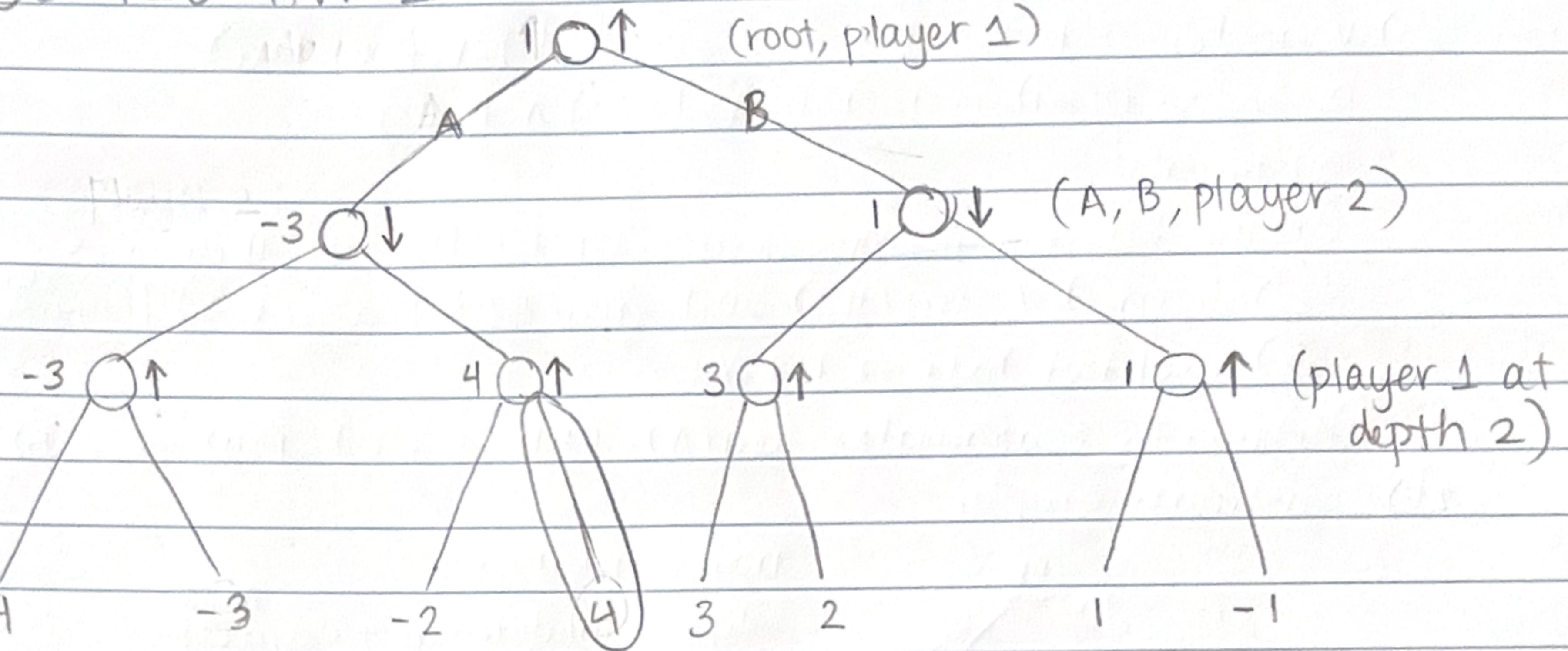


# CSCE 420 HW 2

1a)



1b) Leaves:  $[-4, -3], [-2, 4], [3, 2], [1, -1]$

$\rightarrow$  depth = 2 (MAX) nodes:

$$\cdot \max(-4, -3) = -3, \max(-2, 4) = 4, \max(3, 2) = 3, \max(1, -1) = 1$$

$\rightarrow$  depth = 1 (MIN) nodes:

