Practice Session 2

HW 1 Review

Chapter 1

1.4 Suppose we extend Evans's **`Analogy`** program so that it can score 200 on a standard IQ test. Would we then have a program more intelligent than a human? Explain.

Skip Chapter 1

Chapter 2

2.1 Suppose that the performance measure is concerned with just the first T time steps of the environment and ignores everything thereafter. Show that a rational agent's action may depend not just on the state of the environment but also on the time step it has reached.

Chapter 3

3.15 Consider a state space where the start state is number 1 and each state k has two successors: numbers $2k$ and $2k + 1$.

a. Draw the portion of the state space for states 1 to 15.

b. Suppose the goal state is 11. List the order in which nodes will be visited for breadth-first search, depth-limited search with limit 3, and iterative deepening search.

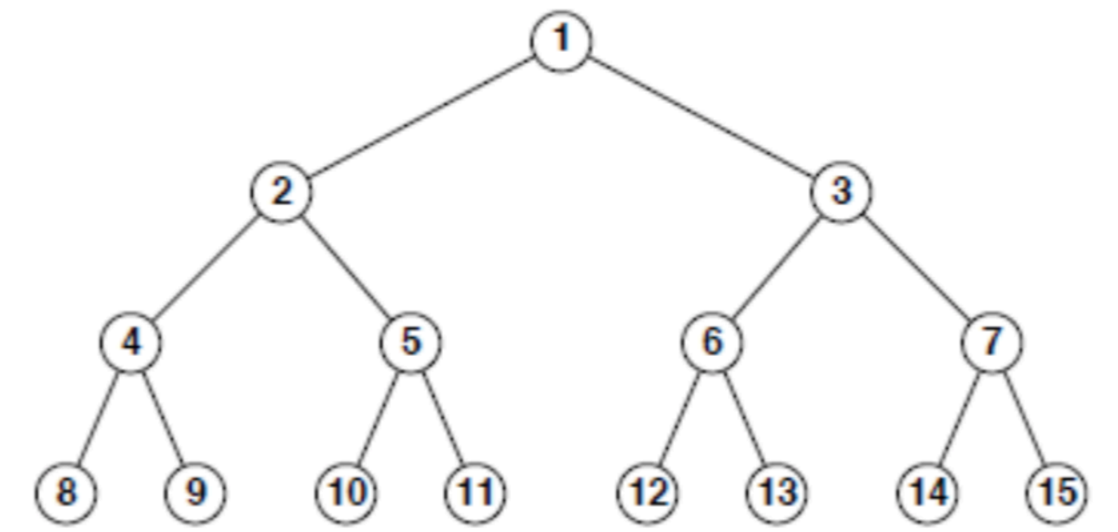
c. How well would bidirectional search work on this problem? What is the branching factor in each direction of the bidirectional search?

d. Does the answer to (c) suggest a reformulation of the problem that would allow you to solve the problem of getting from state 1 to a given goal state with almost no search?

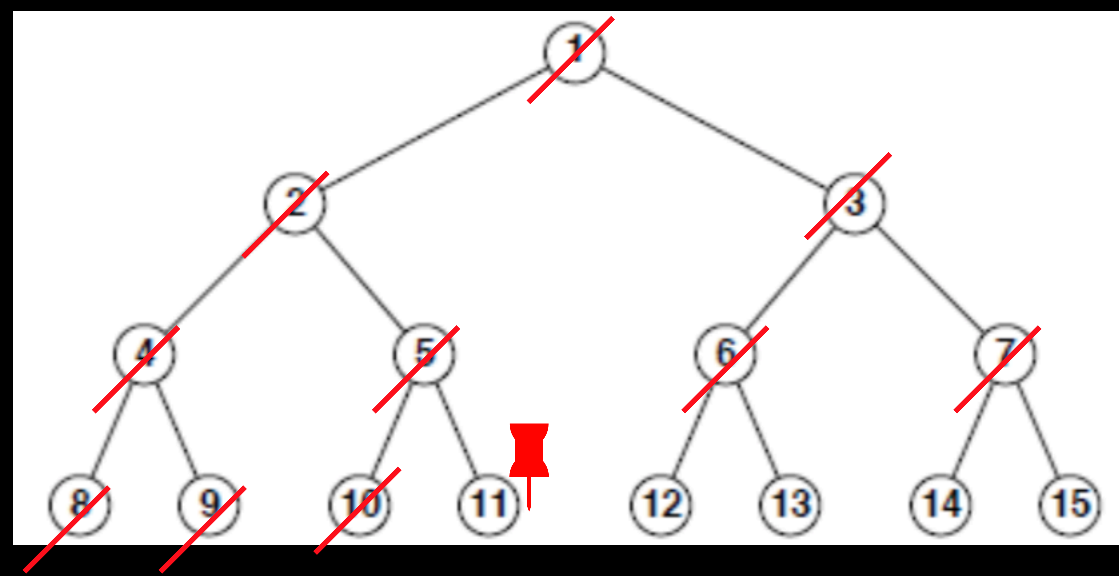
e. Call the action going from k to $2k$ Left, and the action going to $2k + 1$ Right. Can you find an algorithm that outputs the solution to this problem without any search at all?

