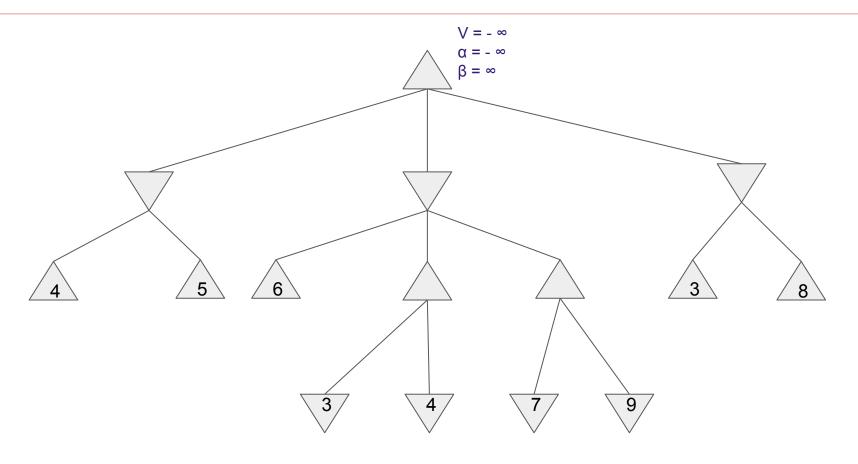
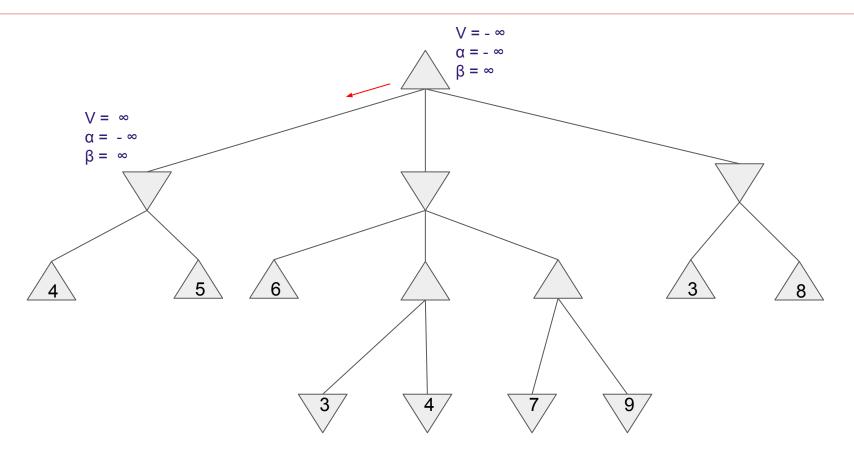
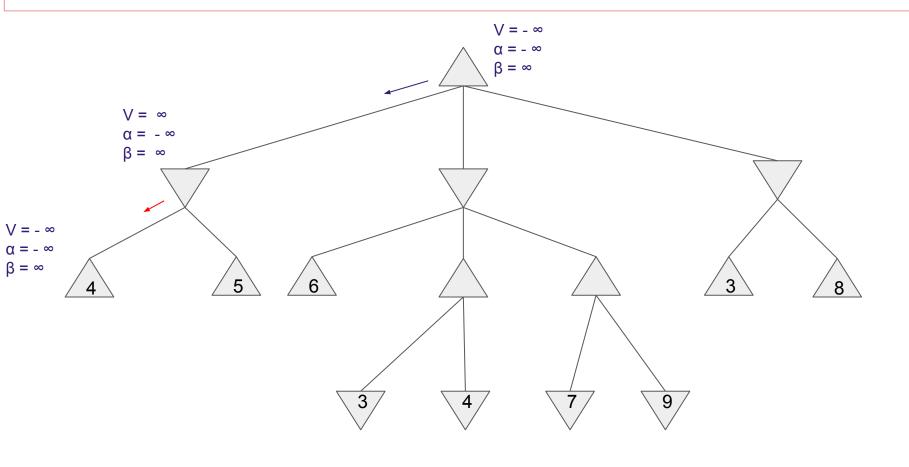
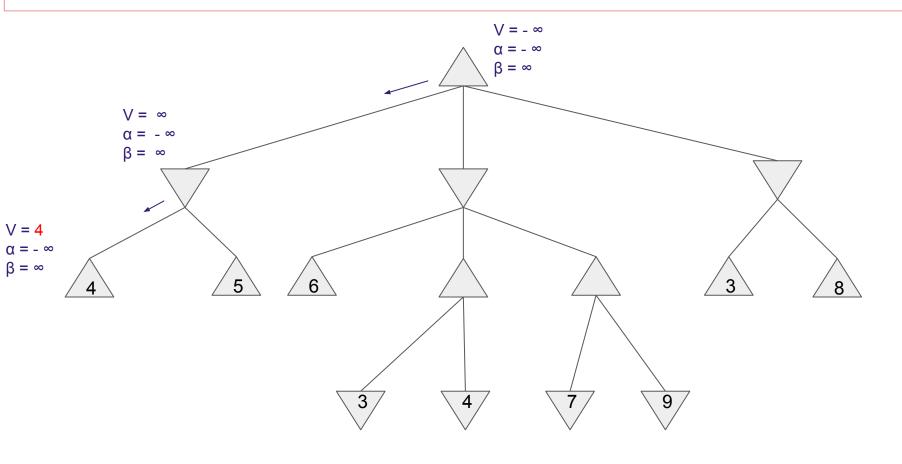
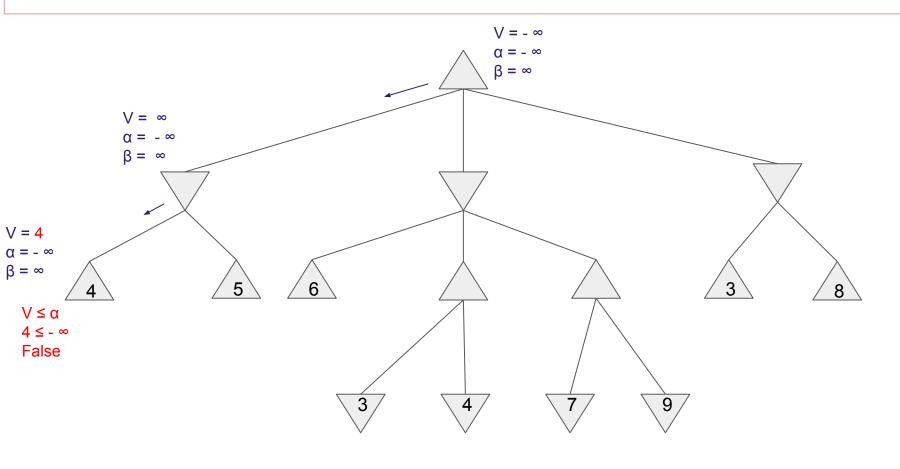
Artificial Intelligence Alpha Beta Pruning

