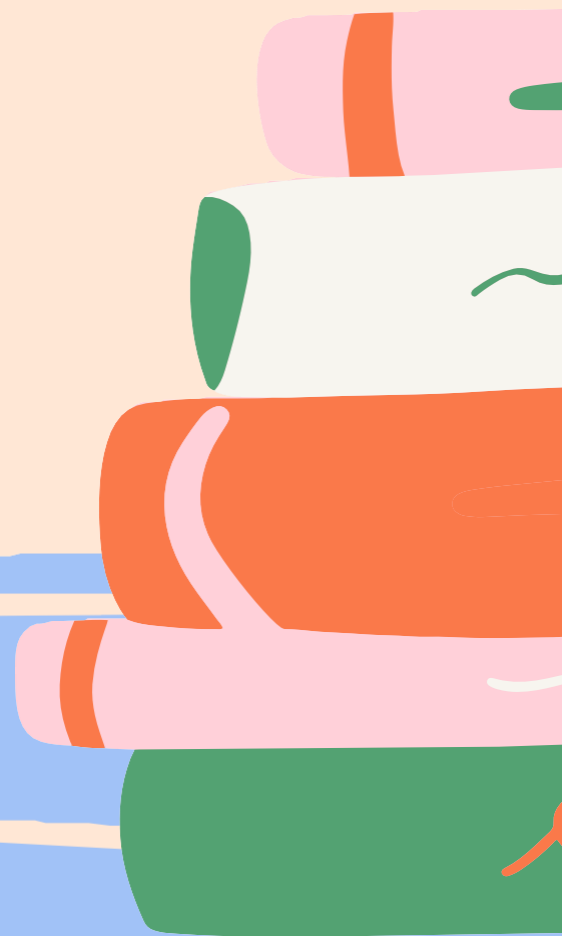


UNIVERSITY OF SCIENCE, VNU-HCM

A* Algorithm

Group 14 - CSC10004





SINCERELY, THANKS!!

Teacher Đinh Bá Tiến

Teacher Hồ Tuấn Thanh

Teacher Nguyễn Lê Hoàng Dũng

Teacher Trương Phước Lộc

Team Member

19127216 - Đặng Hoàn Mỹ

19127544 - Nguyễn Hoàn Hoài Tâm

19127609 - Đinh Quang Tú

“WHAT??.”

Introduction

History

Terms & Data Structure

Implement

Complexity

Graph Example

Application

QUIZ!!!



What is A* Algorithm?

19127609 – Đinh Quang Tú



A* Algorithm is one of the most successful search algorithms to find the shortest path between nodes or graphs.



HOW CAN WE GO TO THE GOAL?

fast?
less consuming?
many obstacles?



A* ALGORITHM

find the shortest
distance; we also want
save as much time as
possible



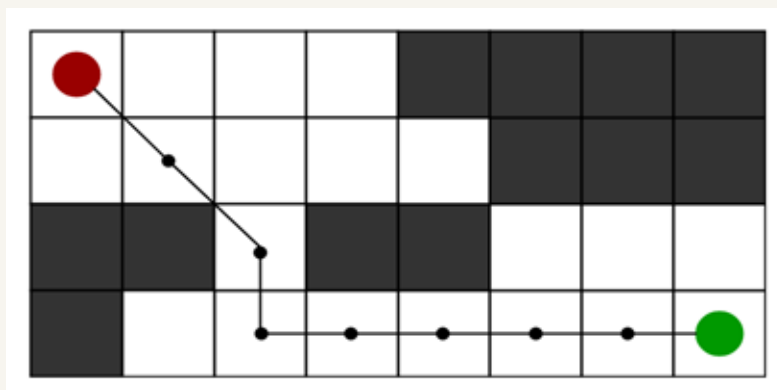
HISTORY

- 1968
- the **Shakey project** aimed to build a mobile robot that has artificial intelligence to plan its actions
- combine heuristic approaches like Greedy Best- First-Search and formal approaches like **Dijkstra's Algorithm**.

APPLICATION

Have everything you need within reach.

- Graph Traversal & Path-findings
- Games & Web-based maps
 - ❑ Warcraft III



2D Grid having several obstacles and we start from the source red cell to reach towards a goal green cell



What is A* Algorithm?