$$\cdot A: \min(-3, 4) = -3, B: (3, 1) = 1$$

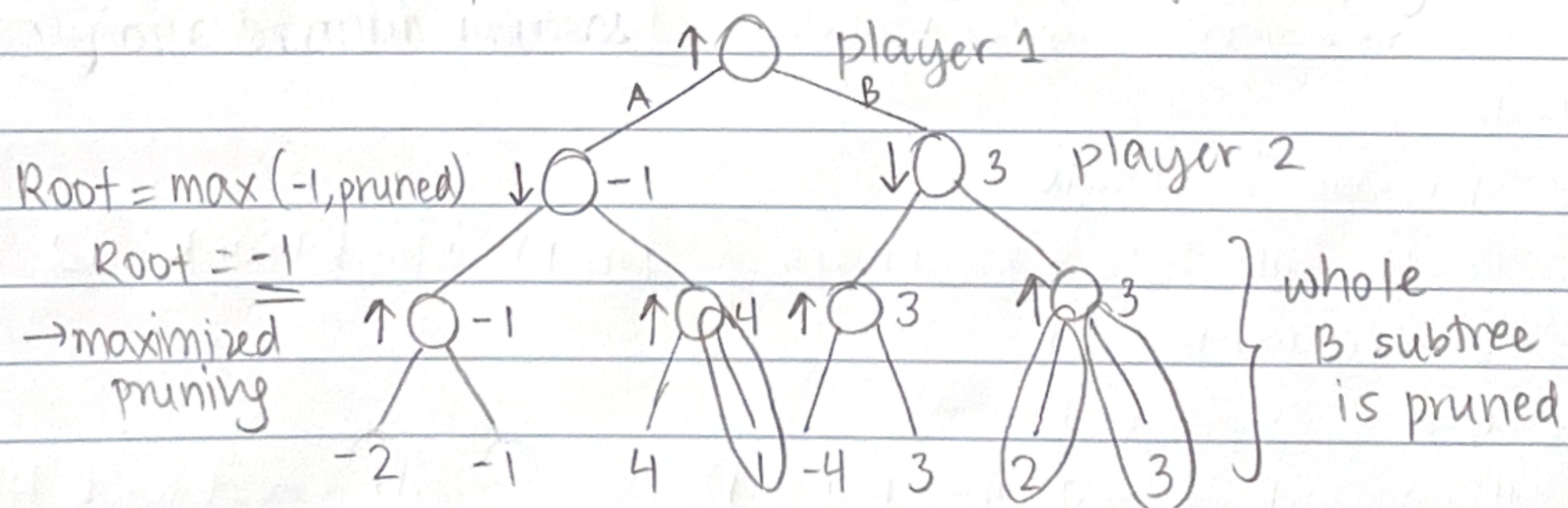
$$\rightarrow \text{Root (MAX)}: \max(-3, 1) = 1$$

1c) Optimal action for player 1 would be B because its minimax value (1) is greater than A's minimax value (-3)

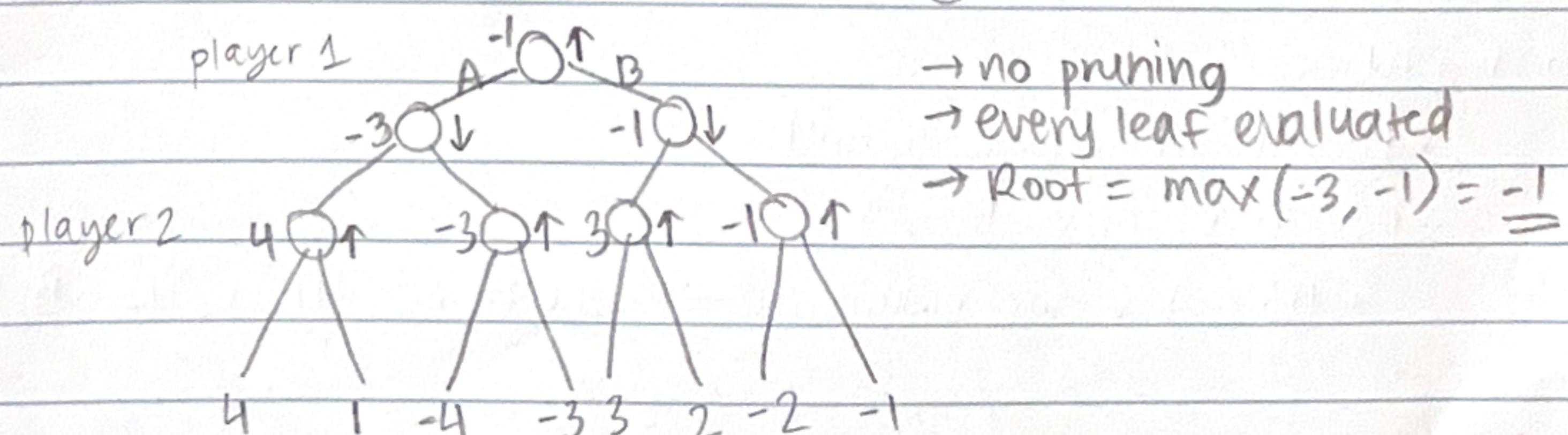
1d) The expected outcome is 1.

1e) Only one branch prunes, circled on the graph.

