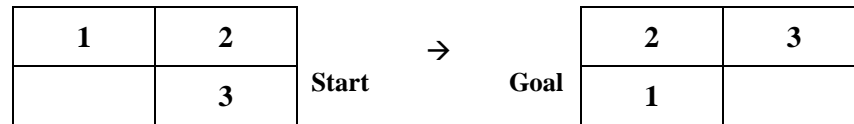
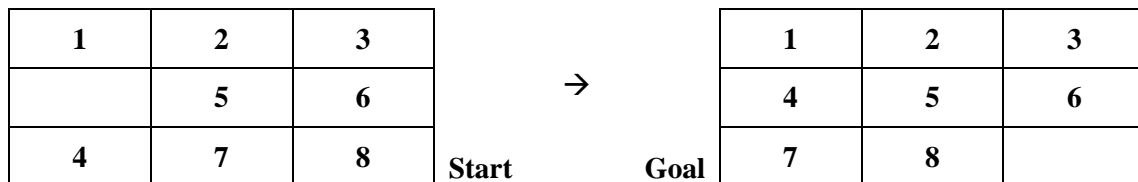


Tutorial 3

1. Discuss the advantages and disadvantages of breadth-first search and depth-first search.
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.

Figure 1: The puzzle problem

- (i) Provide the goal formulation of the puzzle problem above.
 - (ii) Formulate the puzzle problem above by specifying the initial state, successor functions, goal test, step cost, and path cost.
 - (iii) Perform **breadth-first search** and **depth-first search** on the puzzle problem above. Draw the resulting trees for both.
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.

Figure 2: The 8-puzzle problem

- (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)
 - (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.
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.

- (a) Describe the goal formulation and problem formulation.
 - (b)
 - (i) Suggest a simple representation of the initial state. You must briefly explain the representation.
 - (ii) Draw the depth-first search tree to show how all the states are being traversed.
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).

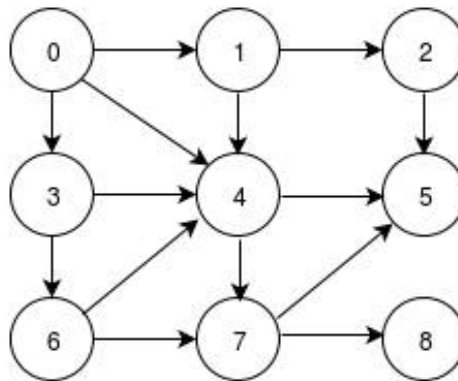


Figure 2. The directed graph

- (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.
- (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.
- (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.