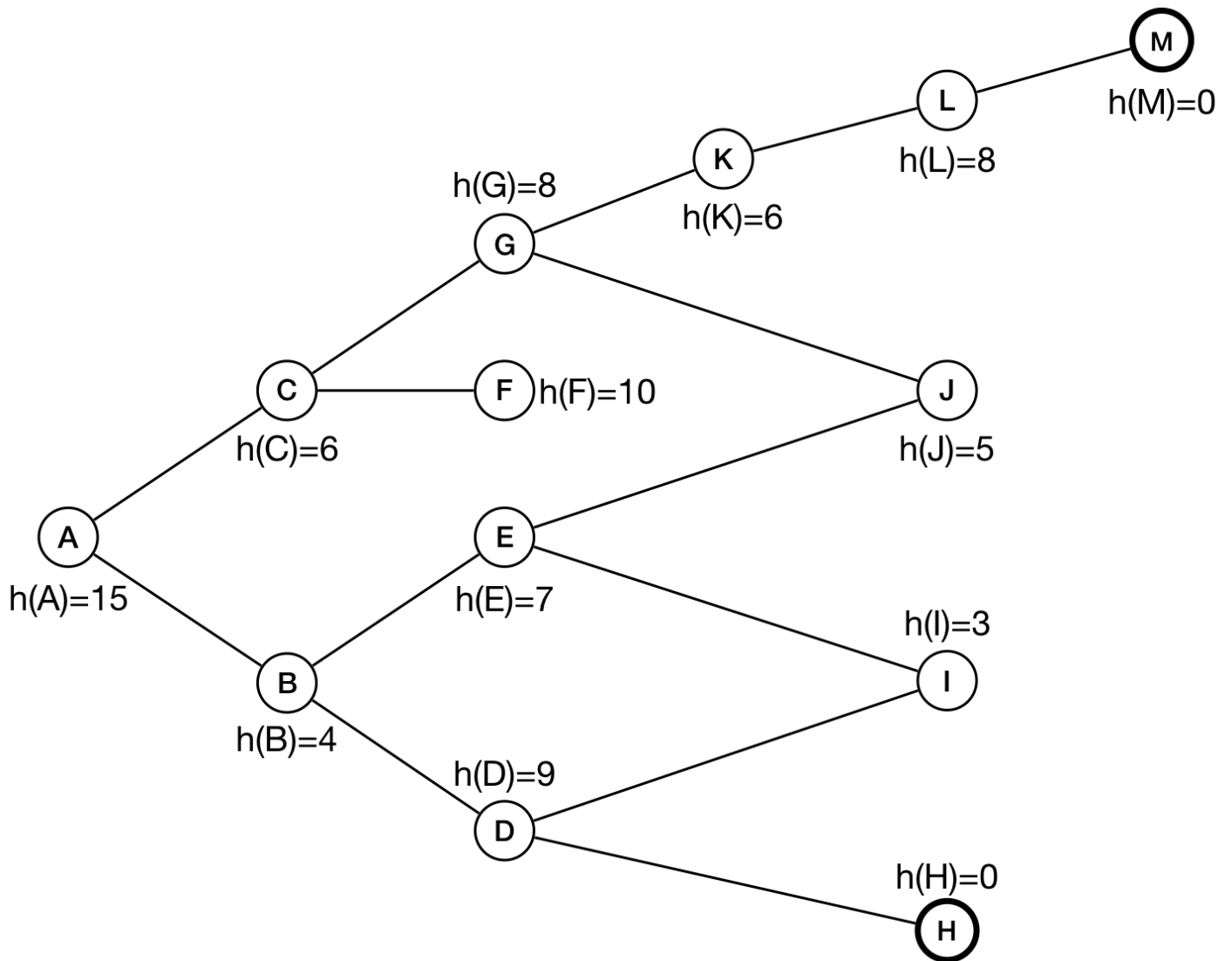# 02180 Practice Exam 2023 Solutions

Heuristic search

Consider the search problem with the following space:

All step costs are 1, the initial state is A and the goal states are H and M. All edges are bidirectional. A heuristic function h for each state is given.