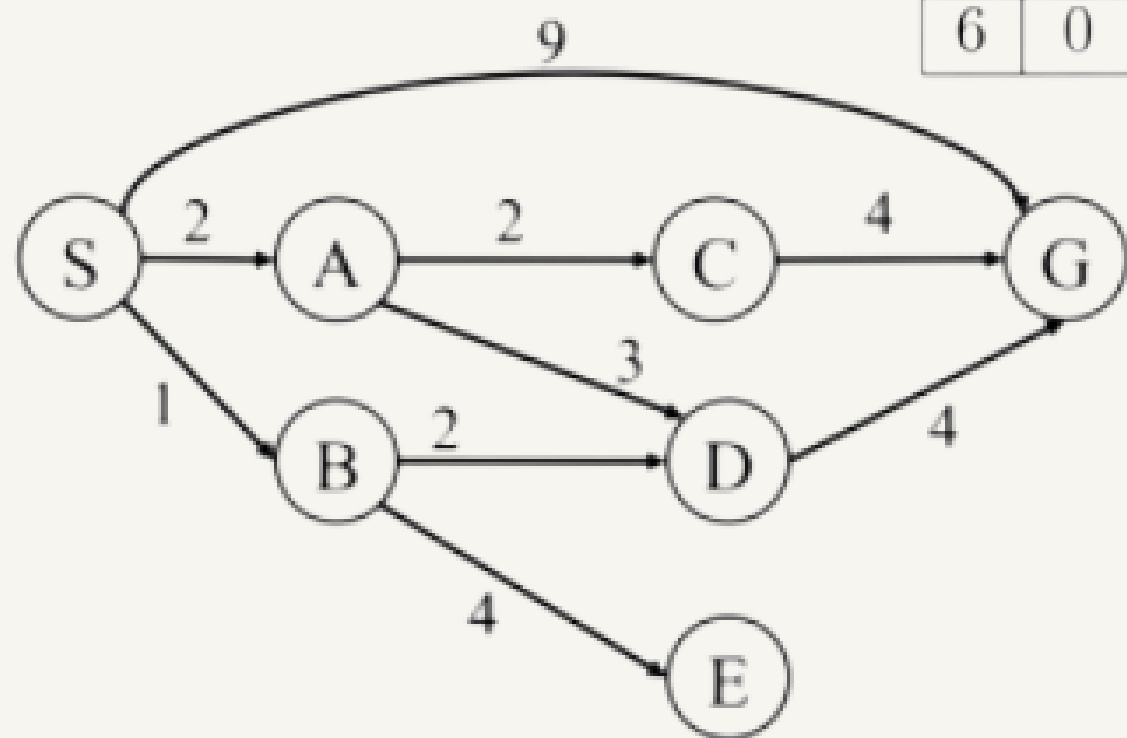
19127216 – Đặng Hoàn Mỹ



Terms

Heuristics? Cost? Admissible? Consistent?

- **Heuristics** the estimated cost of moving from the current state to the goal state.
- **Cost** the cost that we arrange on the graph (weight).