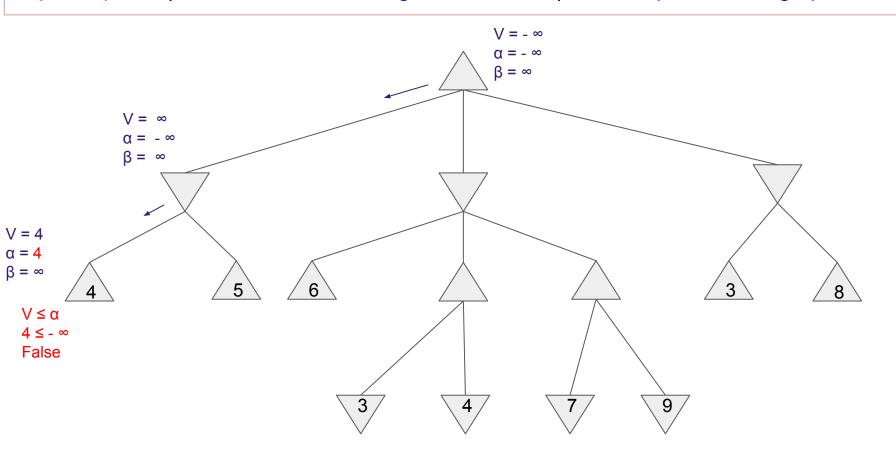


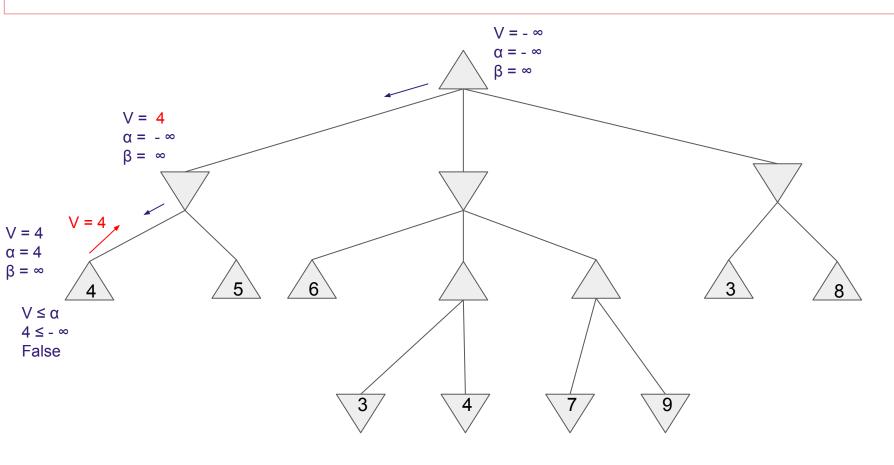


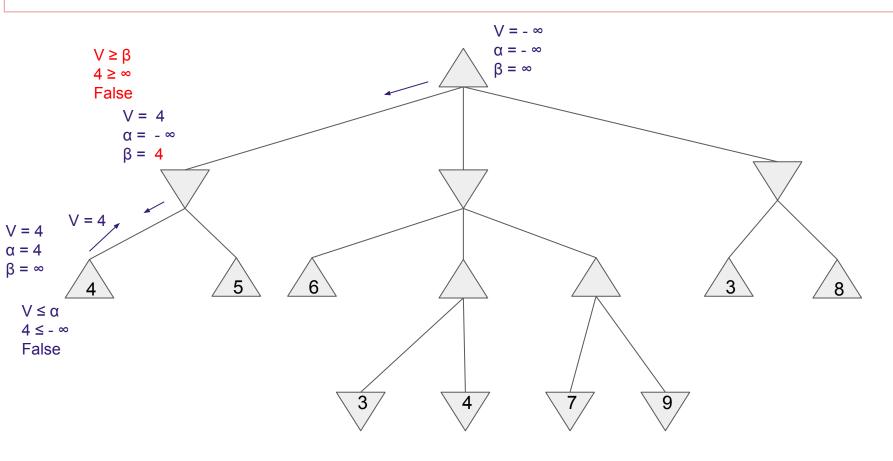


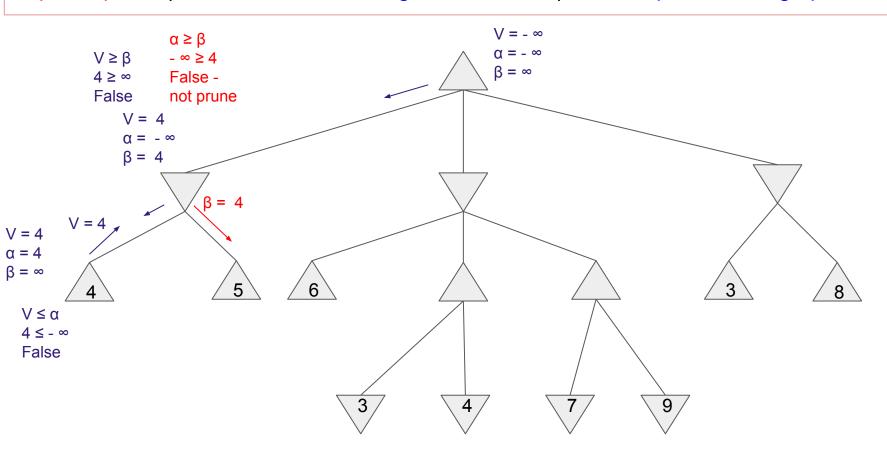


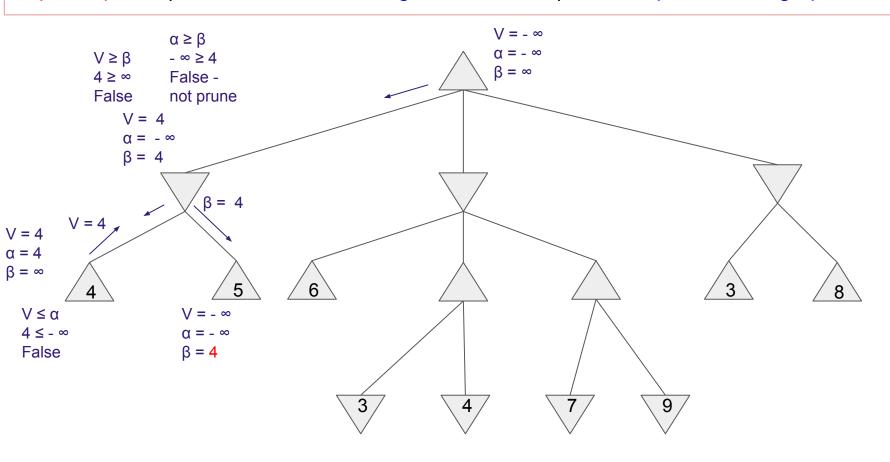


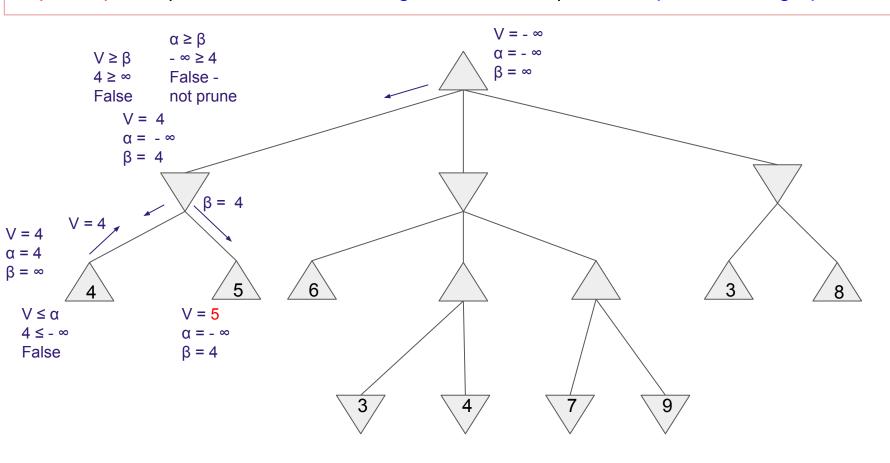


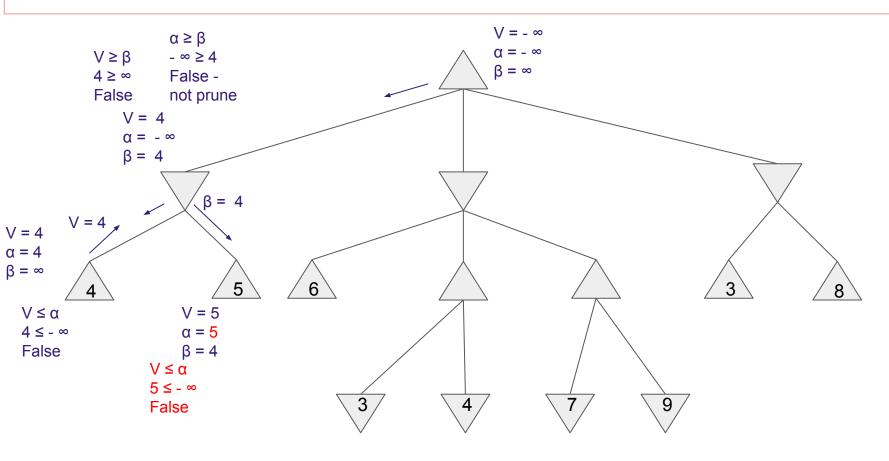


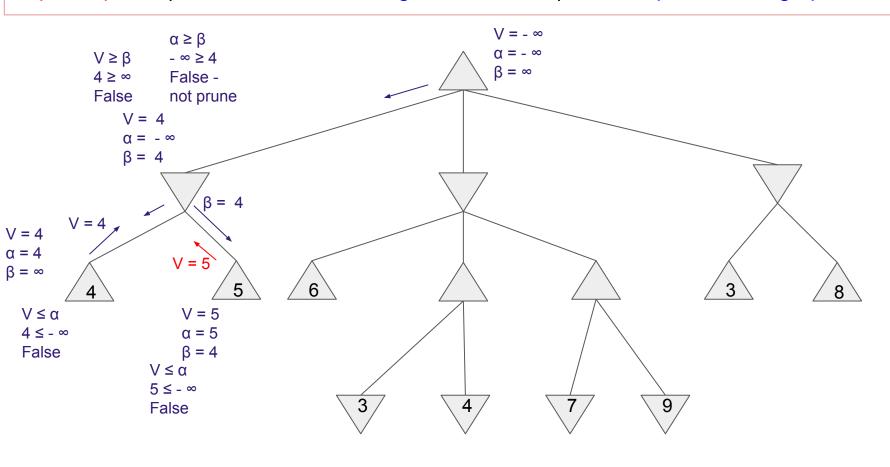


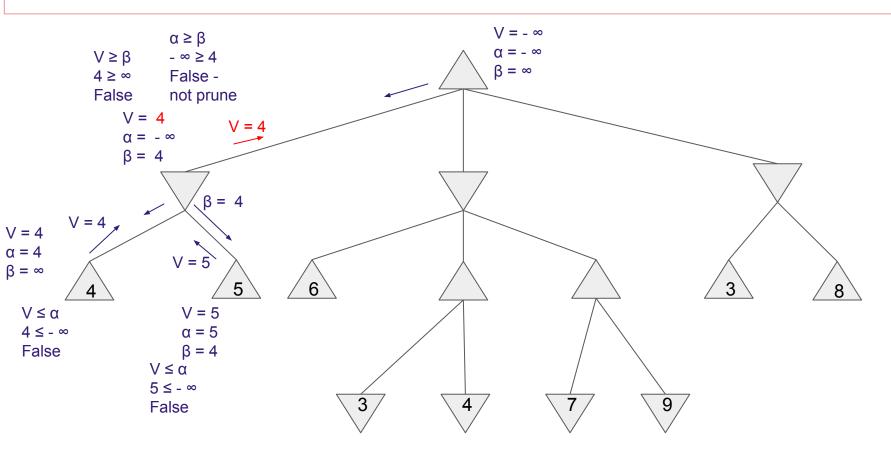


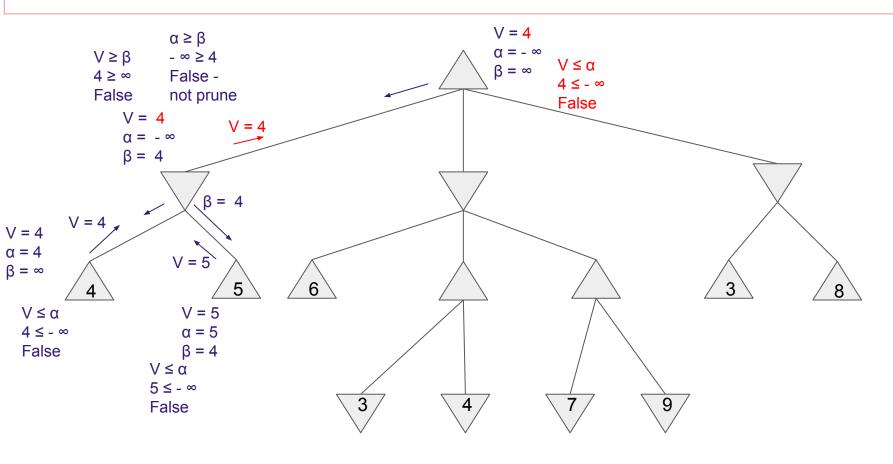


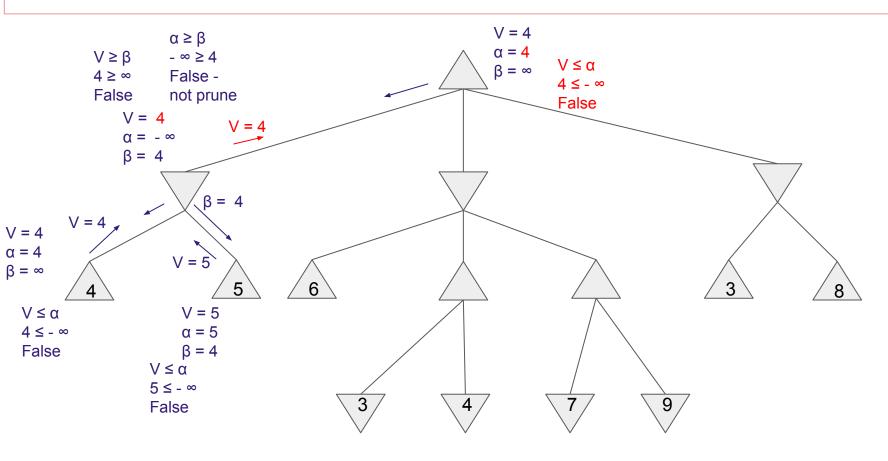


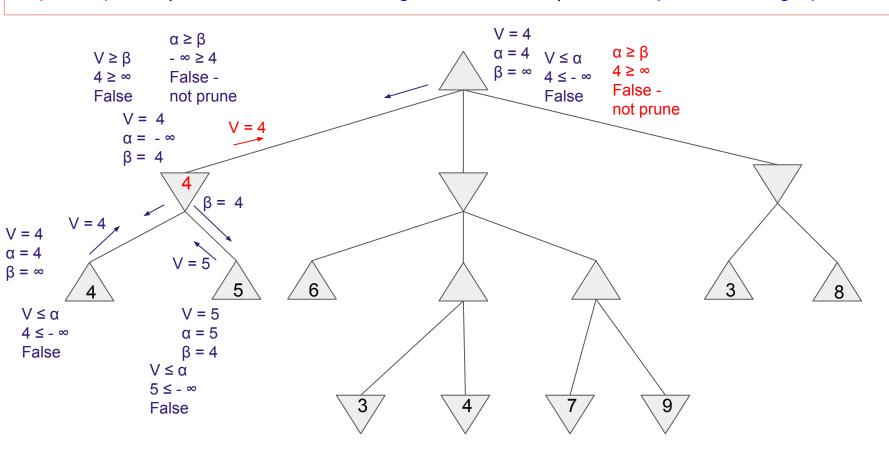


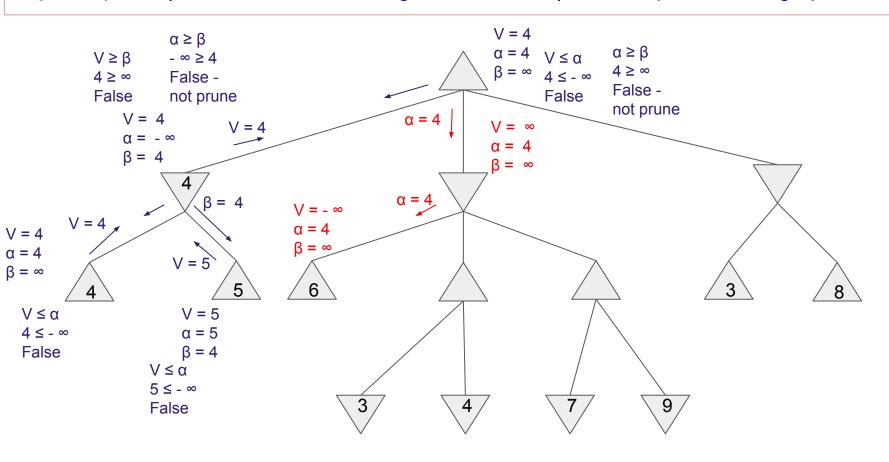


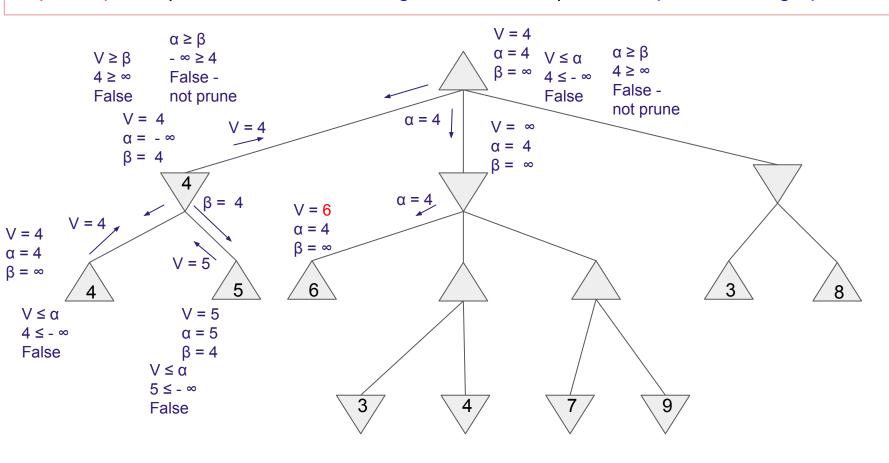


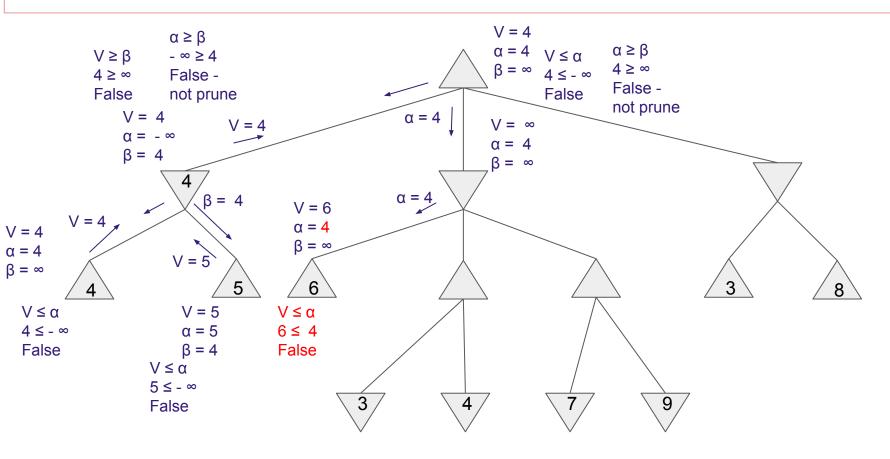


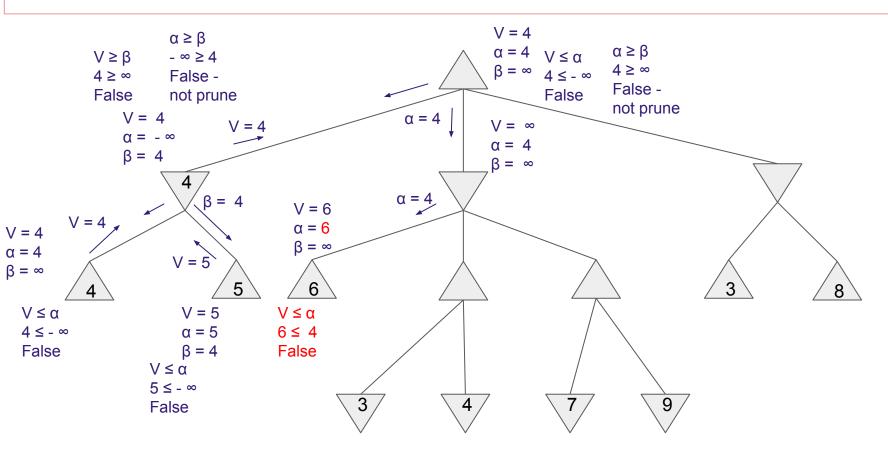