1f)



1g)



## CSCE 420 HW 2

2a) Variables:  $H_1, H_2, H_3$  (1<sup>st</sup>, 2<sup>nd</sup>, 3<sup>rd</sup> hiker in line)

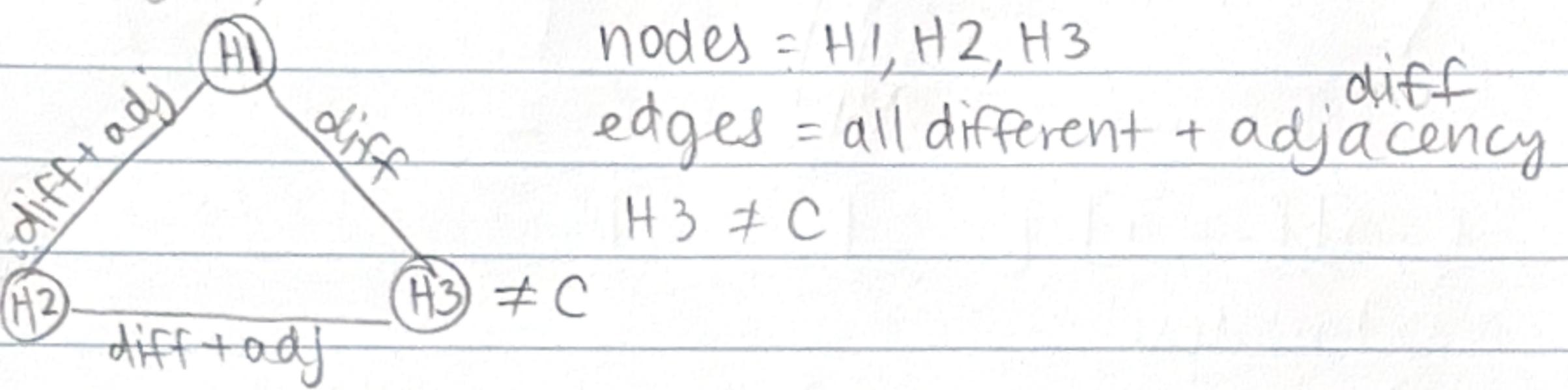
Domains:  $D(H_1) = D(H_2) = D(H_3) = \{A, B, C\}$

Constraints:

- 1) all different permutation:  $H_1, H_2, H_3$  are all distinct
- 2)  $\deg(H_1) \neq \deg(H_2)$  and  $\deg(H_2) \neq \deg(H_3)$  [adjacency <sup>diff</sup>]
- 3) carol not last  $\rightarrow H_3 \neq C$

Attributes for constraints:  $\deg(A) = \text{PHD}$ ,  $\deg(C) = \text{PHD}$ ,  $\deg(B) = \text{MS}$

2b) Constraint graph:



2c) Plain backtracking:

→ Try  $H_1 = A$

- $H_2 = A \rightarrow$  violates all different  $\rightarrow$  Backtrack  $H_2$
- $H_2 = B \rightarrow$  all different, diff adjacent
  - $H_3 = A \rightarrow$  all diff with  $H_1$  fails, try next
  - $H_3 = B \rightarrow$  all diff with  $H_2$  fails, try next
  - $H_3 = C \rightarrow$  violates Carol not last  $\rightarrow$  Backtrack  $H_2$
- $H_2 = C \rightarrow$  adjacent degrees violate  $\rightarrow$  Backtrack  $H_1$

→ Try  $H_1 = B$

- $H_2 = A \checkmark$  does not violate
  - $H_3 = A$  (fail),  $H_3 = B$  (fail),  $H_3 = C$  (fail)  $\rightarrow$  Backtrack  $H_2$
- $H_2 = B \rightarrow$  repeats B, fail
- $H_2 = C \checkmark$  does not violate
  - $H_3 = A$  (fail, degrees),  $H_3 = B$  (fail),  $H_3 = C$  (fail)  $\rightarrow$  Backtrack  $H_1$

→ Try  $H_1 = C$

- $H_2 = A \rightarrow$  degree same, fail
- $H_2 = B \checkmark$  no violations
  - $H_3 = A \checkmark$  no violations  $\rightarrow$  SOLUTION!  $H_1 = C, H_2 = B, H_3 = A$

## CSCE 420 HW 2

2d) Backtracking with MRV:

→ initial domains: H1: A,B,C

H2: A, B, C

H3: A, B (constraint  $H3 \neq C$ )

• pick H3 -

1.  $H3 = A$  (PHD)

→ Then H2 must be MS  $\rightarrow H2 = B$  (forced)

→ Then H1 must be PHD and different from  $A \rightarrow H1 = C$  (forced)

→ SOLUTION! C-B-A found immediately, no backtracking