPath method. The running time is also printed. I attempted the depth-first search doing what the professor suggested in the lab description, using the same code from breadth-first search but the queue is replaced by a stack, but I was only getting more confused. Therefore, I attempted to write a new method from scratch. My method took G and v as parameters, then created and empty listed named visited like my other method and a stack with v. A while loop that continues if the stack is not empty, then it created a variable u, which would pop the item in the stack. After that is a for loop for i in every u in G, if i was not visited the stack would append that element, otherwise visited would append u. Lastly, it returns visited. When I attempted to run my code, it would result in error with my normalMaze method. I could not figure the issue. I also attempted to do the recursion depth-first search but I also had several issues.

But more importantly than getting my code to run correctly using my maze, I learned the importance and difference between depth-first search and breadth-first search. Although, my depth-first search method did not run, I can collect big 0 with the code I wrote for it. My depth-first search method seems to be O(n^2) considering it has two loops. My breadth-first search method also is O(n^2) for the same reason, they are quite similar.

#SOURCE CODE

#PAOLA TERRAZAS

#DR.FUENTES

import matplotlib.pyplot as plt

import numpy as np

import random

import time

def draw\_maze(walls,maze\_rows,maze\_cols,cell\_nums=False):

fig, ax = plt.subplots()

for w in walls:

if w[1]-w[0] ==1: #vertical wall

x0 = (w[1]%maze\_cols)

x1 = x0

y0 = (w[1]//maze\_cols)

y1 = y0+1

else:#horizontal wall

x0 = (w[0]%maze\_cols)

x1 = x0+1

y0 = (w[1]//maze\_cols)

y1 = y0

ax.plot([x0,x1],[y0,y1],linewidth=1,color='k')

sx = maze\_cols

sy = maze\_rows

ax.plot([0,0,sx,sx,0],[0,sy,sy,0,0],linewidth=2,color='k')

if cell\_nums:

for r in range(maze\_rows):

for c in range(maze\_cols):

cell = c + r\*maze\_cols

ax.text((c+.5),(r+.5), str(cell), size=10,

ha="center", va="center")

ax.axis('off')

ax.set\_aspect(1.0)

def wall\_list(maze\_rows, maze\_cols):

# Creates a list with all the walls in the maze

w =[]

for r in range(maze\_rows):

for c in range(maze\_cols):

cell = c + r\*maze\_cols

if c!=maze\_cols-1:

w.append([cell,cell+1])

if r!=maze\_rows-1:

w.append([cell,cell+maze\_cols])

return w

def numOfSets(S):

n =0

for i in range(len(S)):

if S[i] <0:

n+=1

return n

def DisjointSetForest(size):

return np.zeros(size,dtype=np.int)-1

def find(S,i):

if S[i]<0:

return i

return find(S,S[i])

def find\_c(S,i):

if S[i] <= 0:

return i

s = i

while S[i] >= 0:

i = S[i]

root = i

while S[s] >= 0:

p = S[s]

S[s] = root

s = p

return root

def compMaze(row,col,S,walls):

while numOfSets(S)>1:

c = random.randint(0,(len(walls)-1))

if find\_c(S,walls[c][0])!= find\_c(S,walls[c][1]):

union(S,walls[c][0],walls[c][1])

walls.pop(c)

def adjList(l,v,y):

l[v].append(y)

l[y].append(v)

def union(S,i,j):

ri = find\_c(S,i)

rj = find\_c(S,j)

if ri!=rj:

S[rj] = ri

def normalMaze(row,col,S,walls):

count = 0

maze = (maze\_rows\*maze\_cols)-1

while count < maze:

c = random.randint(0,(len(walls)-1))

if find(S,walls[c][0])!= find(S,walls[c][1]):

adjList(l,walls[c][0],walls[c][1])

union(S,walls[c][0],walls[c][1])

walls.pop(c)

count +=1

def printPath(prev,v):

if prev[v] != -1:

printPath(prev,prev[v])

print(v)

def breadthFirst(G,v):

q = []

visited = [False for i in range(len(G))]

previous = [-1 for i in range(len(G))]

q.insert(0,v)

visited[v] = True

while len(q) is not 0:

queue = q.pop(0)

for i in G[queue]:

if visited[i] is False:

visited[i] = True

previous[i] = queue

q.insert(0,i)

return previous

def depthFirst(G,v):

visited = []

stack = [v]

while stack != []:

u = stack.pop()

for i in G[u]:

if i not in visited:

stack.append(i)

visited.append(u)

return visited

plt.close("all")

maze\_rows = 10

maze\_cols = 15

walls = wall\_list(maze\_rows,maze\_cols)

S = DisjointSetForest(maze\_rows\*maze\_cols)

l = [[] for i in range(maze\_rows\*maze\_cols)]

starttime = time.time()

print("Breadth first search ")

normalMaze(maze\_rows, maze\_cols,S,walls)

B = breadthFirst(l,0)

printPath(B,len(l)-1)

endtime = time.time()

print('Running time is', endtime-starttime, 'seconds')

#starttime = time.time()

#print("Depth first search ")

#normalMaze(maze\_rows, maze\_cols,S,walls)

#printPath(D,len(l)-1)

#endtime = time.time()

#print()

#print('Running time is', endtime-starttime, 'seconds')

#print()

draw\_maze(walls,maze\_rows,maze\_cols,cell\_nums=True)

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