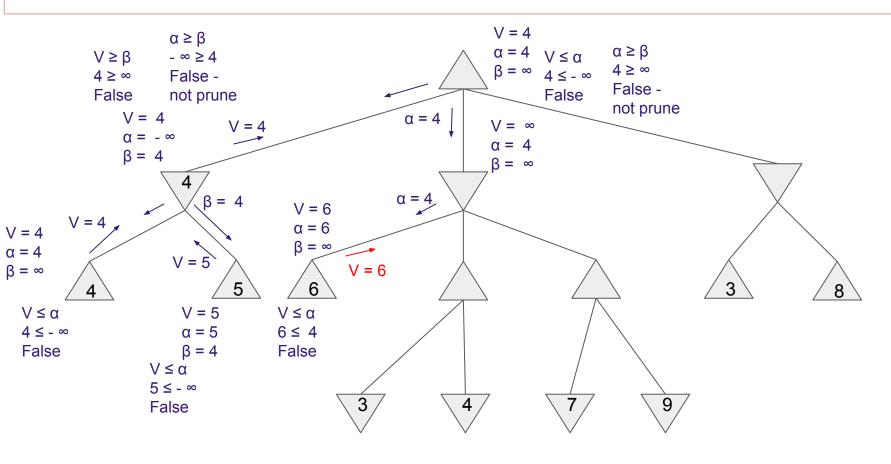


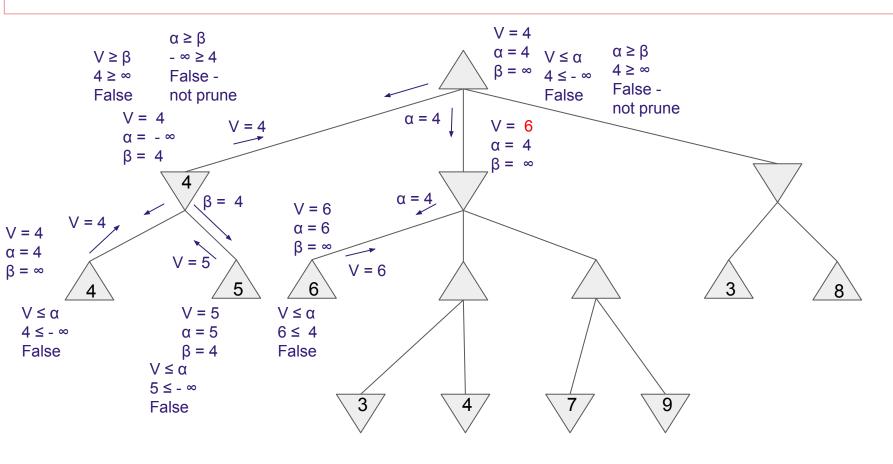


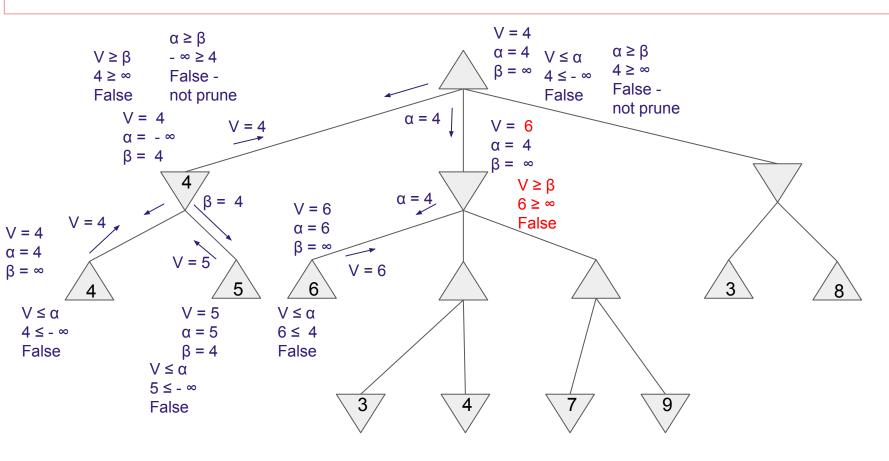


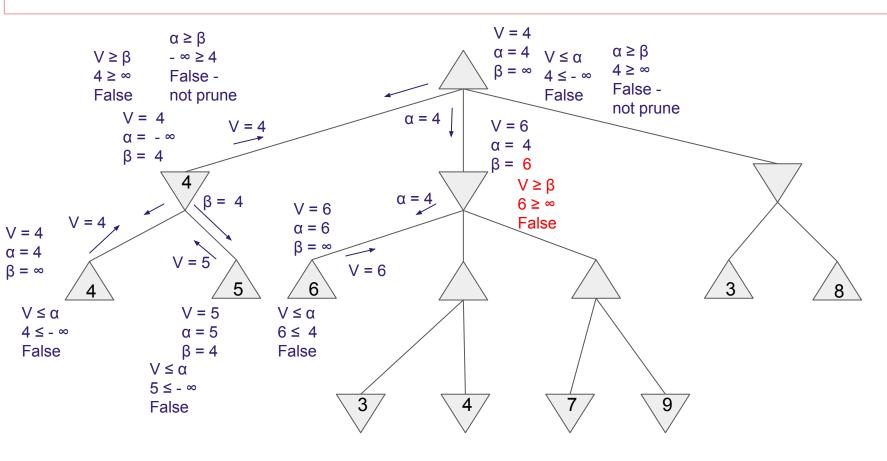


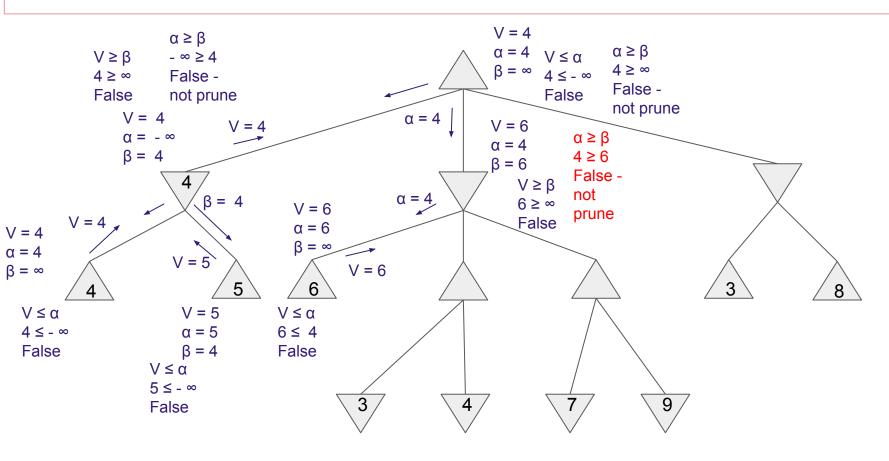


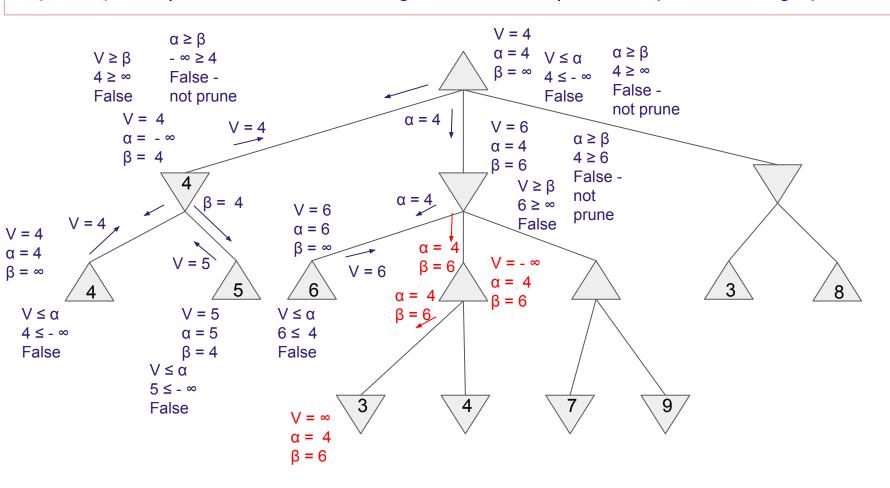


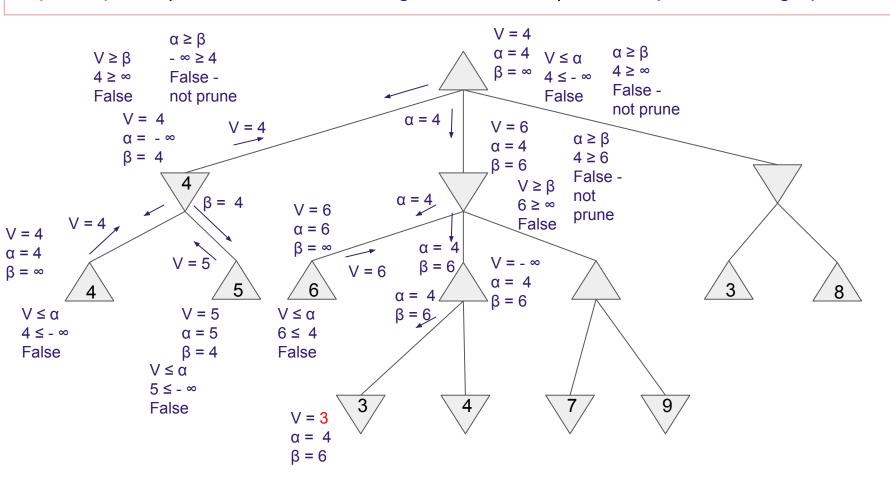




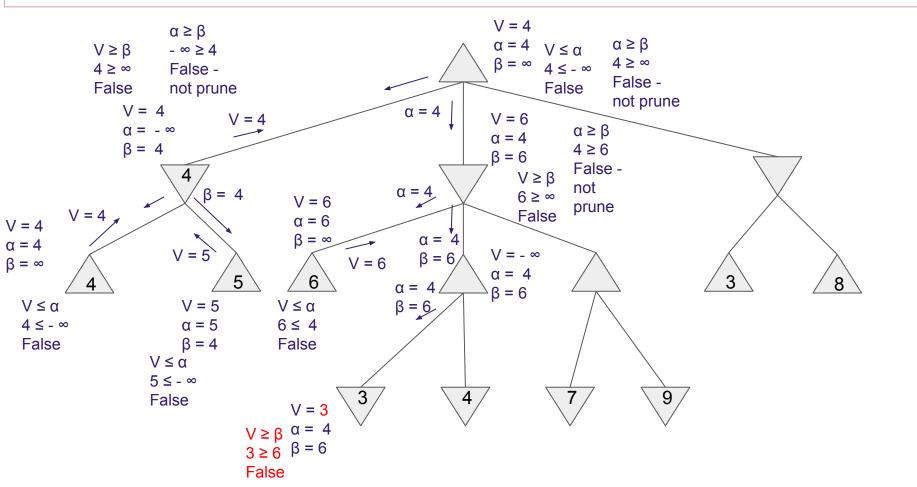




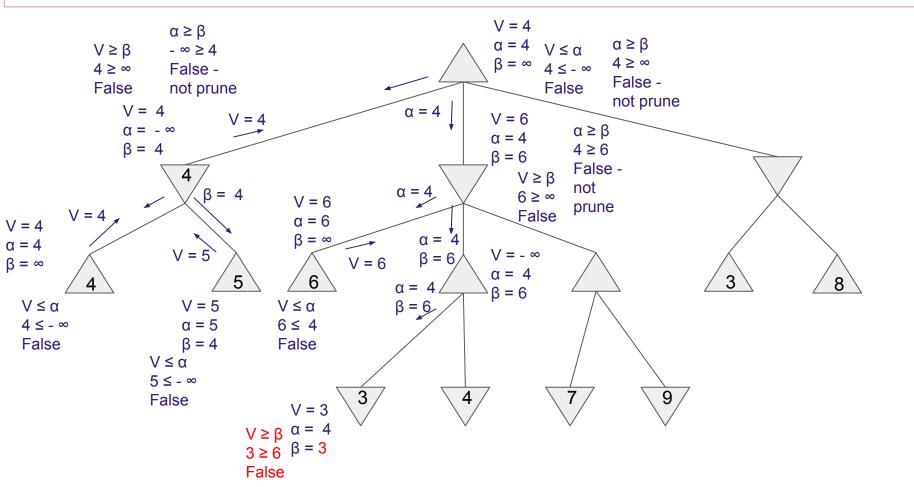




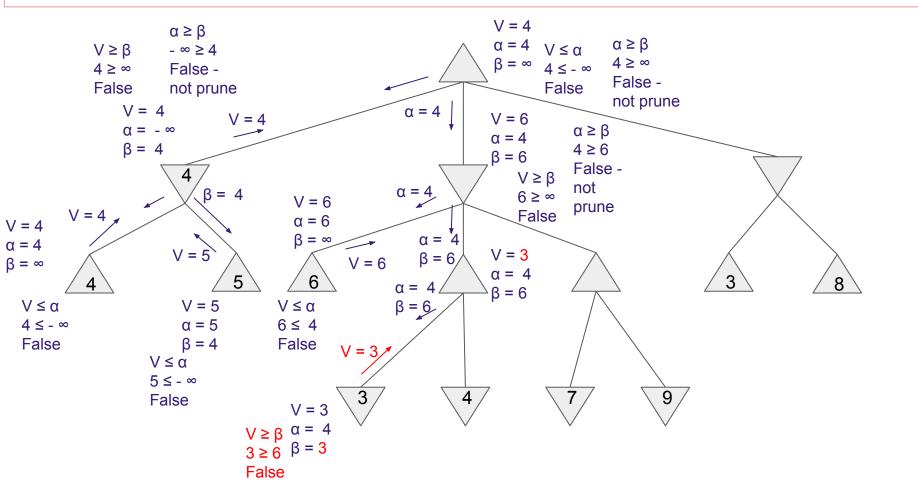
$\alpha {\ge} \beta \ \underline{true} \ prune \ | \ MAX : V {\le} \alpha \ \underline{false} \ change \ \alpha \ to \ value \ V \ | \ MIN : V {\ge} \beta \ \underline{false} \ change \ \beta \ to \ value \ V$



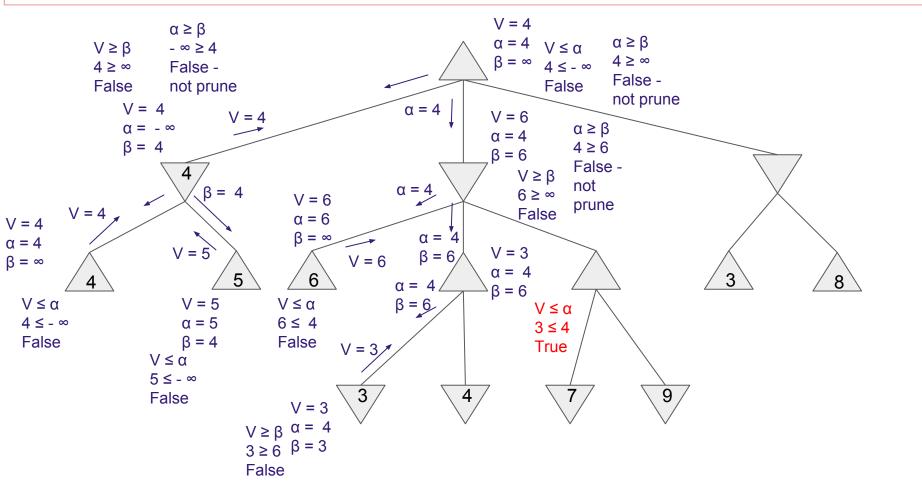