Chapter 3

a. Draw the portion of the state space for state 1 to 15

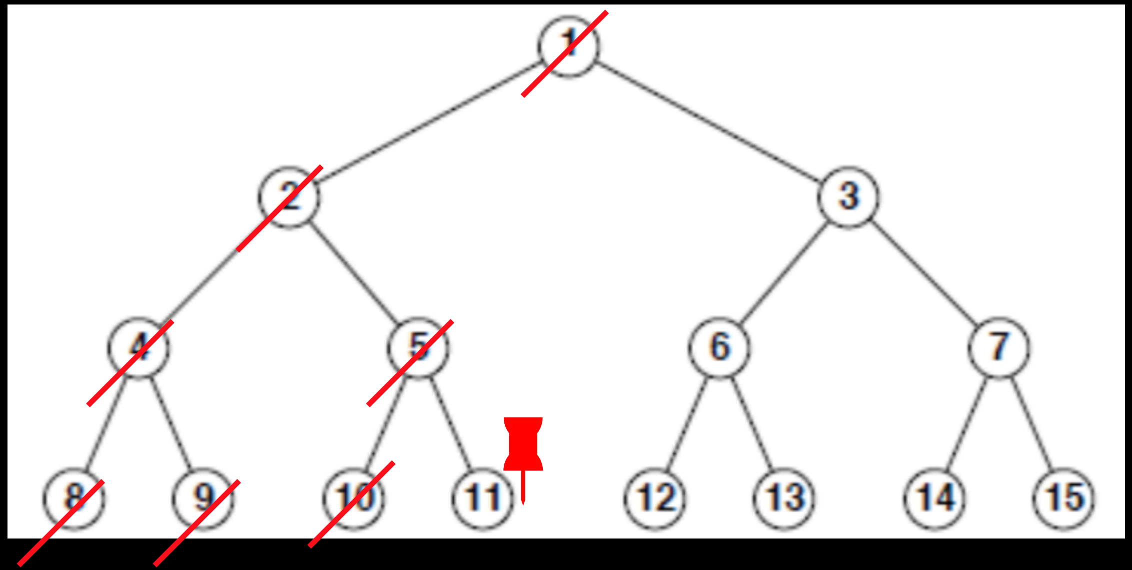


breadth first search



1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11

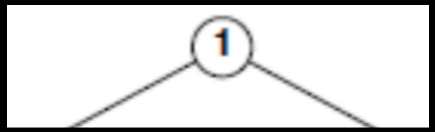
depth limited search



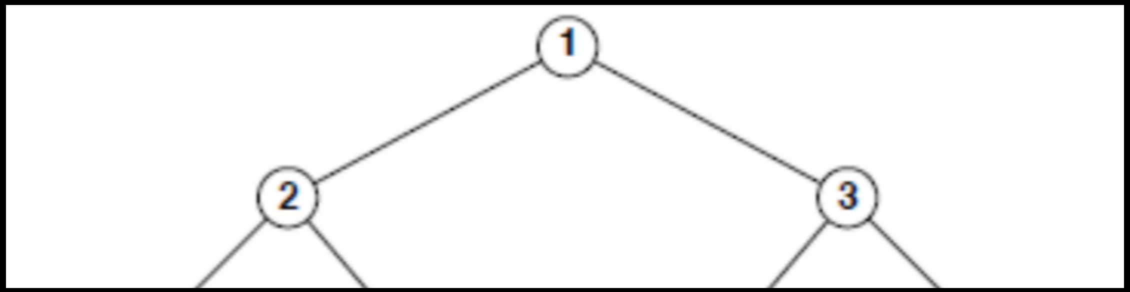
1, 2, 4, 8, 9, 5, 10, 11

Chapter 3

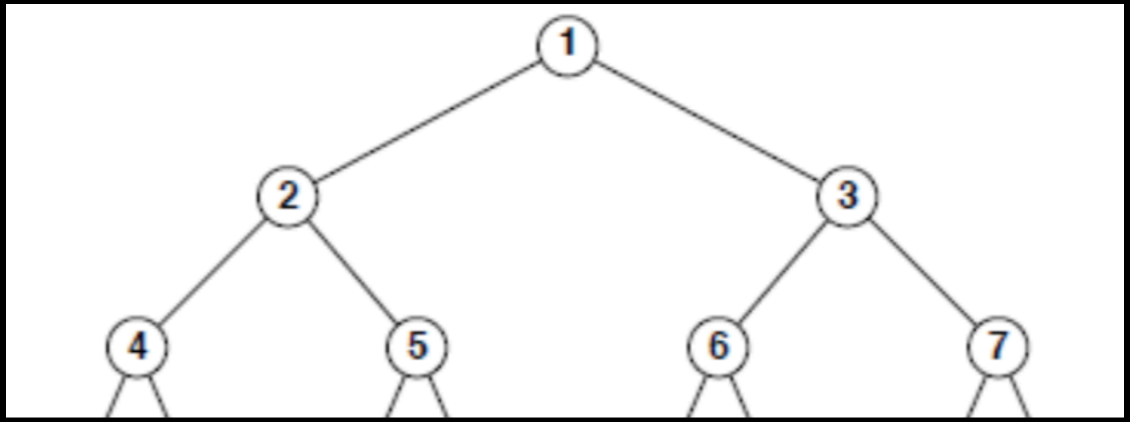
Iterative Deepening Search



1



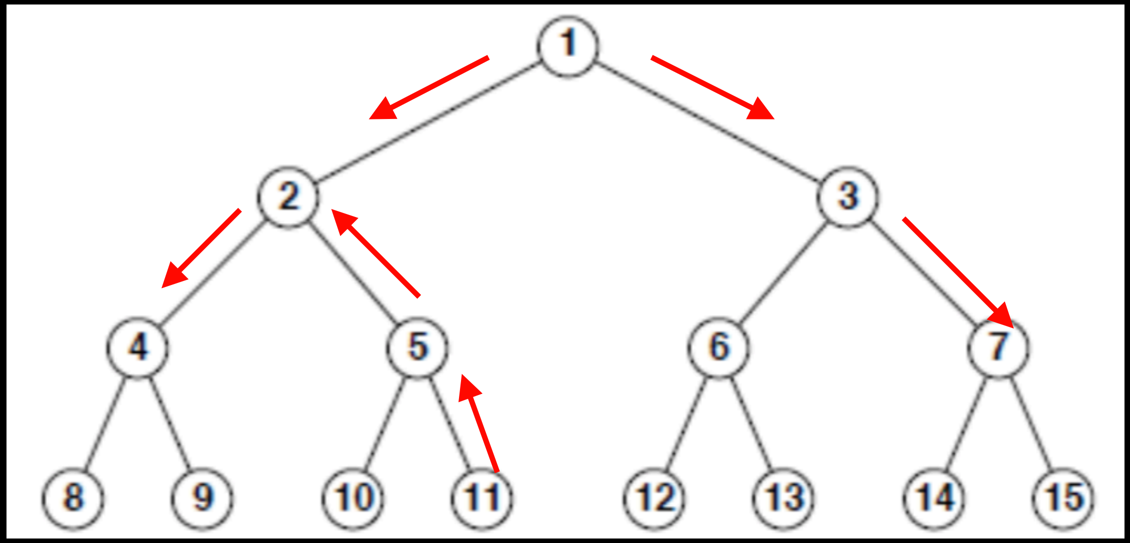
1, 2, 3



1, 2, 3, 4, 5, 6, 7

1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11