Heuristic						
S	A	B	C	D	E	G
6	0	6	4	1	10	0

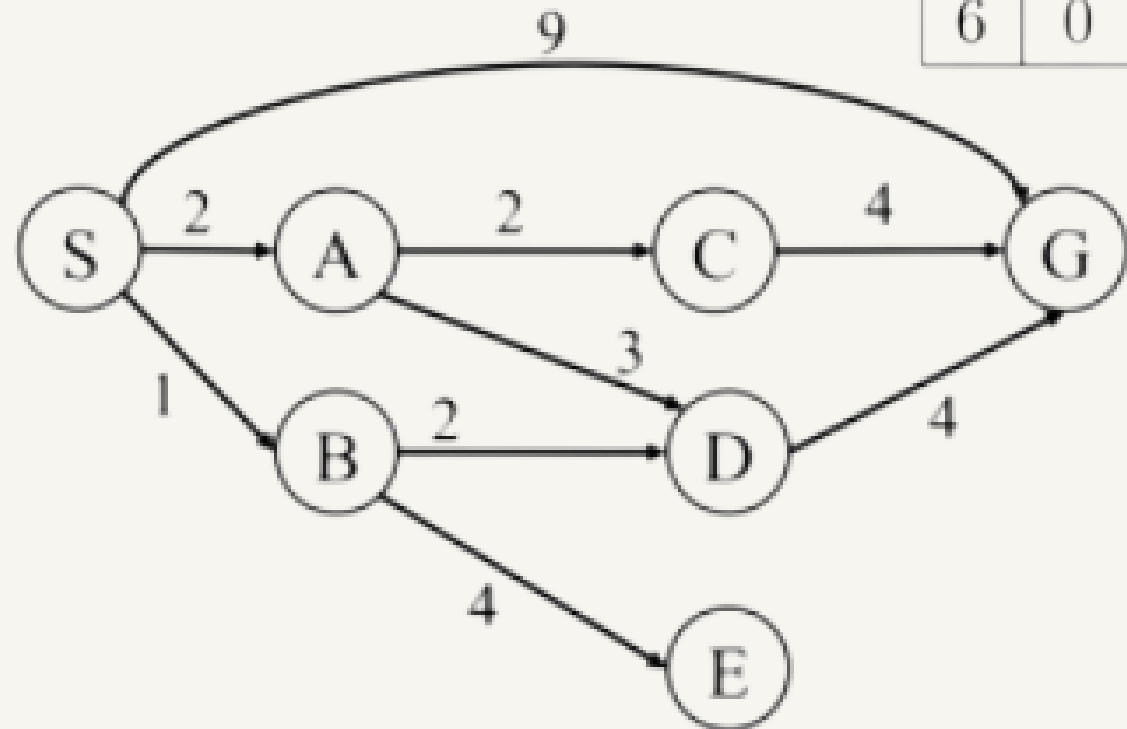


Terms

Heuristics? Cost? Admissible? Consistent?

- **Admissible heuristic** the estimated cost must always be lower than or equal to the actual cost of reaching the goal state.

$$\forall n, 0 \leq h(n) \leq h^*(n)$$



Heuristic						
S	A	B	C	D	E	G
6	0	6	4	1	10	0



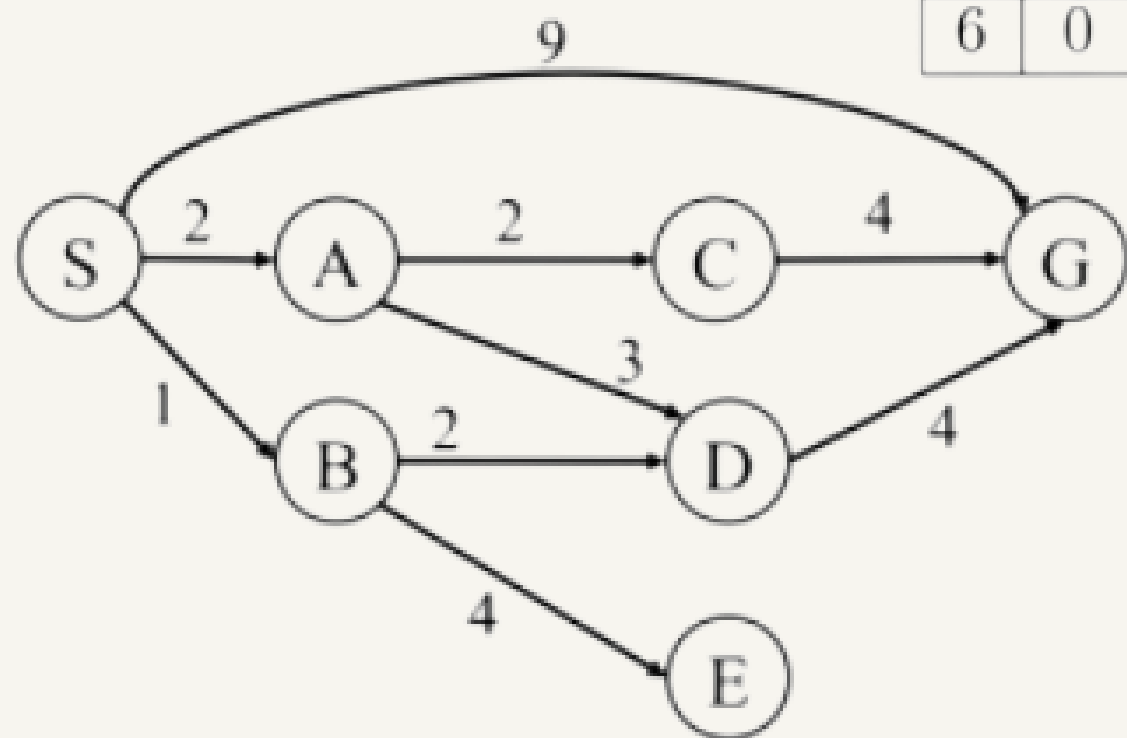
Terms

Heuristics? Cost? Admissible? Consistent?