$\alpha {\ge} \beta \ \underline{true} \ prune \ | \ MAX : V {\le} \alpha \ \underline{false} \ change \ \alpha \ to \ value \ V \ | \ MIN : V {\ge} \beta \ \underline{false} \ change \ \beta \ to \ value \ V$



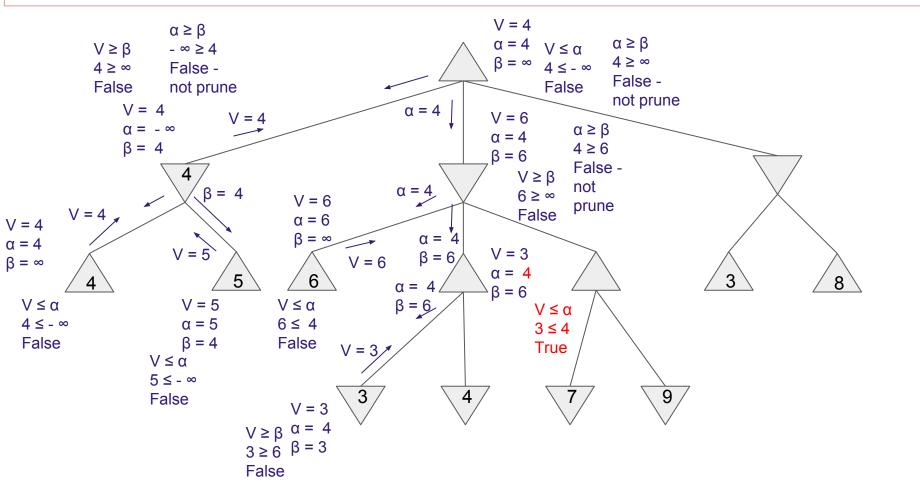
α ≥ β <u>true</u> prune | MAX : V≤ α <u>false</u> change α to value V | MIN : V≥ β <u>false</u> change β to value V



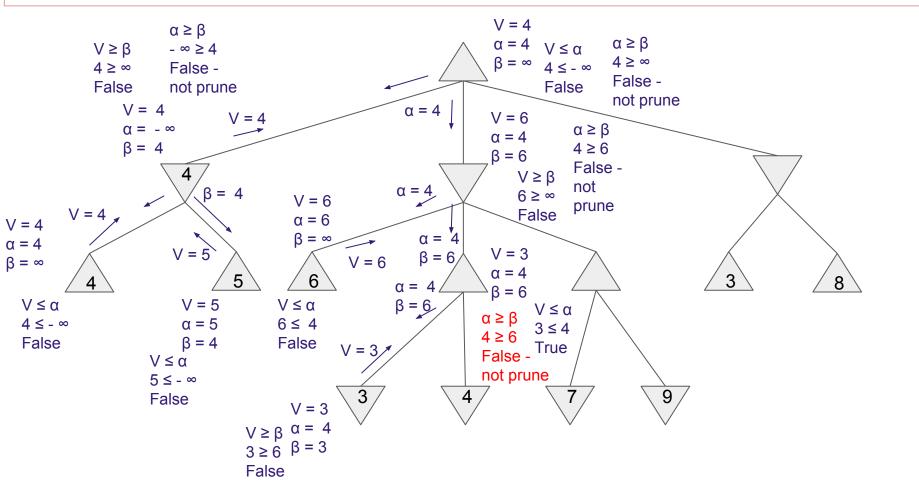
α ≥ β <u>true</u> prune | MAX : V≤ α <u>false</u> change α to value V | MIN : V≥ β <u>false</u> change β to value V



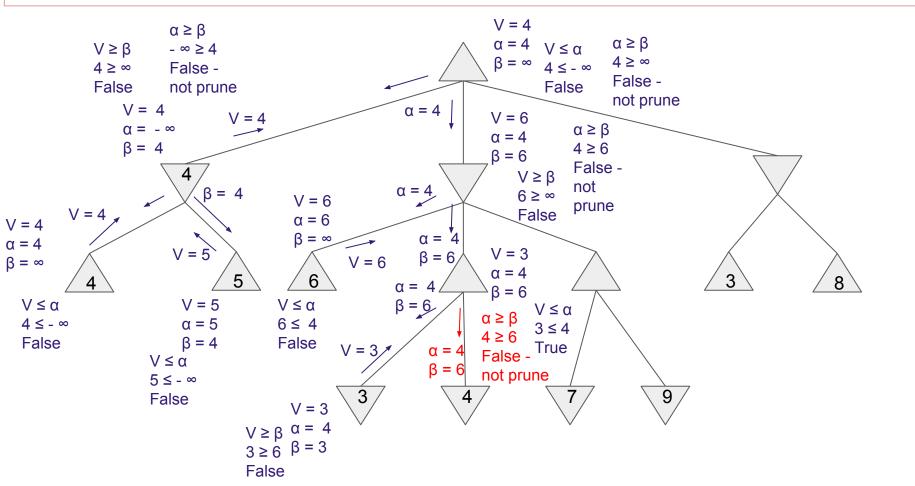
α ≥β <u>true</u> prune | MAX : V≤α <u>false</u> change α to value V | MIN : V≥β <u>false</u> change β to value V