Answer the following questions about A* graph search and greedy best-first graph search (GBFS). (8%)
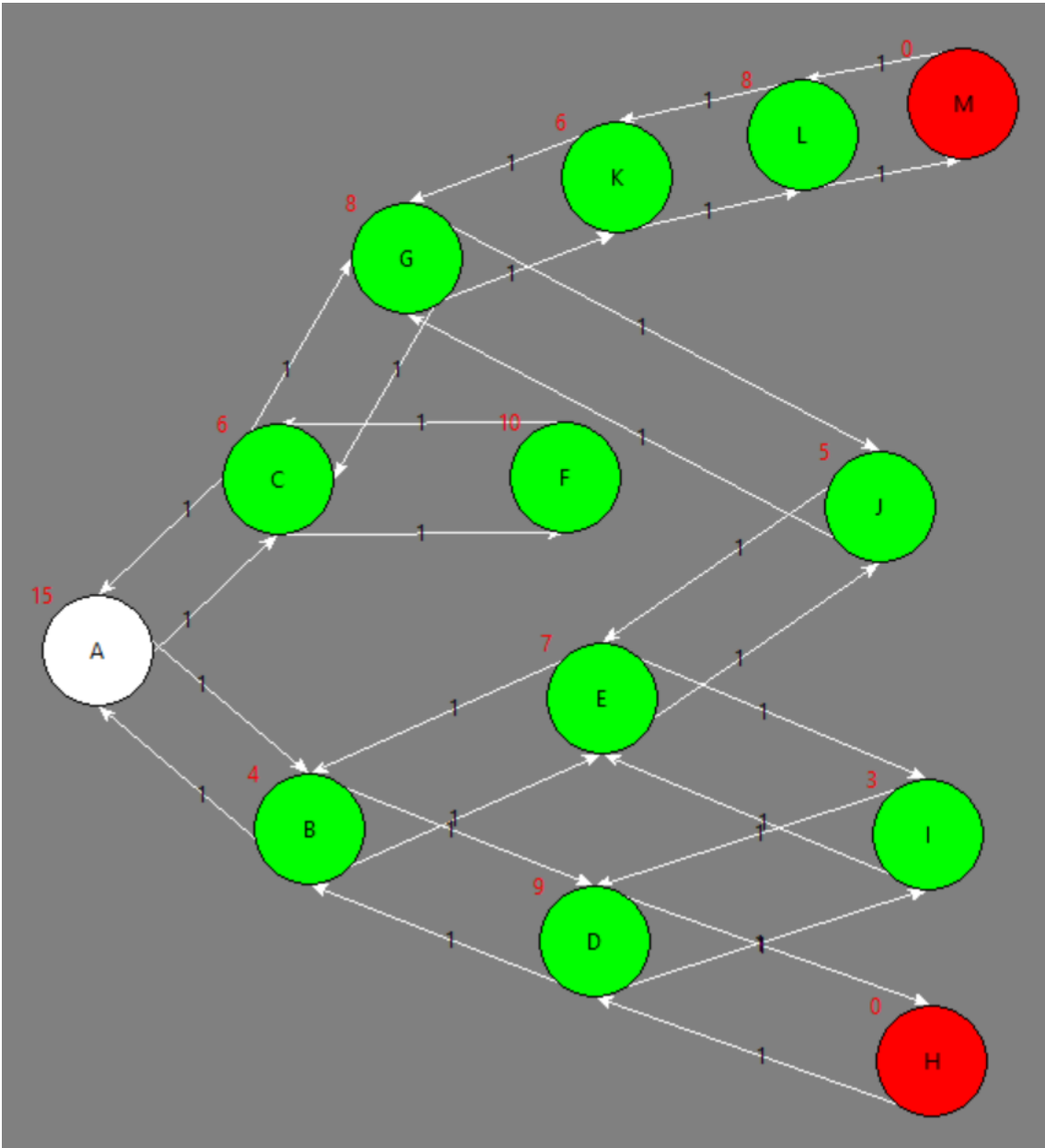
Select the correct answers

	M	H
GBFS finds a solution reaching the following state	Ⓥ	O
A* finds a solution reaching the following state	O	Ⓥ