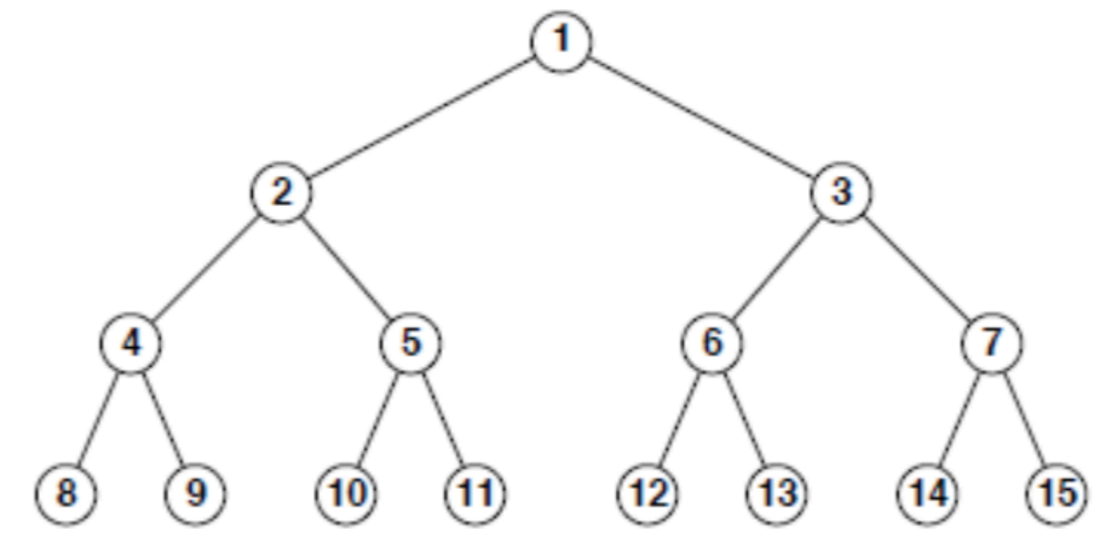
c. How well would bidirectional search work on this problem?



$$b = \begin{cases} 2 & \text{if forward} \\ 1 & \text{if backward} \end{cases}$$

Chapter 3

e. Call the action going from *k* to *2k* Left, and the action going to *2k + 1* Right. Can you find an algorithm that outputs the solution to this problem without any search at all?



$$2k \rightarrow \text{bit shift}$$

$$2k + 1 \rightarrow \text{bit shift and} + 1$$

Chapter 3

