Tutorial 3 Uninformed Search (no information)

1. Discuss the advantages and disadvantages of breadth-first search and depth-first search.
   , efficiency, compare…

   completeness, optimality, time, space

   Answer:

	Breadth-First Search	Depth-First Search
Advantages	Used to find the shortest path between vertices.✔	May not find an optimal solution to the problem.✔
Disadvantages	All of the connected vertices must be stored in memory. So consumes more memory✔	Consumes less memory since it only needs to store a single path from the root of the tree down to the leaf node.✔

   completeness: both guarantee solution

   time: consume more time compare to DFS (depends on the situation)

   JIA SHIN LEE

2. Figure 1 below shows a puzzle problem, which requires rearrangement of the tiles to transform the order from start state to goal state. One is only permitted to slide a tile **left, right, up or down** into the blank square.

Start

1	**2**
	3

Goal

2	**3**
1	

Figure 1: The puzzle problem

(iii) Provide the goal formulation of the puzzle problem above.

Answer:XUE NIR YONG

Goal : To reach the goal state of Puzzle[2,3,1,0]✔

Optimal Solution : To slide the minimum tiles to reach the goal state✔(shortest path/number of step

Abstraction : Each tile can only slide a tile left, right, up or down into the blank square.✔

(iv) Formulate the puzzle problem above by specifying the initial state, successor functions, goal test, step cost, and path cost.

Answer:CHARUKESHI A/P CHANDRA SEKAR

Initial State = Puzzle[1,2,0,3] ✔ indicators: Puzzle[TL,TR,BL,BR]

Successor functions (possible movement) = Move left, right, up or down

move([1,left]), move([1,up]), move([2,right]), move([2,up]), move([3,left]), move([3,down]), move([4,right]), move([3,down])✔