- **Consistent heuristic** less than or equal to the estimated distance from any neighboring vertex to the goal, plus the cost of reaching that neighbor.

$$h(A) \leq \text{cost}(A, C) + h(C)$$

$\forall A, C$ with C is a successor of A



Heuristic						
S	A	B	C	D	E	G
6	0	6	4	1	10	0



DATA STRUCTURE

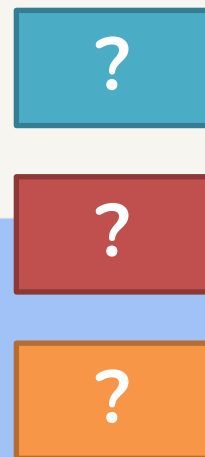
This plays important role in A*.

frontier is a priority queue

- > keep track of the node

- > rearrange that to get the best node

frontier



DATA STRUCTURE

This plays important role in A*.

frontier is a priority queue

-> keep track of the node

-> rearrange that to get the best node

frontier

$$f(n) = g(n) + (n) \mid V \mid P$$

$$f(n) = g(n) + (n) \mid V \mid P$$

$$f(n) = g(n) + (n) \mid V \mid P$$



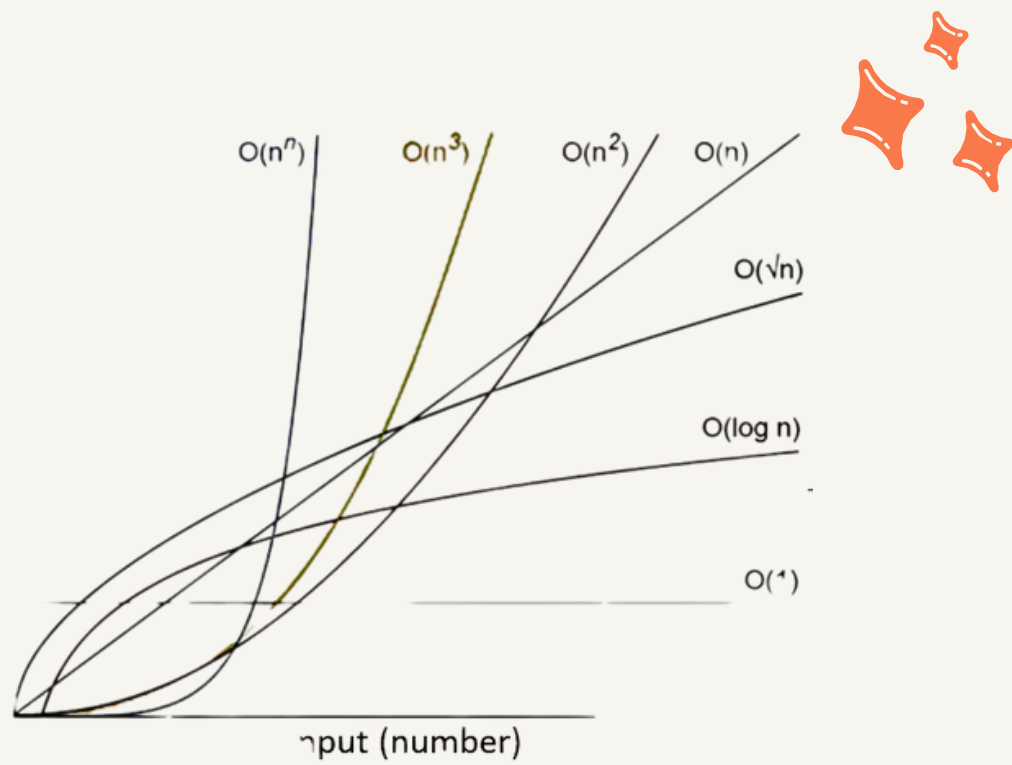
IMPLEMENT

The main technique for this algorithm is using frontier as a priority queue to put the nodes while waiting.