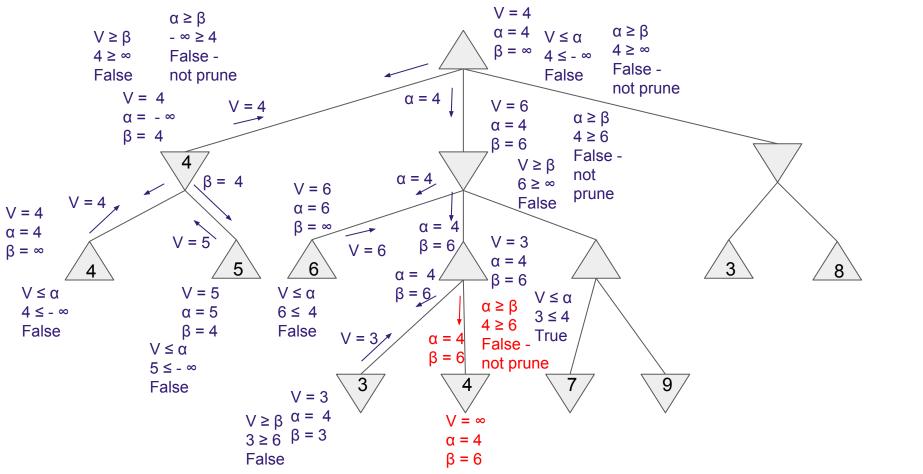


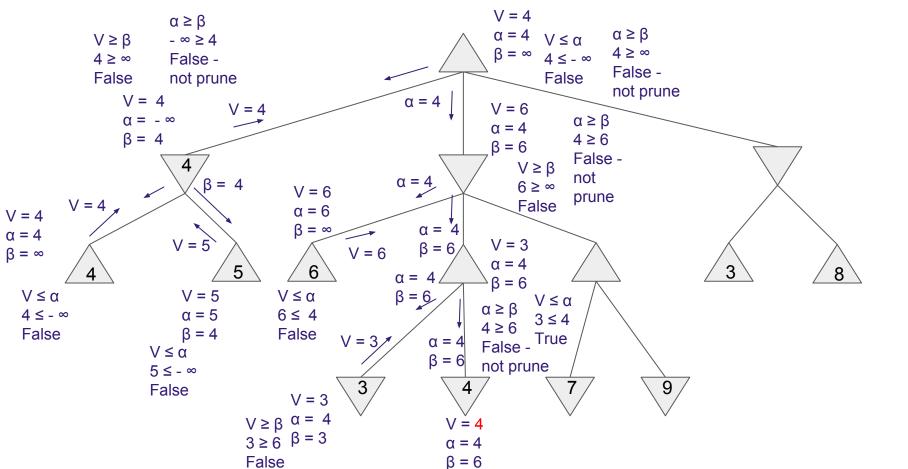
$\alpha {\ge} \beta \text{ } \underline{\text{true}} \text{ prune} \mid \text{MAX} : \text{V} {\le} \alpha \text{ } \underline{\text{false}} \text{ change } \alpha \text{ to value V} \mid \text{MIN} : \text{V} {\ge} \beta \text{ } \underline{\text{false}} \text{ change } \beta \text{ to value V}$

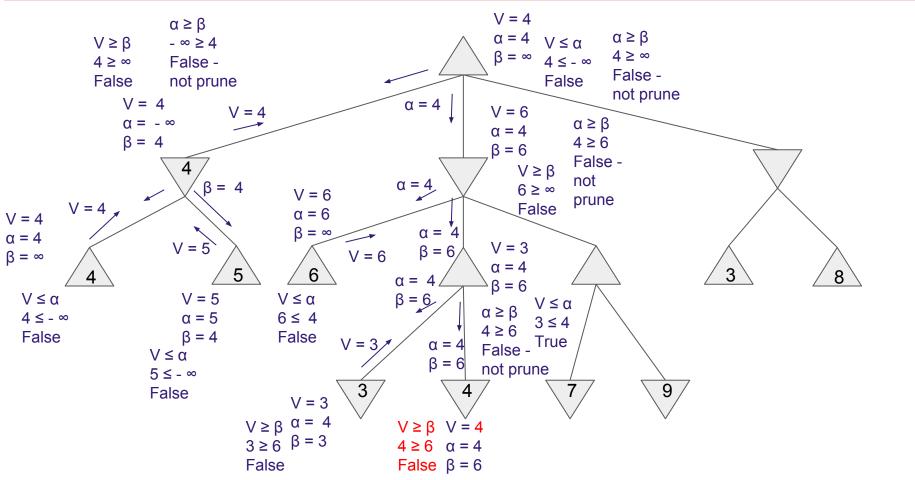


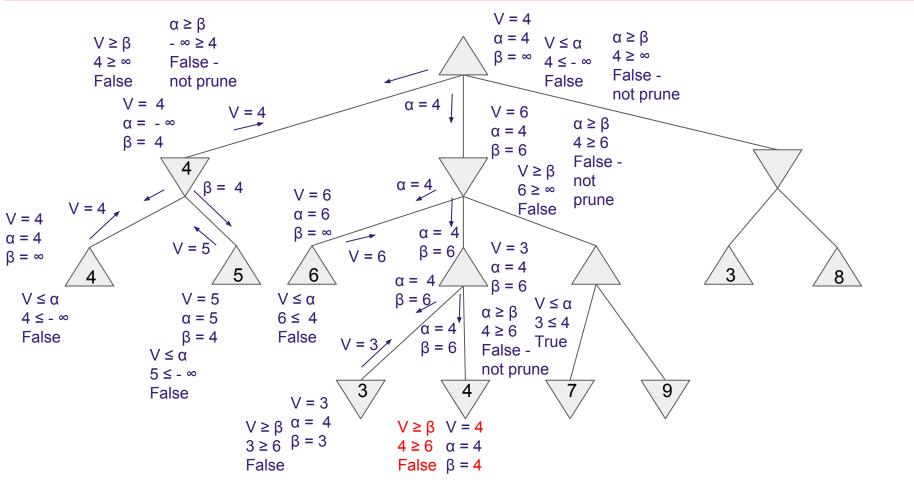
α ≥β <u>true</u> prune | MAX : V≤α <u>false</u> change α to value V | MIN : V≥β <u>false</u> change β to value V