Goal test = search([TL,TR,BL,BR], [2,3,1,0]) :- ✔

goal([2,3,1,0])✔

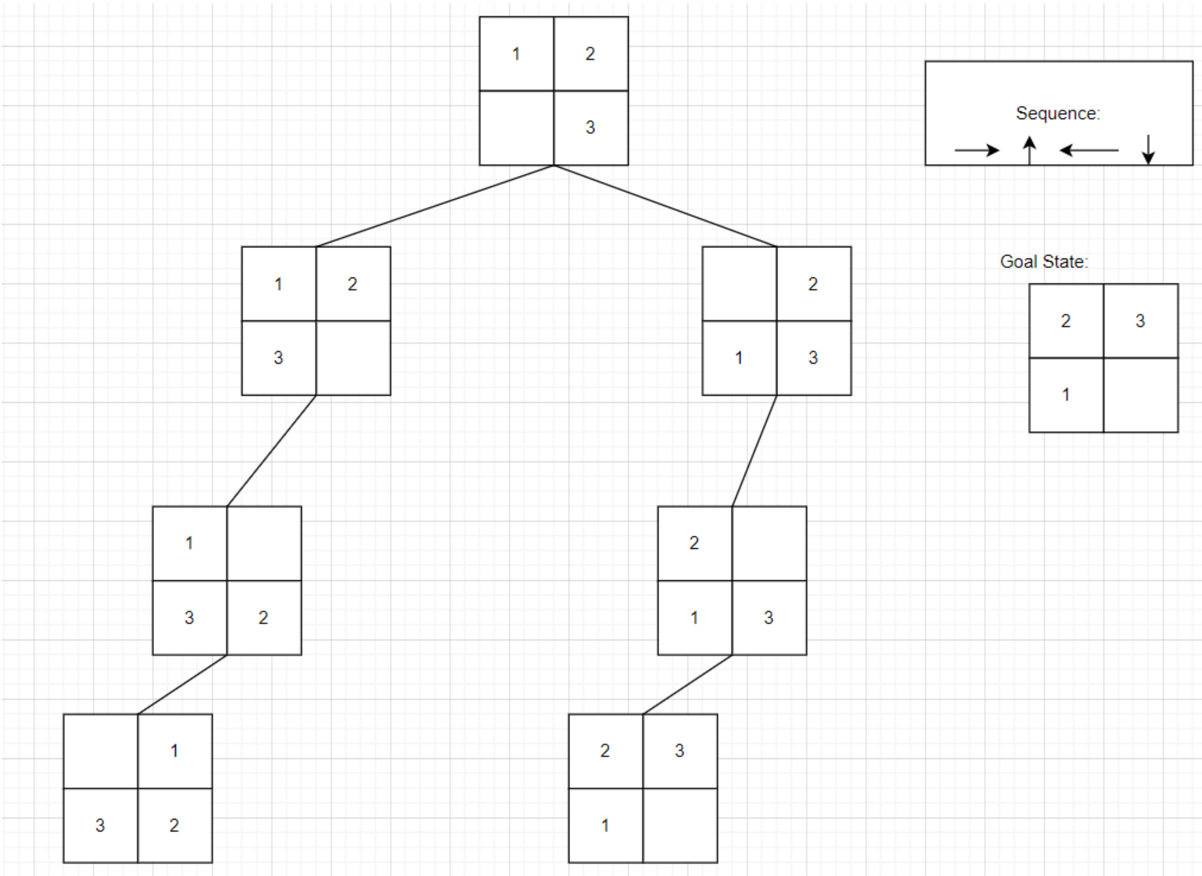
Step cost = 1✔

Path cost = total step cost to reach the goal (bear in mind, goal and problem formulation are just planning stage, no solution)

(v) Perform **breadth-first search** and **depth-first search** on the puzzle problem above. Draw the resulting trees for both.

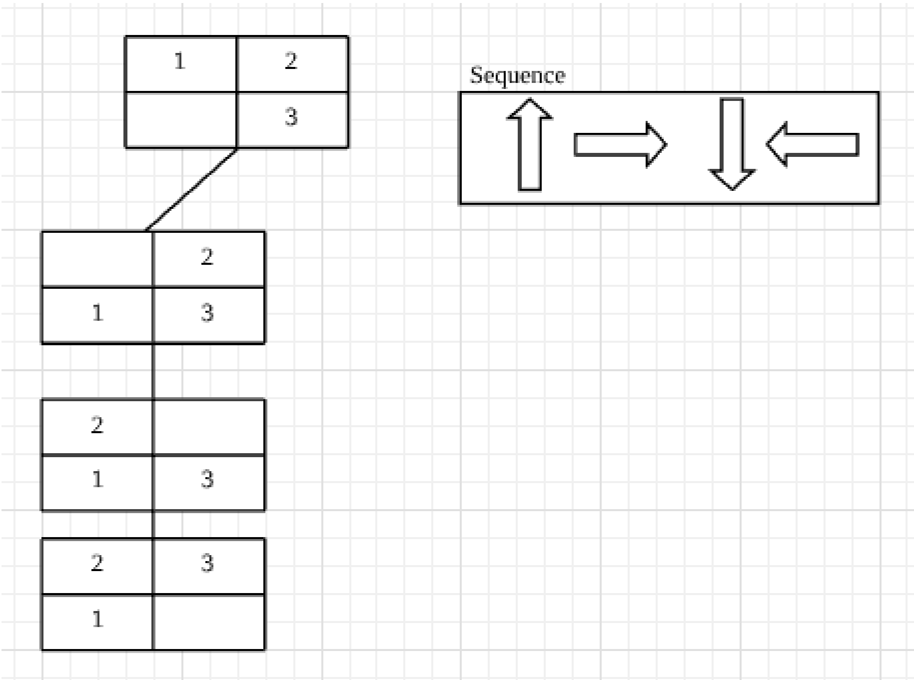
Answer:WEI MENG NG **breadth-first search** KIT YAO LOKE **depth-first search**

breadth-first search



good try✔

DFS



good try✓

sequence: ↑ → ↓ ←

3. Figure 1 below shows an 8-puzzle problem, which requires rearrangement of the tiles to transform the order from start state to goal state. One is only permitted to slide a tile **up, down, left or right** into the blank square.