- get the smallest cost of a path from that and put in the visited to mark up what has been visited
- catch the goal, we start to reverse the path (the parents of visited nodes) that we saved in the expanded
- there is no goal, we traverse all the children of that node and put it in the frontier with the formula

$$f(n) = g(n) + h(h)$$



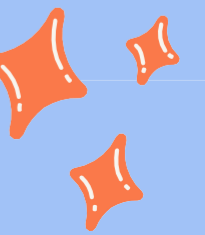
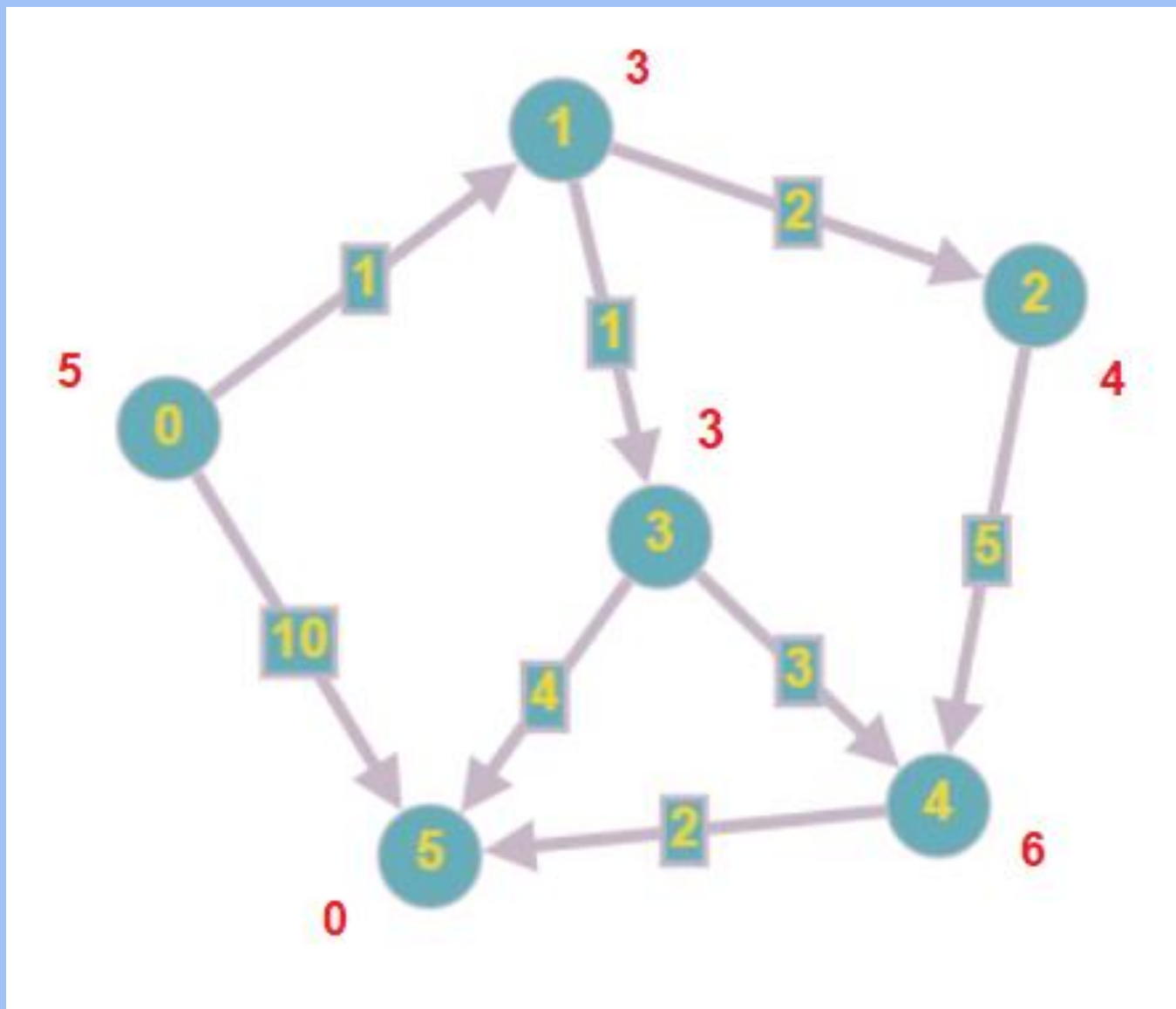