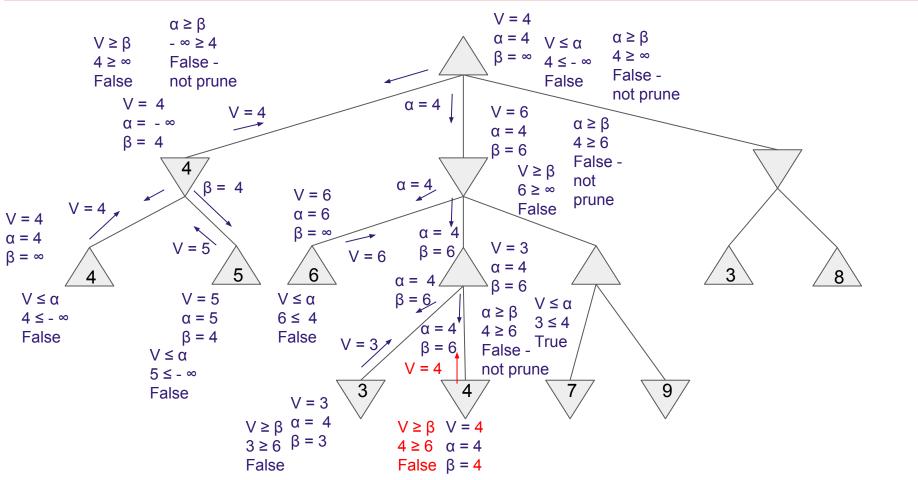


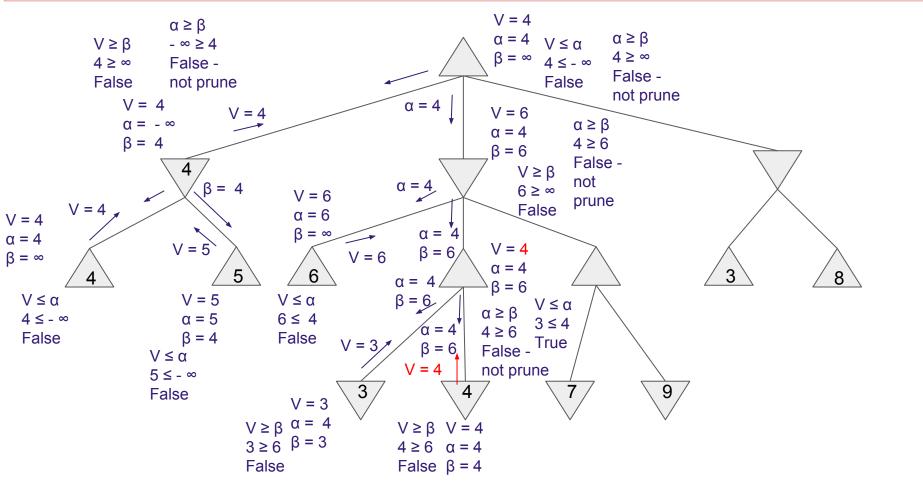


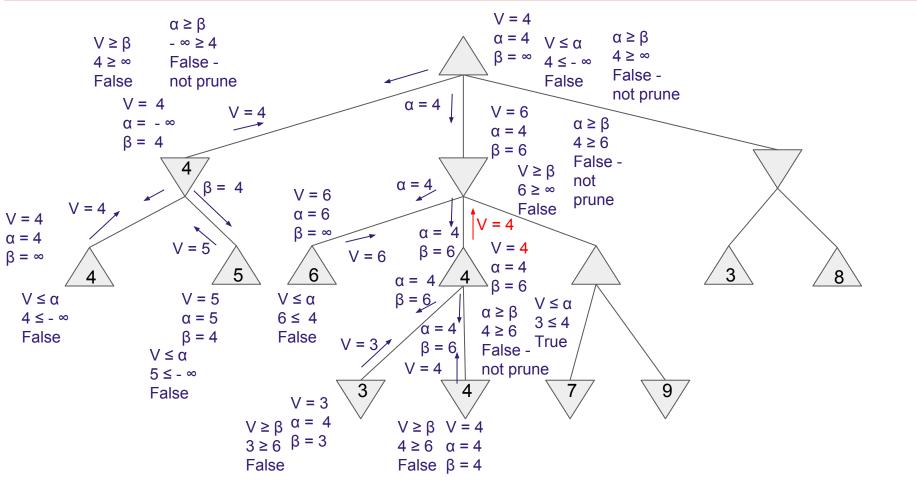


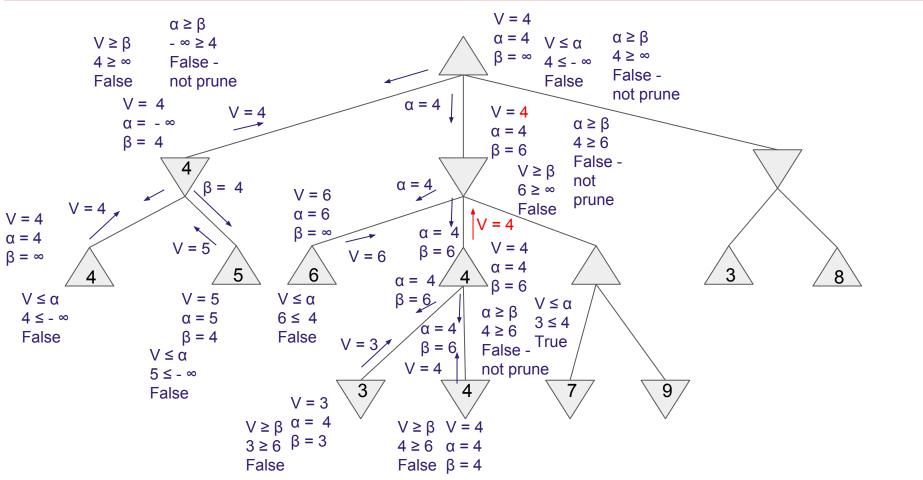


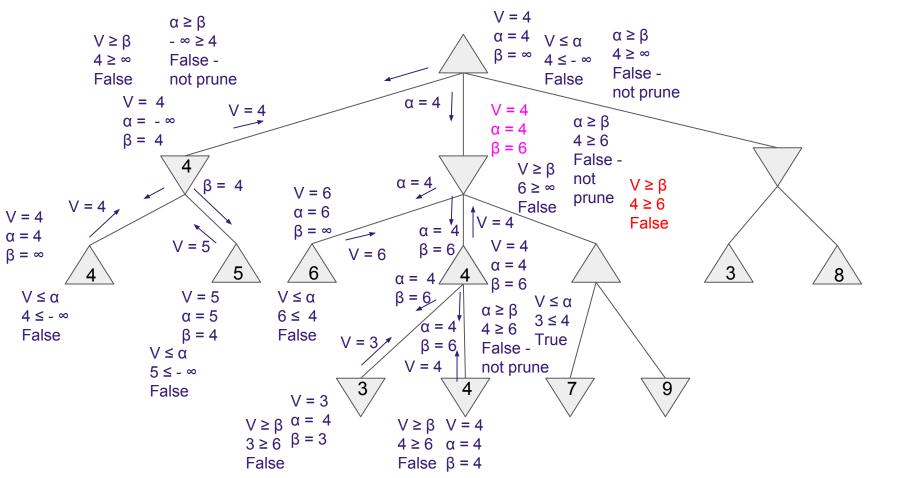


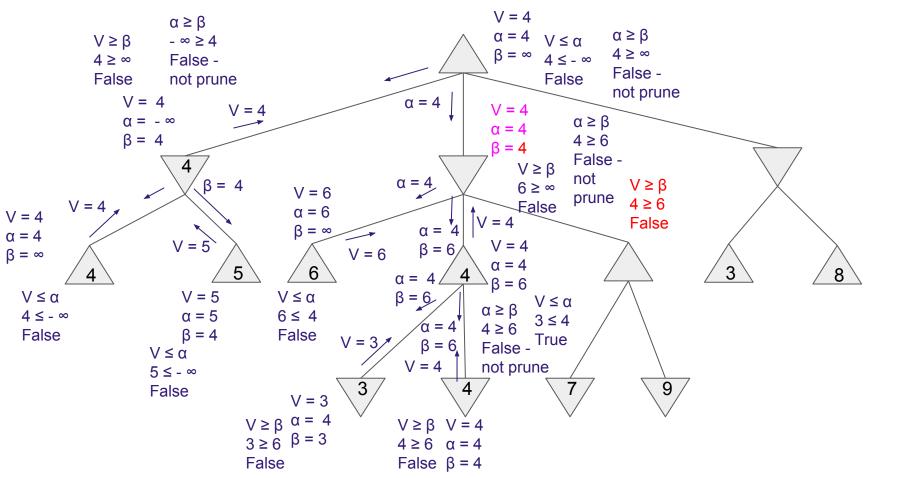


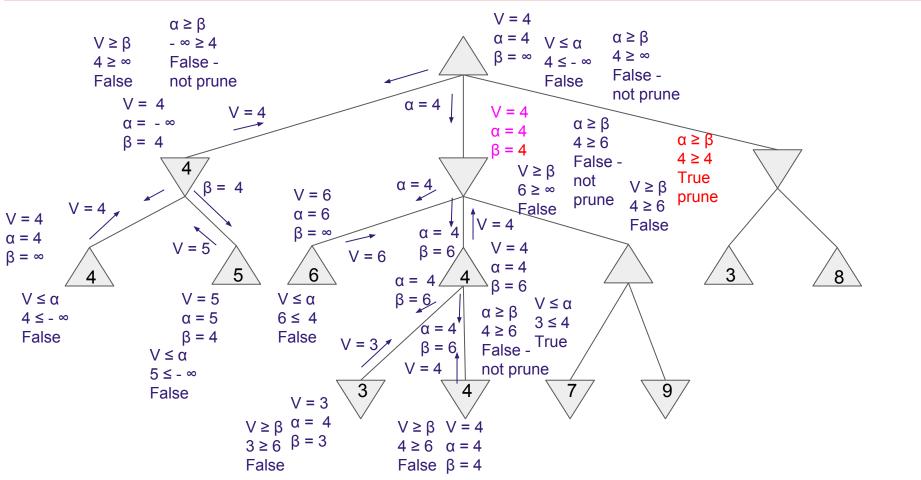


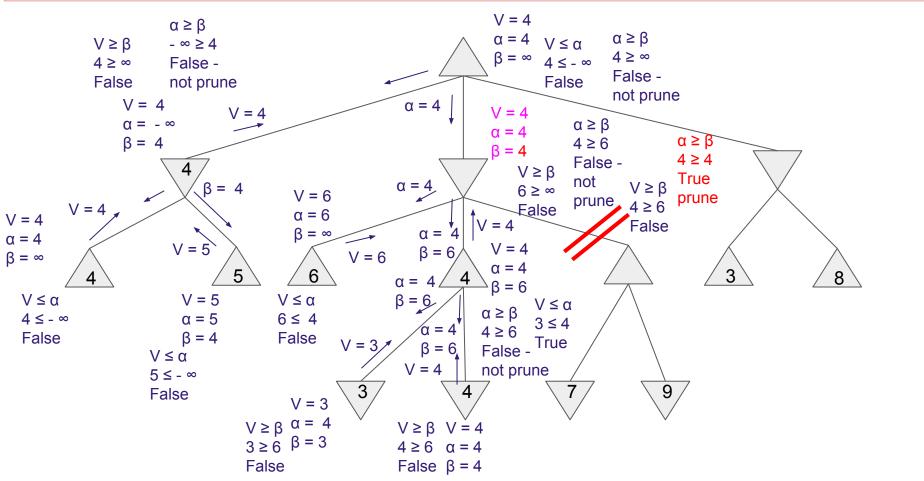


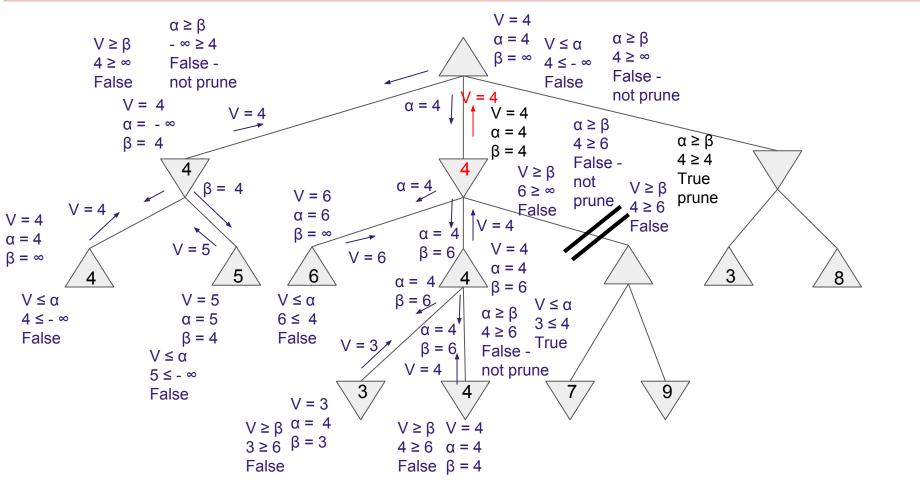


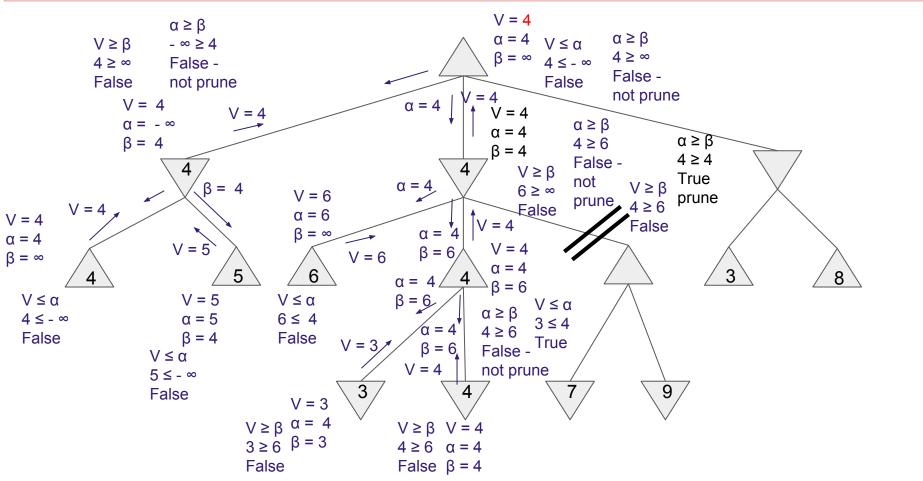


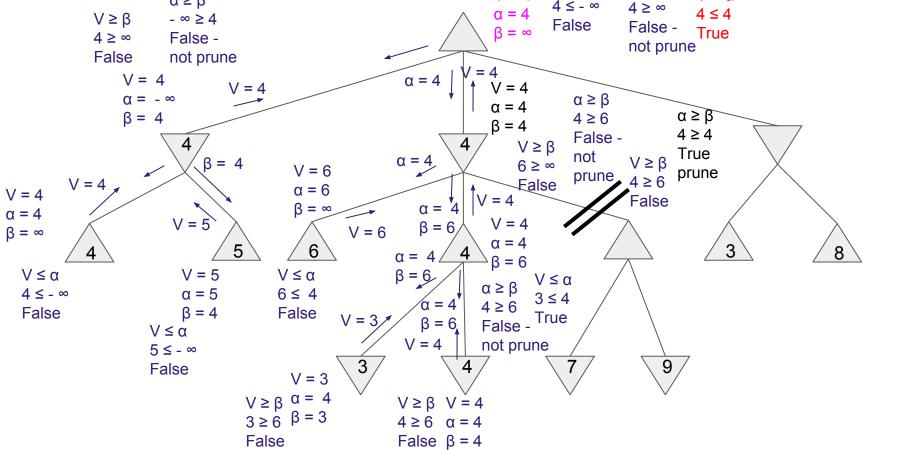


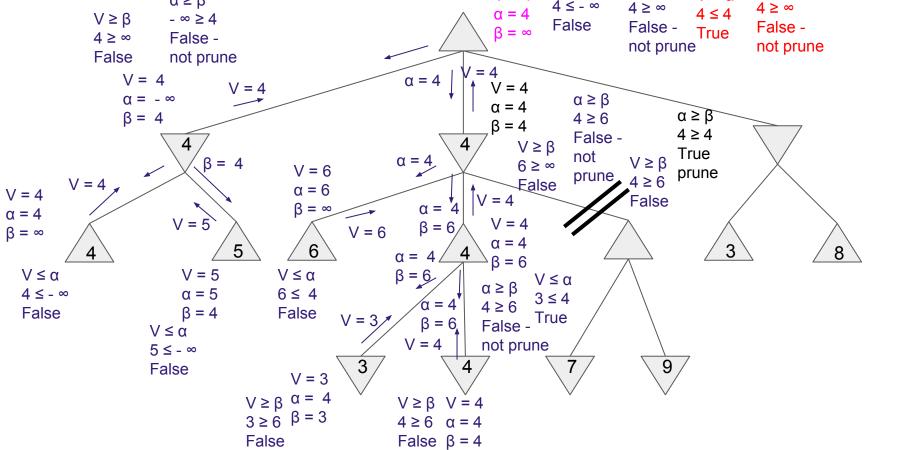




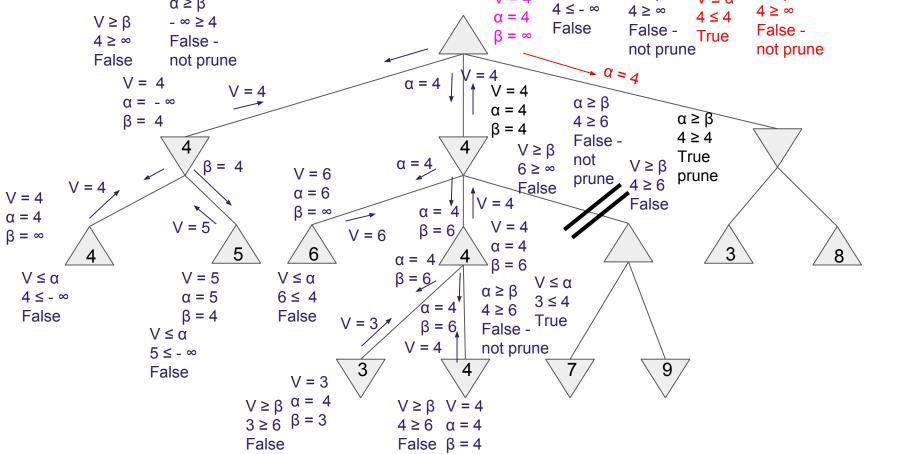


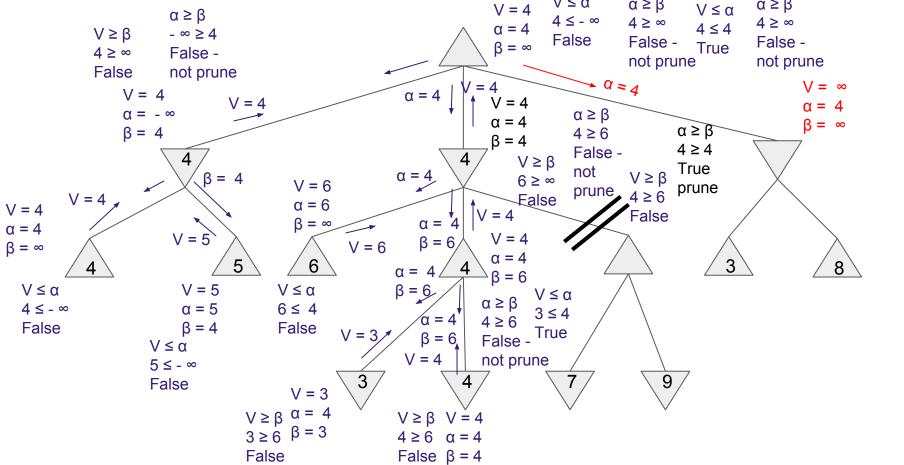




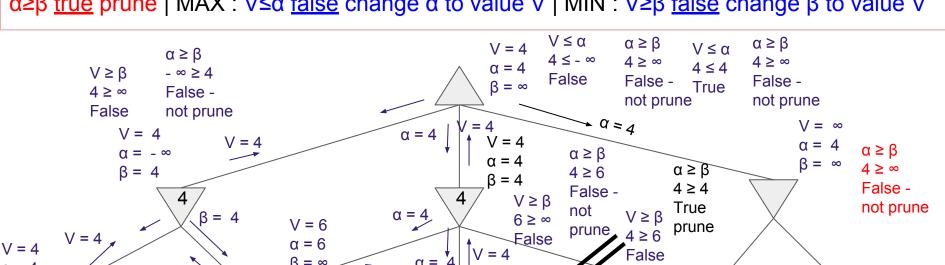


α ≥β <u>true</u> prune | MAX : V≤α <u>false</u> change α to value V | MIN : V≥β <u>false</u> change β to value V α ≥β α α ≥β α α ≥β α α ≥β α α ≥β α





α≥β true prune | MAX : V≤α false change α to value V | MIN : V≥β false change β to value V $V \le \alpha$ $\alpha \geq \beta$ $\alpha \geq \beta$ $V \le \alpha$ V = 4



 $V \le \alpha$

 $3 \le 4$

9

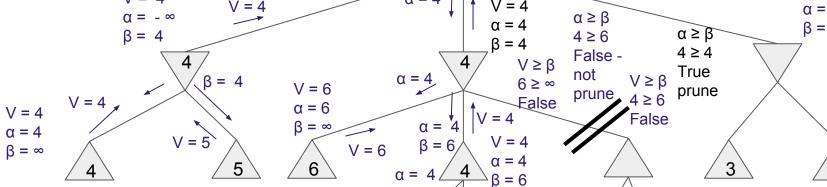
 $\alpha \geq \beta$

4 ≥ 6

False - True

not prune

8



 $\beta = 6$

V = 3

3

 $\alpha = 4$

 $\beta = 6$

 $V \ge \beta \quad V = 4$

False $\beta = 4$

V = 4

 $V \le \alpha$

4 ≤ - ∞

False

V = 5

 $\alpha = 5$

 $\beta = 4$

 $V \le \alpha$

5 ≤ - ∞

False

 $V \le \alpha$

 $6 \le 4$

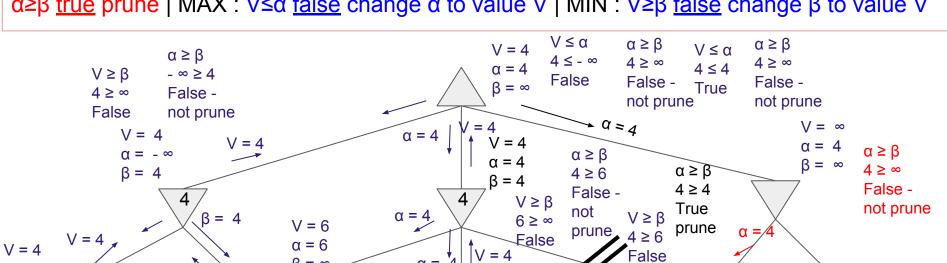
False

V = 3

 $V \ge \beta \alpha = 4$

 $3 \ge 6$ $\beta = 3$

α≥β true prune | MAX : V≤α false change α to value V | MIN : V≥β false change β to value V $V \le \alpha$ $\alpha \geq \beta$ $\alpha \geq \beta$ $V \le \alpha$ V = 4



$$\beta = 4$$

$$V = 4$$

$$\alpha = 4$$

$$\alpha = 4$$

$$\alpha = 4$$

$$\beta = \infty$$

$$0 = 4$$

$$0 = 4$$

$$0 = 6$$