1	**2**	**3**
	5	**6**
4	**7**	**8**

Start □ **Goal**

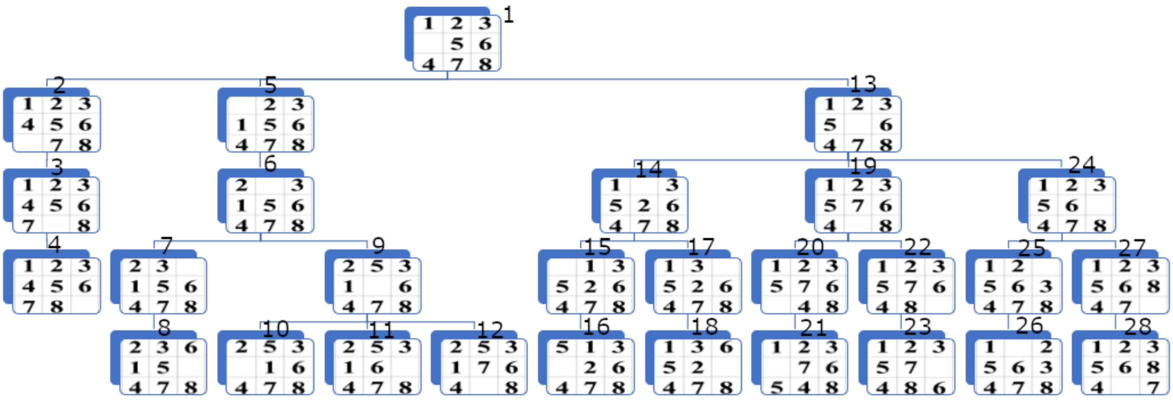
1	**2**	**3**
4	**5**	**6**
7	**8**	

<u>Figure 2: The 8-puzzle problem</u>

(i) Perform **breadth-first search** and **depth-first search** on the 8-puzzle problem above. Draw the resulting trees for both. (Remark: you may stop the search at level 4)

Answer:TING SHUN KAM **depth-first search**YI CHIN OOI **breadth-first search**

Depth-first search



✔

(ii) Evaluate the efficiency of **breadth-first search** and **depth-first search** in terms of completeness, optimality, time efficiency and space efficiency in solving the problem above.

Answer:SHUN WAI TANG

	BFS	DFS
Completeness	Complete	Complete (as long as not trapped in endless loop)
Optimality	Optimal (shortest path)	Not optimal
Time Complexity	Depends on the location of the goal node.	
Space Complexity	Consume more memory	Consume less memory

	Breadth-first search	Depth-first search
Completeness	higher	lower
Optimality	higher	lower
Time efficiency	slower	faster
Space efficiency	lower	higher

4. In the family river-crossing problem, two parents are with their two children - a son and a daughter - came to a wide river. The only way to get to the other side was to ask a fisherman if he could lend them his boat. However, the boat could carry only two persons. For safety reason, no child should be left alone without the supervision of at least one parent. The family must get to the other side and finally returns the boat to the fisherman, assuming only the fisherman and the two parents know how to row the boat.

Based on the family river-crossing problem, answer the following questions.

(b) Describe the goal formulation and problem formulation.

Answer: JUN XIAN LEE

	Goal formulation	Problem formulation
definition	- is the first step in solving problem	- is the process of deciding what actions and states to consider.
component:	- goal :family reach the right river bank and return the boat to F	- initial state : 2P , 2C, F,B at left
	- optimal solution: reach the goal with minimal step/distance	- successor function: possible movement: e.g. when 2P, 2C at left, possible movement= 1P, 1C> right/ 1F+1P>right...
	- abstraction: 1 boat=2people, ……….	- goal test :to check current state=goal state
		- path/step cost=distance between left, right river bank, path = total distance to reach the goal

(c) (i) Suggest a simple representation of the initial state. You must briefly explain the representation.

Answer:JING HENN SOH

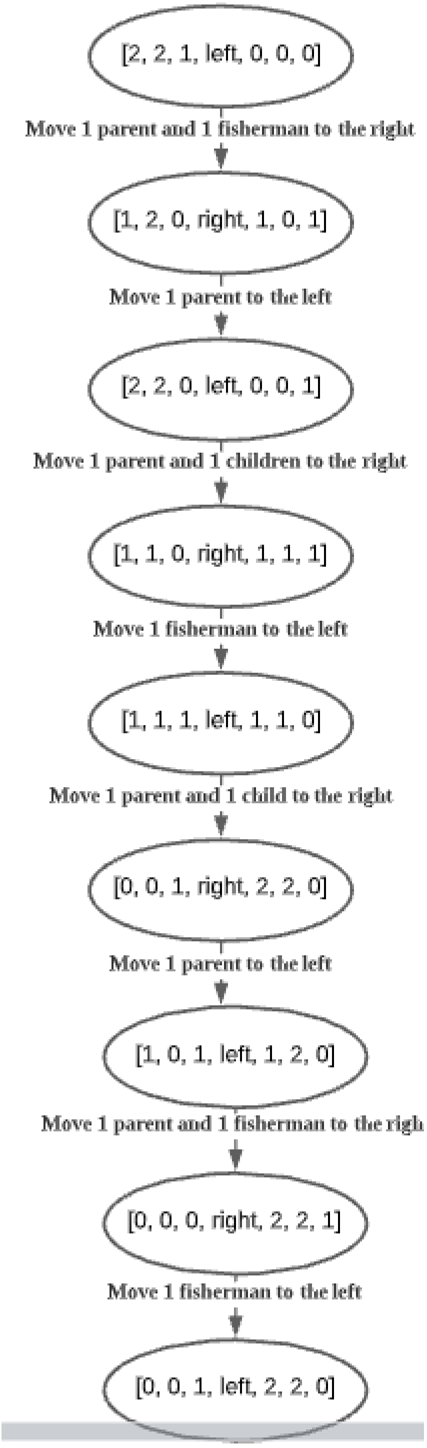
Index	Representation
0	Number of parents on the left side.
1	Number of children on the left side.
2	Number of fisherman on the left side.
3	Location of boat