Recreated in the AI Graph tool and run with the search methods gives results consistent with the above.
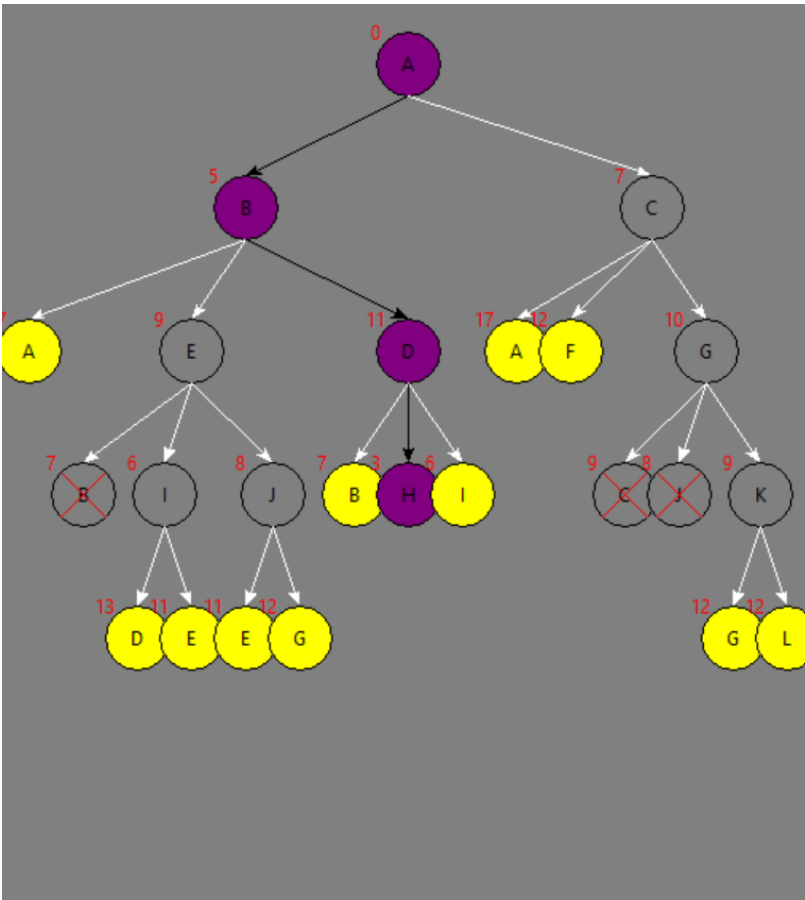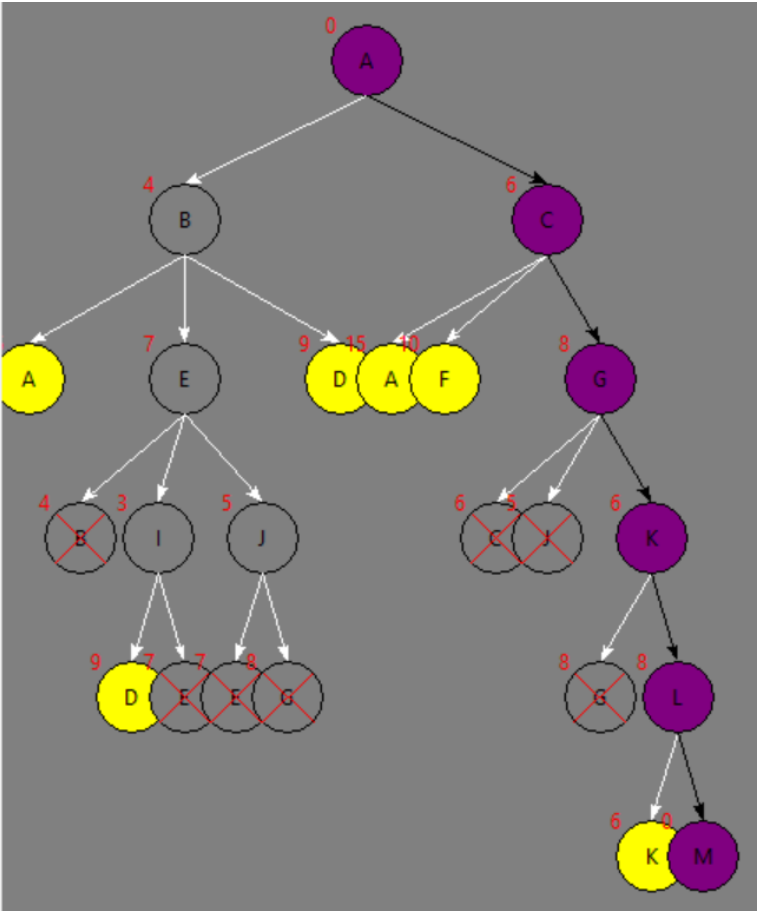
Answer the following questions about A* graph search and greedy best-first graph search (GBFS). (12%)