3.19 Write a program that will take as input two Web page URLs and find a path of links from one to the other. What is an appropriate search strategy? Is bidirectional search a good idea? Could a search engine be used to implement a predecessor function?

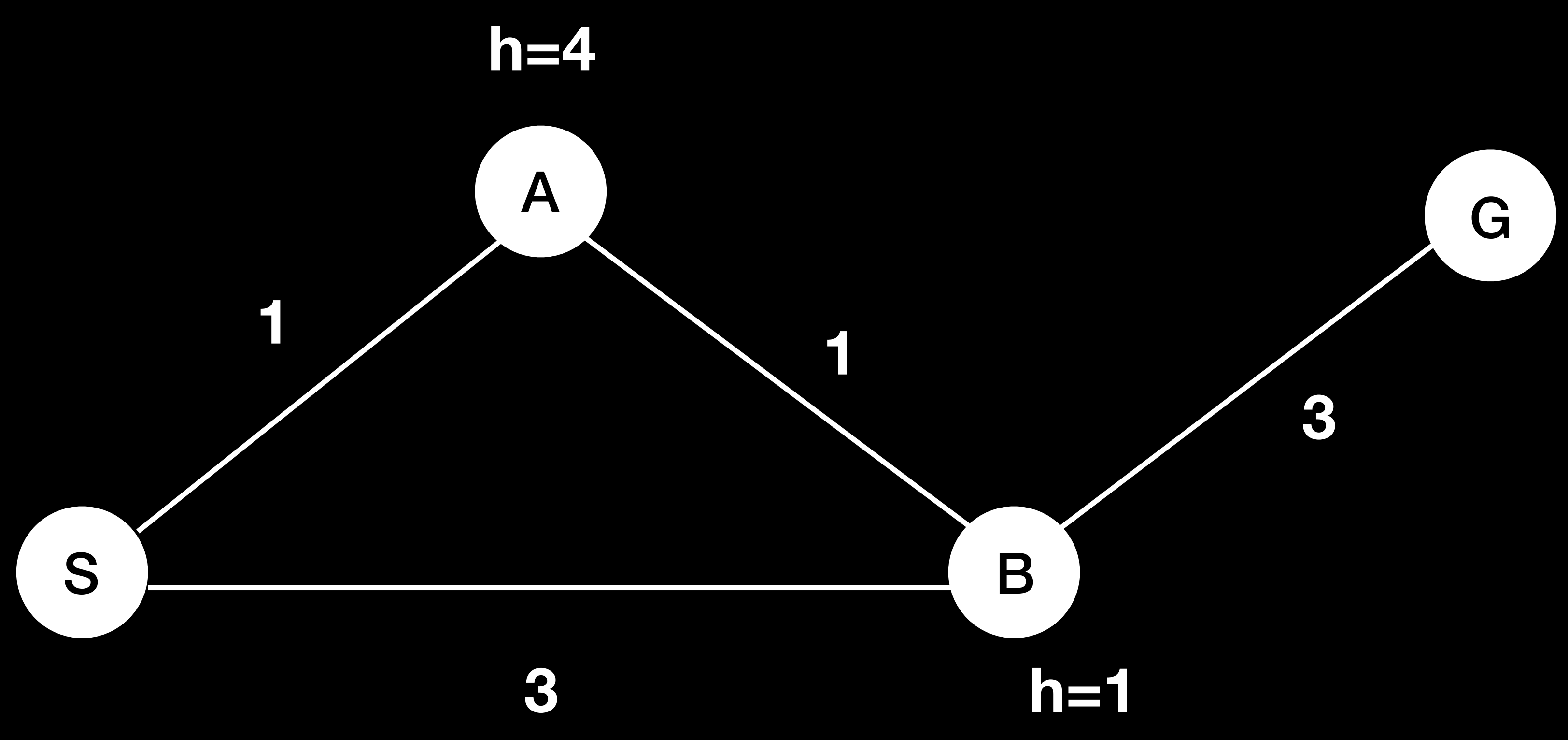
- **Best-first search with good heuristics is fine**
- **Breadth-first search is also fine**
- **Since we do not know predecessors, it is hard to use bidirectional search**
- **search engine can be used to implement a predecessor function**