4	Number of parents on the right side.
5	Number of children on the right side.
6	Number of fisherman on the right side.

initial state = [2, 2, 1, left, 0, 0, 0] ✔

(ii) Draw the depth-first search tree to show how all the states are being traversed.

Answer:NG KWOK WAI ARVIN



✔good, but ensure it follows the constraint/abstraction

5. Figure 2 below shows a directed graph. Assume that the traversal would start from **Vertex 0 to Vertex 7**. All vertices to be visited in **ascending order** (i.e. from smaller number to bigger number).

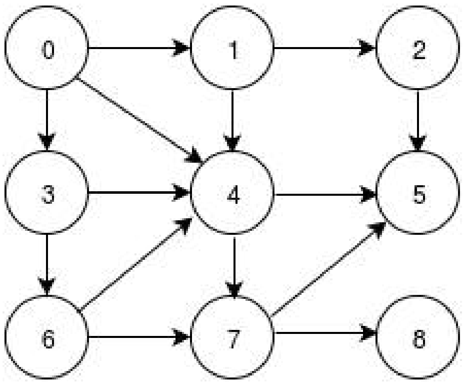
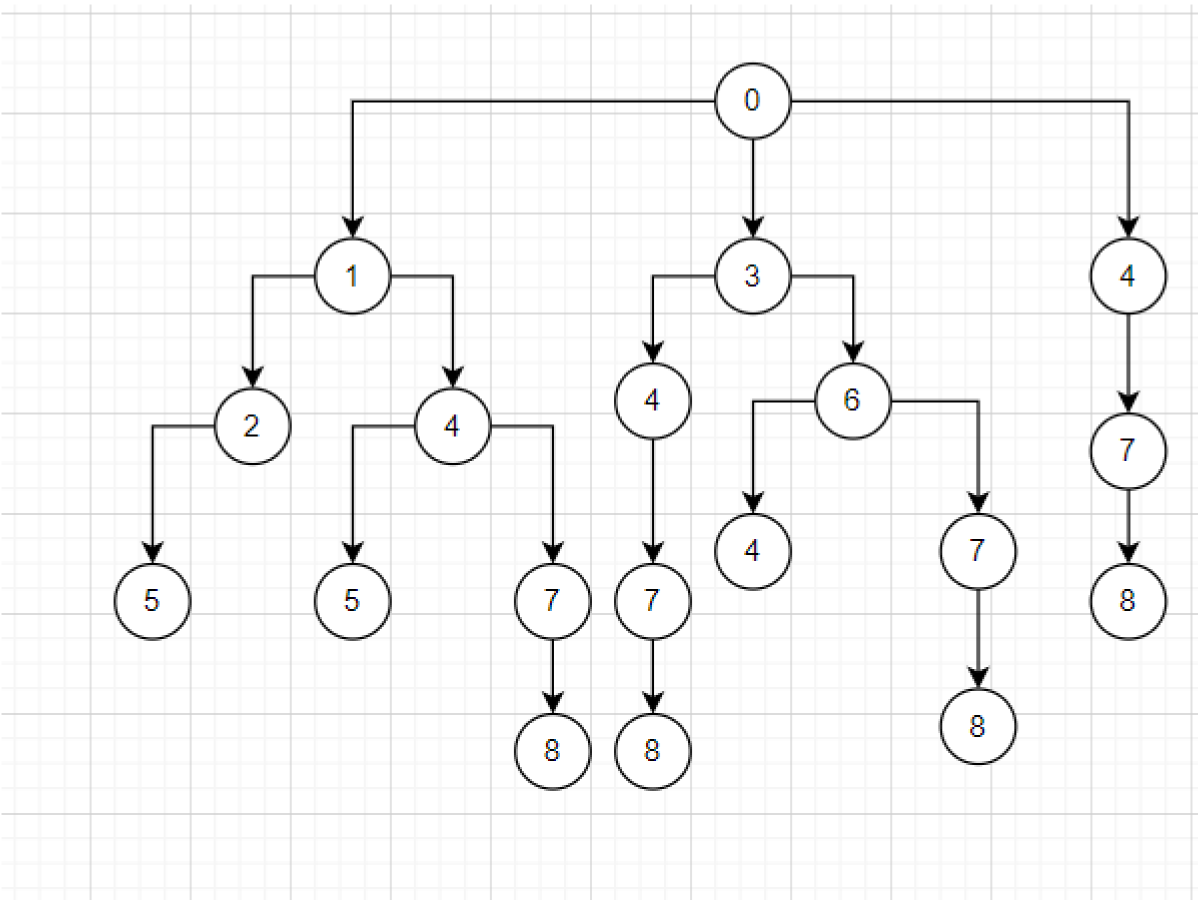