Select the correct answers

	true	false
GBFS explores node D		Ⓥ
GBFS explores node L	Ⓥ	
A* explores node D	Ⓥ	
A* explores node L		Ⓥ

GBFS:
D is not explored
L is explored

A*:
D is explored
L is not explored

Answer the following question about heuristic function h. (4%)

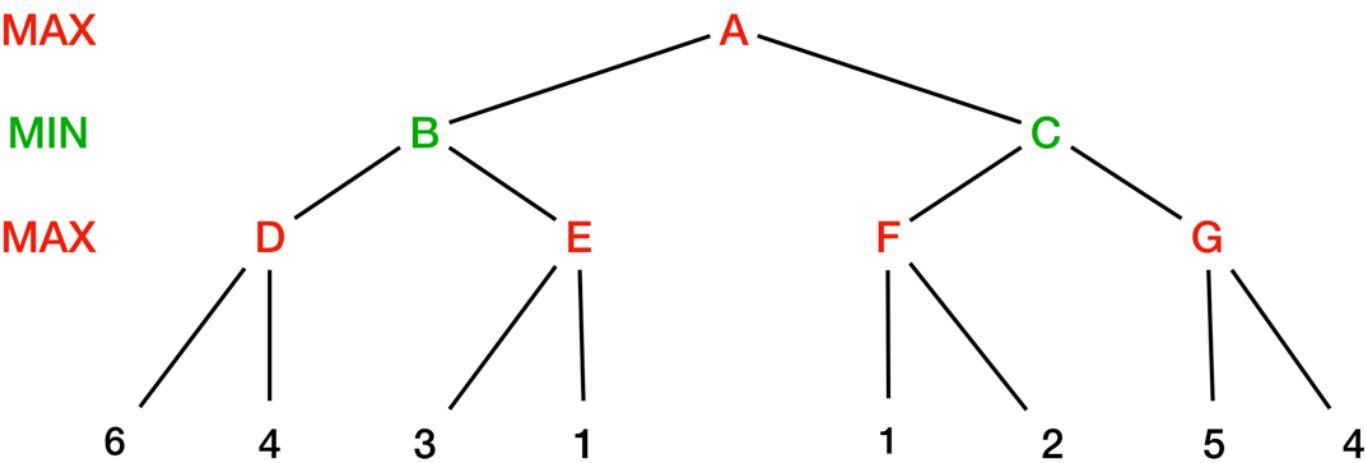**Select the correct answers**

	true	false
Heuristic function h is admissible	○	Ⓥ

It is not admissable, since the Heuristic function (severely) overestimates the cost of reaching the goal

Adversarial search

Consider the following game tree:
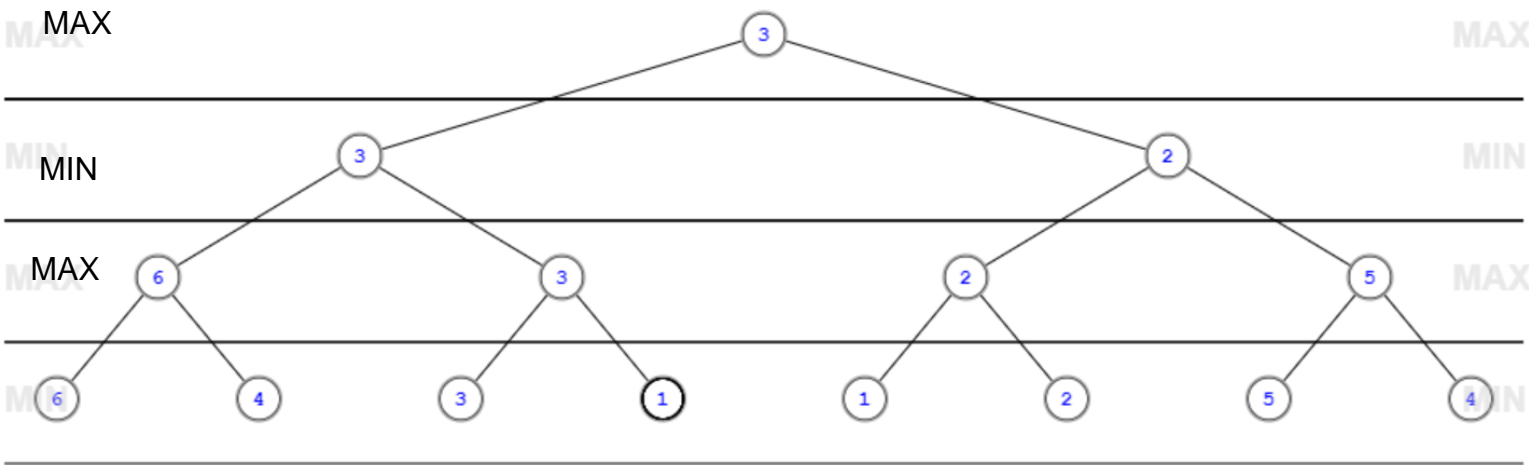
MAX   A