Chapter 3

3.22 Compare the performance of A* and RBFS on a set of randomly generated problems in the 8-puzzle (with Manhattan distance) and TSP (with MST—see Exercise 3.30) domains. Discuss your results. What happens to the performance of RBFS when a small random number is added to the heuristic values in the 8-puzzle domain?

- **RBFS expands more. (no repeated states)**
- **Doesn't change it's mind so frequently. (move cost is only 1)**
- **not many re-expansion.**
- **random number heuristic incurs many re-expansion**

3.24 Devise a state space in which A* using GRAPH-SEARCH returns a suboptimal solution with an h(n) function that is admissible but inconsistent



Chapter 5

5.2 Consider the problem of solving two 8-puzzles.

a. Give a complete problem formulation in the style of Chapter 3.

- **Initial state: two arbitrary 8-puzzle states.**
- **Successor function: one move on an unsolved puzzle.**
- **Goal test: both puzzles in goal state.**
- **Path cost: 1 per move.**

Chapter 5

5.2 Consider the problem of solving two 8-puzzles.

b. How large is the reachable state space? Give an exact numerical expression

cf) p.71

$$\left(\frac{9!}{2}\right)^2 = \frac{(9!)^2}{4}$$

Chapter 5

5.2 Consider the problem of solving two 8-puzzles.

c. Suppose we make the problem adversarial as follows: the two players take turns moving; a coin is flipped to determine the puzzle on which to make a move in that turn; and the winner is the first to solve one puzzle. Which algorithm can be used to choose a moving in this setting?

expectminimax

5.2 Consider the problem of solving two 8-puzzles.

d. Give an informal proof that someone will eventually win if both play perfectly,

The statement is not true

Chapter 5

5.21 Which of the following are true and which are false? Give brief explanations.

a. In a fully observable, turn-taking, zero-sum game between two perfectly rational players, it does not help the first player to know what strategy the second player is using—that is, what move the second player will make, given the first player's move.

True.

The first player knows the optimal behavior of the second player in advance.

Chapter 5

5.21 Which of the following are true and which are false? Give brief explanations.

b. In a partially observable, turn-taking, zero-sum game between two perfectly rational players, it does not help the first player to know what strategy the second player is using—that is, what move the second player will make, given the first player's move.

False.

Chapter 5

5.21 Which of the following are true and which are false? Give brief explanations.

c. A perfectly rational backgammon agent never loses.

False. ***backgammon*** **is a stochastic game.**