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 $\beta = 6$

 $\alpha \geq \beta$

4 ≥ 6

False - True

not prune

 $V \le \alpha$

 $3 \le 4$

9

 $\alpha =$

V = 3

3

 $V \le \alpha$

4 ≤ - ∞

False

V = 5

 $\alpha = 5$

 $\beta = 4$

 $V \le \alpha$

5 ≤ - ∞

False

 $V \le \alpha$

 $6 \le 4$

False

V = 3

 $V \ge \beta \alpha = 4$

 $3 \ge 6$ $\beta = 3$

False

 $\beta = 6$

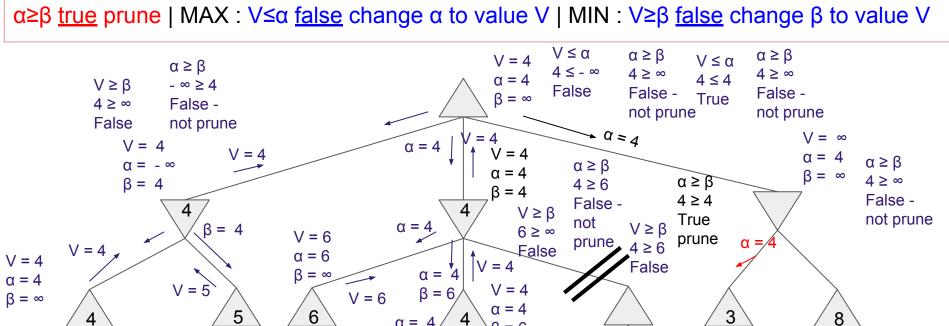
 $\alpha = 4$

 $\beta = 6$

 $V \ge \beta \quad V = 4$

False $\beta = 4$

V = 4



 $\beta = 6$

 $\alpha \geq \beta$

4 ≥ 6

False -

not prune

 $\beta = 6$

 $V \ge \beta \quad V = 4$

False $\beta = 4$

V = 4

 $V \le \alpha$

3 ≤ 4

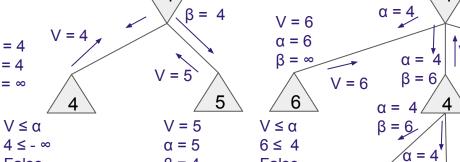
True

V = ∞

 $\alpha = 4$

β = ∞

9



False

V = 3

 $V \ge \beta \alpha = 4$

 $3 \ge 6$ $\beta = 3$

False

V = 3

3

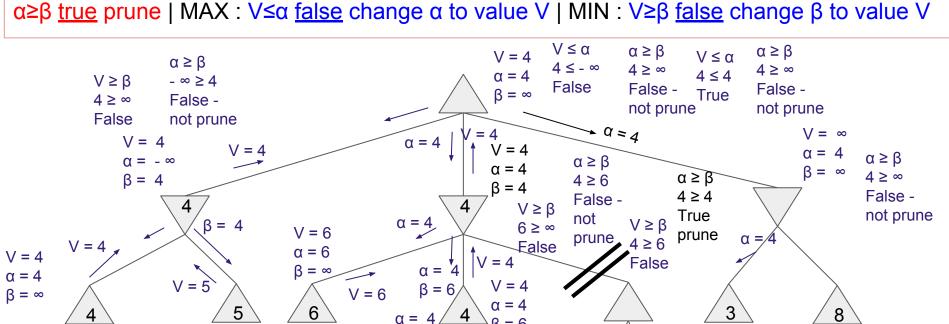
 $\beta = 4$

 $V \le \alpha$

5 ≤ - ∞

False

α≥β true prune | MAX : V≤α false change α to value V | MIN : V≥β false change β to value V $V \le \alpha$ $\alpha \geq \beta$ $\alpha \geq \beta$ $V \le \alpha$ V = 4



 $\beta = 6$

V = 3

3

 $\alpha = 4$

 $\beta = 6$

 $V \ge \beta \quad V = 4$

False $\beta = 4$

V = 4

 $V \le \alpha$

4 ≤ - ∞

False

V = 5

 $\alpha = 5$

 $\beta = 4$

 $V \le \alpha$

5 ≤ - ∞

False

 $V \le \alpha$

 $6 \le 4$

False

V = 3

 $V \ge \beta \alpha = 4$

 $3 \ge 6$ $\beta = 3$

False

 $\beta = 6$

 $\alpha \geq \beta$

4 ≥ 6

False -

not prune

 $V \le \alpha$

3 ≤ 4

True

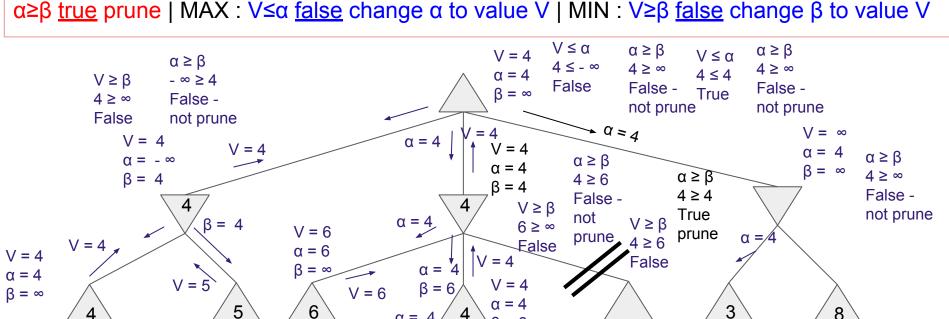
V = 3

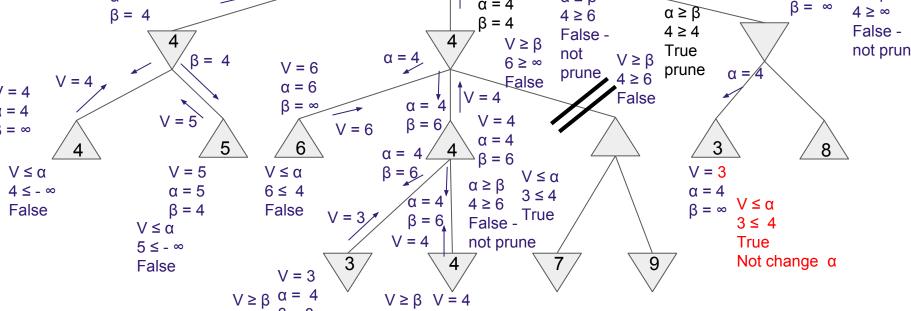
 $\alpha = 4$

β = ∞

9

α≥β true prune | MAX : V≤α false change α to value V | MIN : V≥β false change β to value V V ≤ α $\alpha \geq \beta$ $\alpha \geq \beta$ $V \le \alpha$ V = 4