MIN   B   C

MAX   D   E   F   G

6   4   3   1   1   2   5   4

What is the minimax value of the state A? (6%)

Choose one answer

○ 1

○ 2

Ⓥ 3

○ 4

○ 5

○ 6

Using the minimax simulator

MAX

MIN

MAX

Which non-terminal states will be played if the players play optimally? (6%)

Choose one answer

○ A, C, F

○ A, B, D

Ⓥ A, B, E

○ A, C, G

In the first state, it will try to maximize - so it goes for B which has the highest value, 3.
In the second state, it will try to minimize, so it goes for E which has the lowest value, E

Suppose that the game tree is searched with Alpha-Beta search (from left to right).
Will the search examine all states? (6%)
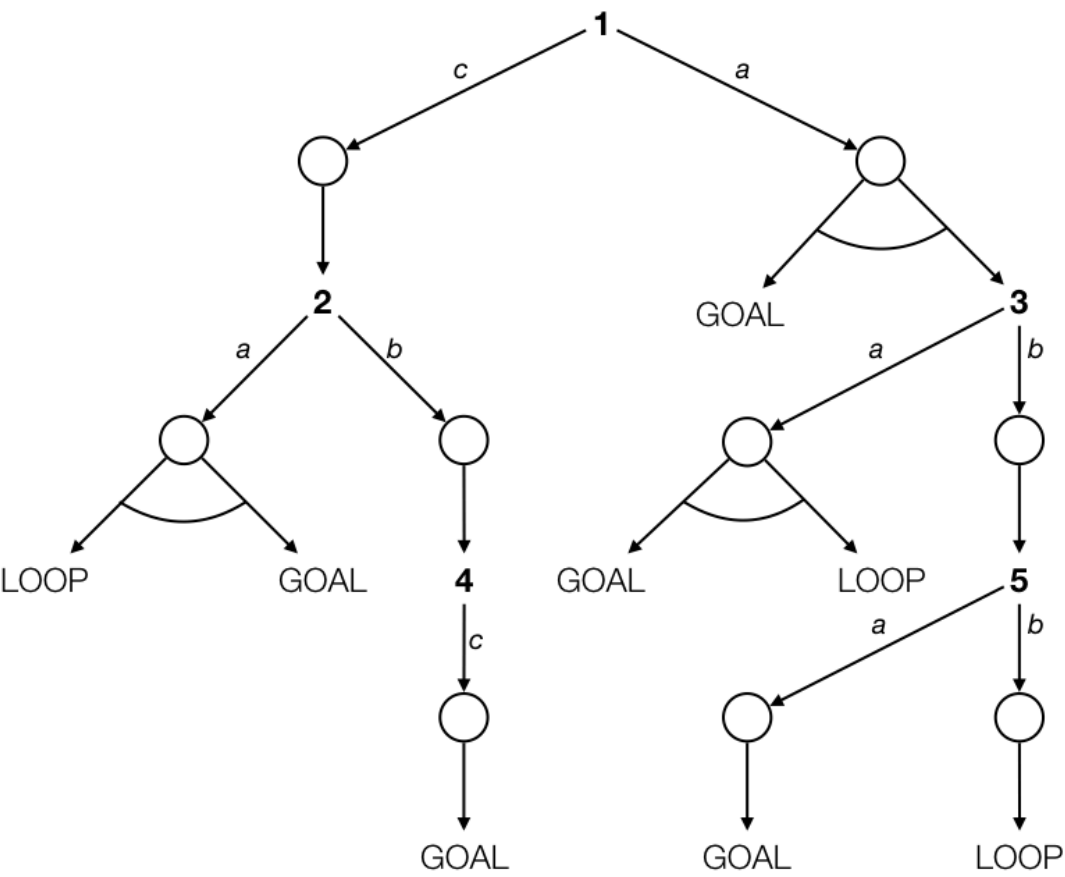
Choose one answer