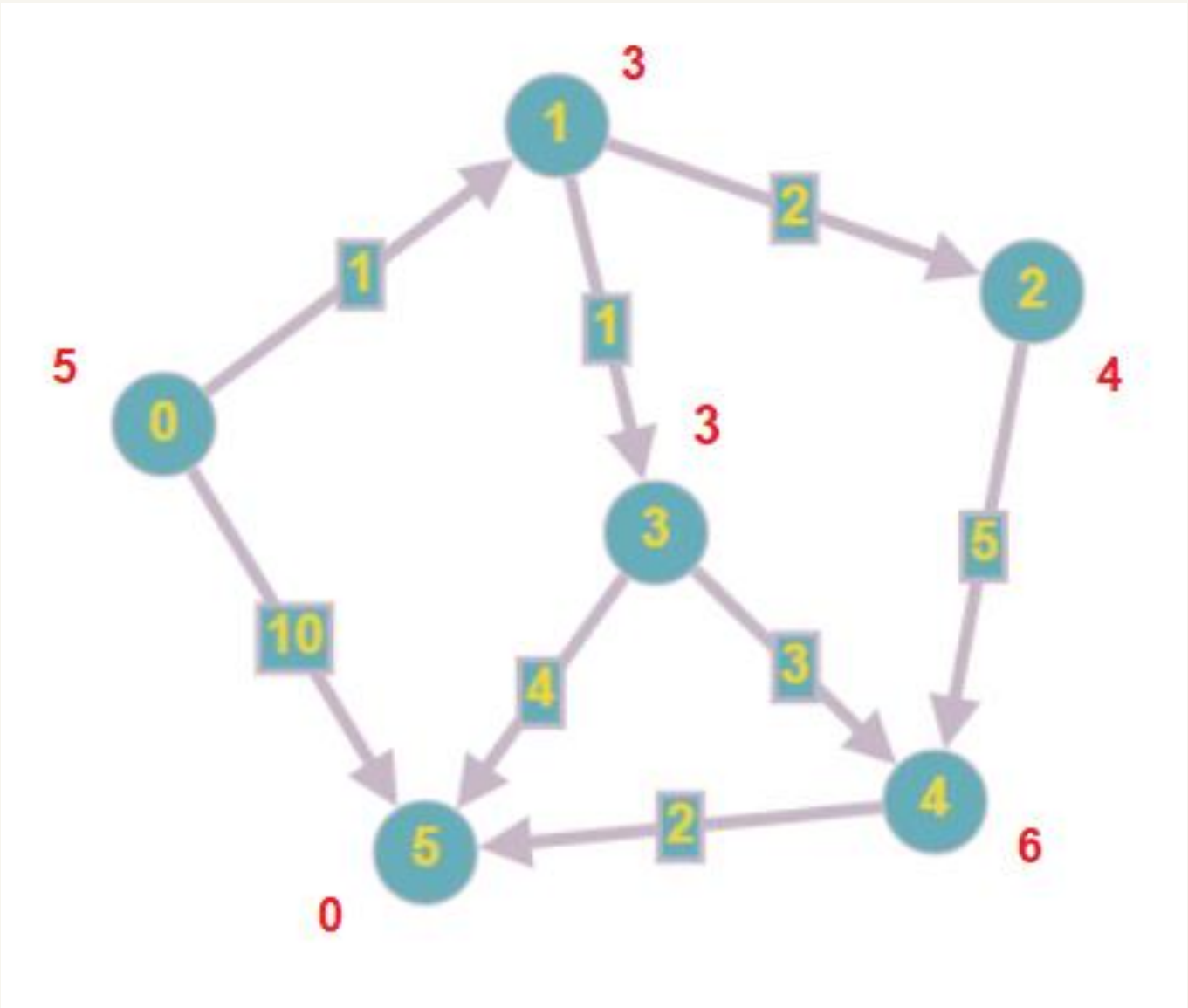
COMPLEXITY

The number of nodes expanded is exponential in the depth of the solution (the shortest path) d , where b is the branching factor (the average number of successors per state)

$$O(b^d)$$

GRAPH EXAMPLE





Frontier

$f(n) = g(n) + h(n)$	V	P
$4 = 1 + 3$	1	0
$7 = 3 + 4$	2	1
$11 = 5 + 6$	4	3
$5 = 6 + 0$	5	3