Figure 2. The directed graph

(i) Perform a **depth-first search** on the directed graph to traverse from Vertex 0 to Vertex 7. Draw the resulting tree and list the returned path.

Answer:WEI HAN YONG

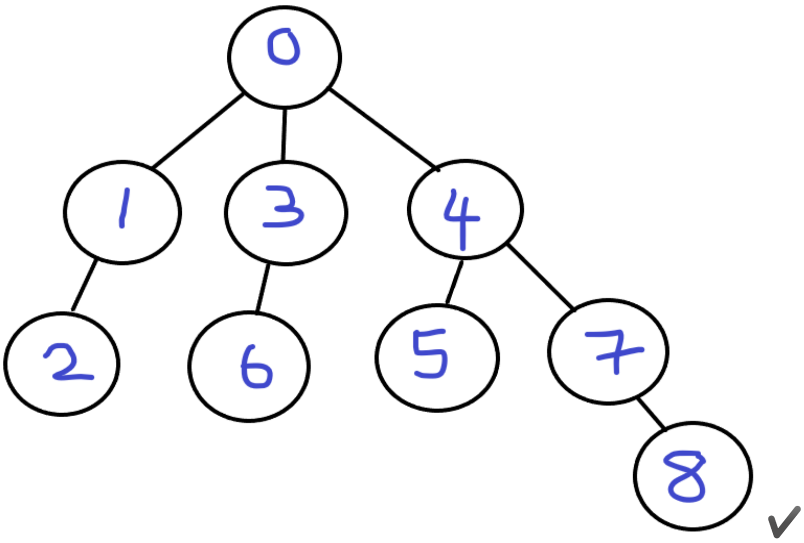


Return path:0-1-4-7

0 → 1 → 2 → 5 → 4 → 5 → 7

(ii) Perform a **breadth-first search** on the directed graph to traverse from Vertex 0 to Vertex 7. Draw the resulting tree and list the returned path. Avoid repeated state.

Answer:CHUNG SING CHAN



0 → 4 → 7

(iii) Evaluate the efficiency of **breadth-first search** and **depth-first search** in terms of completeness, optimality, time efficiency and space efficiency in solving the problem above.

Answer:LEE HONG QUAN NICHOLAS

Depth-first search is generally preferred when the tree is very deep and desired values or data occurs infrequently while breadth-first search is generally preferred in shallow trees that aren't too wide. Also used if it is known that the desired node is closer to the root level.

	Breadth-first Search	Depth-first Search
Completeness	Yes ✓ *It always reaches goal*	yes ✓ *Fails in infinite-depth spaces*
Optimality	Yes ✓ *If we guarantee that deeper*	No ✓ *It may find a non-optimal*

	solutions are less optimal, e.g. step-cost=1	*goal first*
Time Efficiency	BFS takes more time 1+b+b2+b3+… +bd + (bd+1-b)) = O(bd+1) *This is the number of nodes we generate*	DFS consumes lesser time O(b^m) with m=maximum depth
Space Efficiency	Consume more memory O(bd+1) *keeps every node in memory*	Consume less memory O(bm), i.e., linear space *Only need to remember a single path*

Tutorial 2 Assessing AI

Instead of asking, *'Can machines think?'*, Alan Turing said we should ask, *'Can machines pass a behavior test for intelligence?'*. Turing predicted that by the year 2000, a computer could be programmed to have a conversation with a human interrogator for five minutes and would have a 30% chance of deceiving the interrogator that it was a human. (Negnevitsky, 2002).

5. Explain Turing Test. CHUNG SING CHAN

   Answer: A Turing Test is a method of inquiry in artificial intelligence (AI) for **determining whether or not a computer is capable of thinking like a human being.** In this test, Turing proposed that the computer can be said to be intelligent if it can mimic human response under specific conditions. The Turing Test is a deceptively simple method of determining whether a machine can demonstrate human intelligence: If a machine can engage in a conversation with a human without being detected as a machine, it has demonstrated human intelligence. ✓