○ yes

Ⓥ no

It can be seen that it does not examine all states, since the branch with G is cut off
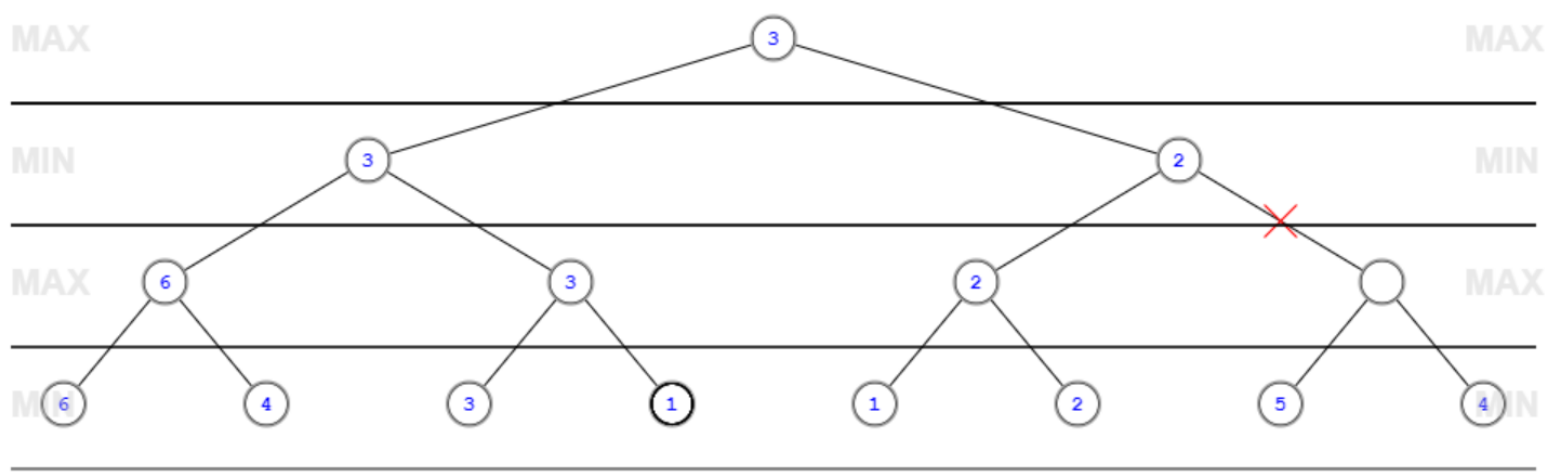
Non-deterministic search

Consider the following non-deterministic search problem (in the form of AND-OR tree):

Which of the following policies gives a solution to the problem? (8%)

Choose one answer

○ $\Pi(1) = c, \Pi(2) = a, \Pi(4) = c$

○ $\Pi(1) = a, \Pi(3) = a$

Ⓥ $\Pi(1) = a, \Pi(3) = b, \Pi(5) = a$

By applying the above policies step by step, it can be seen that it reaches a confident Goal state

Belief revision: plausibility orders

Consider the following plausibility order.

p, q	$p, \bar{q}$	$\bar{p}, q$	$\bar{p}, \bar{q}$
			w
x		z	
	y		

more plausible

Which states determine the result of contraction with p? (10%)

Choose one answer

- ◯ y
- ◯ z
- ◯ x
- ◯ w
- Ⓥ y and z
- ◯ x, y, and z
- ◯ x and y

Når vi contracter, så vælger vi den mest plausible der passer med det samme som man contracter med, og det mest plausible der der modsiger det man contracter med

Which states determine the result of revision with $\neg p$? (10%)

○ x

○ y

Ⓥ z

○ w

○ x and y

○ y and z

○ z and w

○ x and z

Med revision tager vi den mest plausible som er enig i det som man reviser med.

For each of the following formulas decide if it is in the belief set after revision with $\neg p$? (20%)

Select the correct answers

	yes	no
$p \to q$	Ⓥ	○
$q \to p$	○	Ⓥ
$p \wedge q$	○	Ⓥ
$p \vee q$	Ⓥ	○
$p \leftrightarrow q$	○	Ⓥ

Vi tager de sæt der stadig kan lade sig gøre med en Not(P)

Belief revision: belief bases

Consider the belief base $A = \{p, q, p \rightarrow q, \neg p \rightarrow q\}$.