Expanded

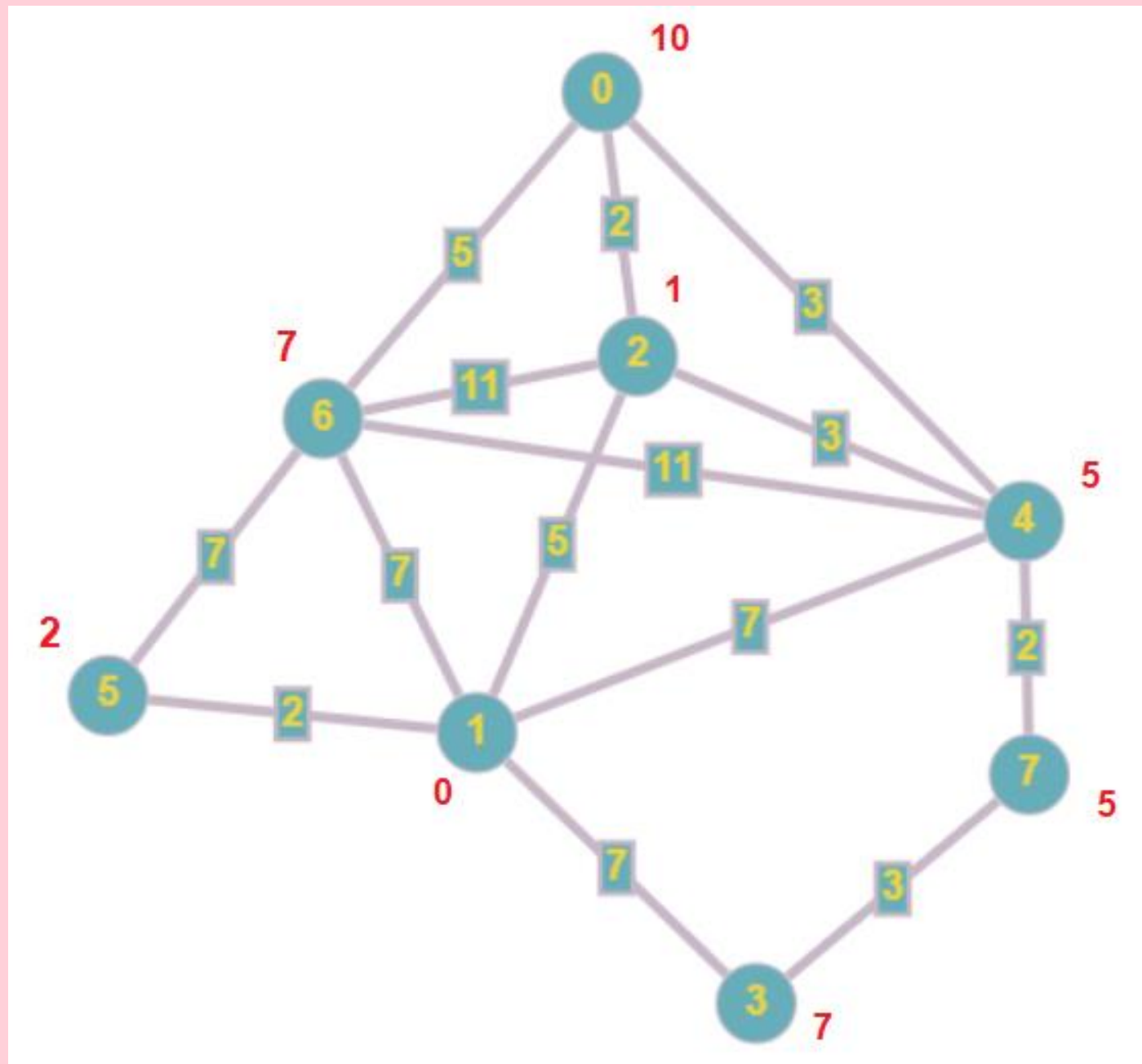
V	P

Path

0	1	3	5
---	---	---	---

Is it better than any algorithm?

BETTER?



Dijkstra's Algorithm expands double number of nodes to find the same path. (0, 2, 4, 7, 6, 1)

A* Algorithm just expands only 3 nodes which is exact the same path. (0, 2, 1)



QUIZ!!!



Quang Tú – 25%

- Find out the introduction and history
- Some terminologies (heuristic, $f(n) = g(n) + h(n)$)
- Application

Hoàn Mỹ - 50%

- Notes for implementation, time/ space complexity
- Some terminologies (consistency and admissibility, completeness and optimality)
- Comparison
- Write source code (Graph)
- Graph demo (draw -> result)
- Report composer and PowerPoint arranger

Hoài Tâm – 25%

- Find the questions for Quiz and put the questions on Kahoot
- Template for PowerPoint and report



THANK YOU FOR LISTENING