Solved using my Python Script - remainder_finder.py

```
radiction test> & C:/Python/python.exe "c:/Users/hc/Google Drive/Autonomous Systems/4. semester/02180 Introduction to A
rtificial Intelligence/Exam prep/Contradiction test/remainder_finder_final"
Practice Exam 2023
Checking if each set is a subset of A
True: {q, p, Implies(~p, q), Implies(p, q)} is a subset of [p, q, Implies(p, q), Implies(~p, q)]
True: {q, p} is a subset of [p, q, Implies(p, q), Implies(~p, q)]
True: {p} is a subset of [p, q, Implies(p, q), Implies(~p, q)]
True: {q} is a subset of [p, q, Implies(p, q), Implies(~p, q)]
True: {q, p, Implies(p, q)} is a subset of [p, q, Implies(p, q), Implies(~p, q)]
True: {q, p, Implies(~p, q)} is a subset of [p, q, Implies(p, q), Implies(~p, q)]
True: {p, Implies(~p, q)} is a subset of [p, q, Implies(p, q), Implies(~p, q)]
True: {p, Implies(p, q)} is a subset of [p, q, Implies(p, q), Implies(~p, q)]
True: {q, Implies(p, q)} is a subset of [p, q, Implies(p, q), Implies(~p, q)]
True: {q, Implies(~p, q)} is a subset of [p, q, Implies(p, q), Implies(~p, q)]
True: {Implies(~p, q), Implies(p, q)} is a subset of [p, q, Implies(p, q), Implies(~p, q)]
True: {Implies(p, q)} is a subset of [p, q, Implies(p, q), Implies(~p, q)]
True: {Implies(~p, q)} is a subset of [p, q, Implies(p, q), Implies(~p, q)]
True: {q, Implies(~p, q), Implies(p, q)} is a subset of [p, q, Implies(p, q), Implies(~p, q)]
True: {p, Implies(~p, q), Implies(p, q)} is a subset of [p, q, Implies(p, q), Implies(~p, q)]
-----------------------------------------------------------
Checking if each set implies x
True: {q, p, Implies(~p, q), Implies(p, q)} implies q
True: {q, p} implies q
False: {p} does not imply q
True: {q} implies q
True: {q, p, Implies(p, q)} implies q
True: {q, p, Implies(~p, q)} implies q
False: {p, Implies(~p, q)} does not imply q
True: {p, Implies(p, q)} implies q
True: {q, Implies(p, q)} implies q
True: {q, Implies(~p, q)} implies q
True: {Implies(~p, q), Implies(p, q)} implies q
False: {Implies(p, q)} does not imply q
False: {Implies(~p, q)} does not imply q
True: {q, Implies(~p, q), Implies(p, q)} implies q
True: {p, Implies(~p, q), Implies(p, q)} implies q
-----------------------------------------------------------
The following sets are subsets of A and do not imply x:
{p} is a subset of [p, q, Implies(p, q), Implies(~p, q)] and does not imply q
{p, Implies(~p, q)} is a subset of [p, q, Implies(p, q), Implies(~p, q)] and does not imply q
{Implies(p, q)} is a subset of [p, q, Implies(p, q), Implies(~p, q)] and does not imply q
{Implies(~p, q)} is a subset of [p, q, Implies(p, q), Implies(~p, q)] and does not imply q
-----------------------------------------------------------
Now we will filter out the sets which are already subsets of others, giving us the the final result:
{p, Implies(~p, q)}
{Implies(p, q)}
```

Which of the following sets are elements of $A \perp q$? (10%)

Select the correct answers

	yes	no
$\{p, q, p \to q, \neg p \to q\}$	○	ⓥ
$\{p, q\}$	○	ⓥ
$\{p\}$	○	ⓥ
$\{q\}$	○	ⓥ
$\{p, q, p \to q\}$	○	ⓥ
$\{p, q, \neg p \to q\}$	○	ⓥ
$\{p, \neg p \to q\}$	ⓥ	○
$\{p, p \to q\}$	○	ⓥ
$\{q, p \to q\}$	○	ⓥ
$\{q, \neg p \to q\}$	○	ⓥ
$\{p \to q, \neg p \to q\}$	○	ⓥ
$\{p \to q\}$	ⓥ	○
$\{\neg p \to q\}$	○	ⓥ
$\{q, p \to q, \neg p \to q\}$	○	ⓥ
$\{p, p \to q, \neg p \to q\}$	○	ⓥ