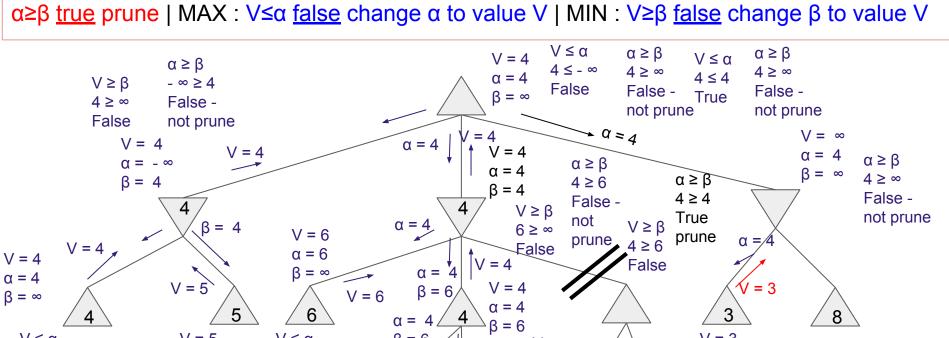




 $V \ge \beta \quad V = 4$

False $\beta = 4$

 $3 \ge 6$ $\beta = 3$



True

False -

not prune

V ≤ α

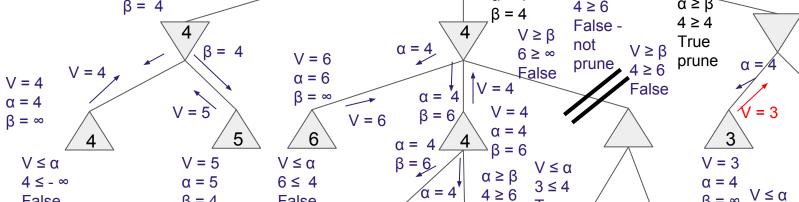
 $3 \leq 4$

True

Not change α

β = ∞

9



 $\beta = 6$

 $V \ge \beta \quad V = 4$

False $\beta = 4$

V = 4

V = 3

3

 $\beta = 4$

 $V \le \alpha$

5 ≤ - ∞

False

False

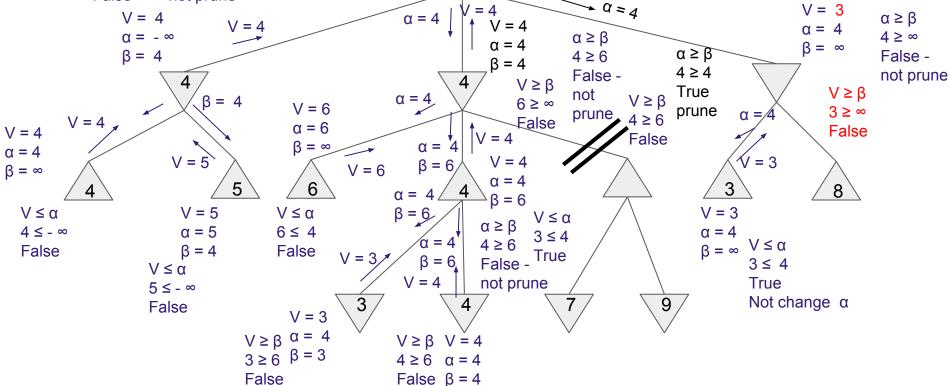
False

V = 3

 $V \ge \beta \alpha = 4$

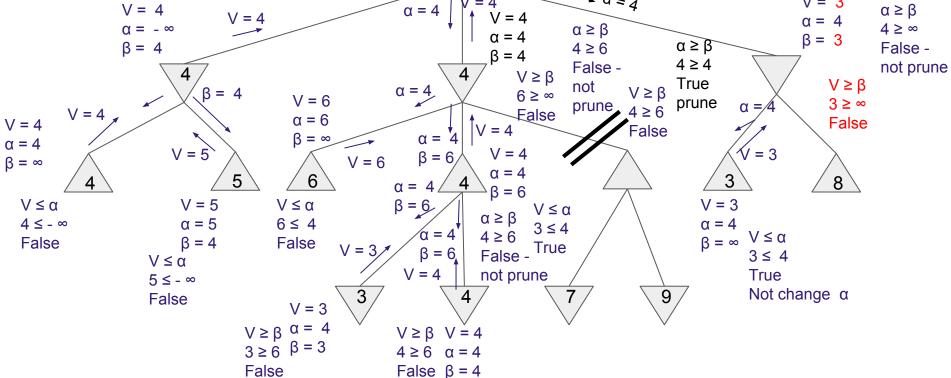
 $3 \ge 6$ $\beta = 3$

α≥β true prune | MAX : V≤α false change α to value V | MIN : V≥β false change β to value V $V \le \alpha$ $\alpha \geq \beta$ $\alpha \geq \beta$ $V \le \alpha$ V = 4 $\alpha \geq \beta$ 4 ≤ - ∞ 4 ≥ ∞ 4 ≥ ∞ $\alpha = 4$ 4 ≤ 4 $V \ge \beta$ - ∞ ≥ 4 False False -False β = ∞ True 4 ≥ ∞ False not prune not prune False not prune $\alpha = 4$ V = 3

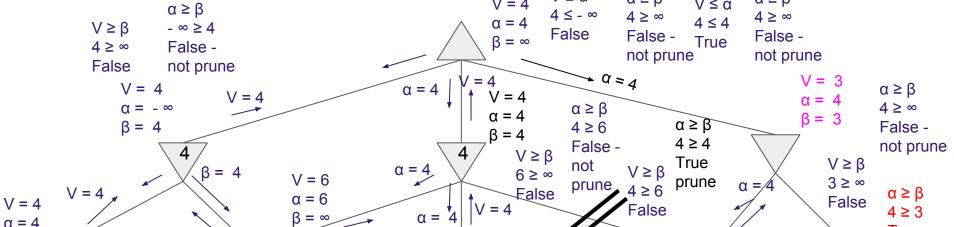


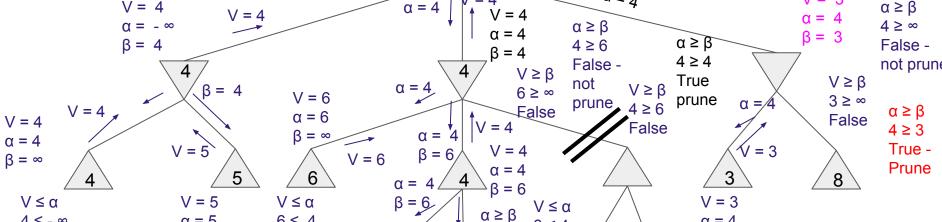
False $\beta = 4$

α≥β true prune | MAX : V≤α false change α to value V | MIN : V≥β false change β to value V $V \le \alpha$ $\alpha \geq \beta$ $\alpha \geq \beta$ $V \le \alpha$ V = 4 $\alpha \geq \beta$ 4 ≤ - ∞ 4 ≥ ∞ 4 ≥ ∞ $\alpha = 4$ 4 ≤ 4 $V \ge \beta$ - ∞ ≥ 4 False False -False β = ∞ True 4 ≥ ∞ False not prune not prune False not prune $\alpha = 4$ V = 3



α≥β true prune | MAX : V≤α false change α to value V | MIN : V≥β false change β to value V $V \le \alpha$ $\alpha \geq \beta$ $\alpha \geq \beta$ $V \le \alpha$ V = 4 $\alpha \geq \beta$ 4 ≤ - ∞ 4 ≥ ∞ 4 ≥ ∞ $\alpha = 4$ 4 ≤ 4 $V \ge \beta$ - ∞ ≥ 4 False False -False β = ∞ True 4 ≥ ∞ False not prune not prune False not prune V = 3





4 ≥ 6

False -

not prune

 $\alpha = 4$

 $\beta = 6$

 $V \ge \beta \quad V = 4$

False $\beta = 4$

V = 4

3 ≤ 4

True

 $6 \le 4$

False

V = 3

 $V \ge \beta \alpha = 4$

 $3 \ge 6$ $\beta = 3$

False

V = 3

3

 $\alpha = 5$

 $\beta = 4$

 $V \le \alpha$

5 ≤ - ∞

False

4 ≤ - ∞

False

 $\alpha = 4$

β = ∞

9

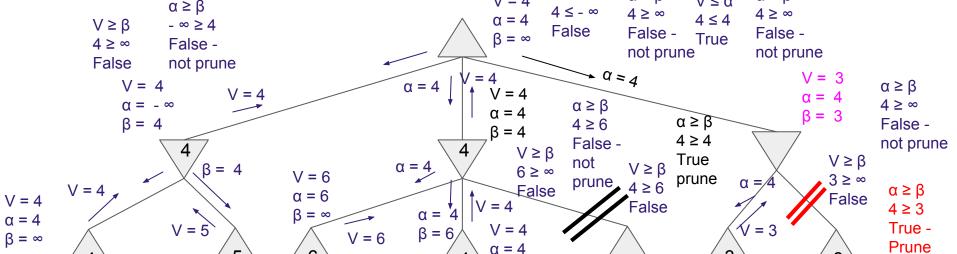
V ≤ α

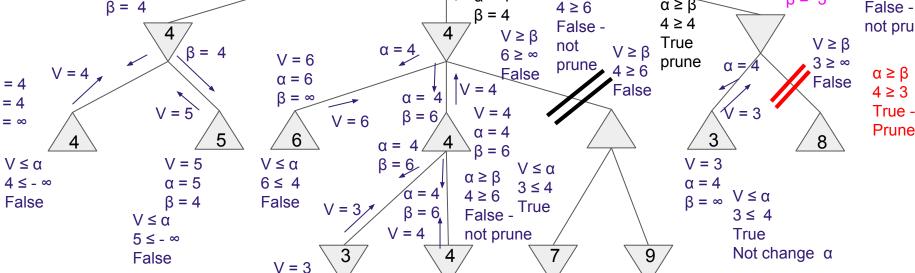
 $3 \leq 4$

True

Not change α

α≥β true prune | MAX : V≤α false change α to value V | MIN : V≥β false change β to value V $V \le \alpha$ $\alpha \geq \beta$ $\alpha \geq \beta$ $V \le \alpha$ V = 4 $\alpha \geq \beta$ 4 ≤ - ∞ 4 ≥ ∞ 4 ≥ ∞ $\alpha = 4$ 4 ≤ 4 $V \ge \beta$ - ∞ ≥ 4 False False -False β = ∞ True 4 ≥ ∞ False not prune not prune





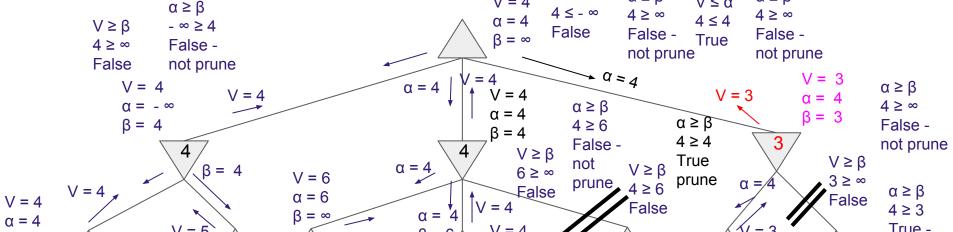
 $V \ge \beta \quad V = 4$

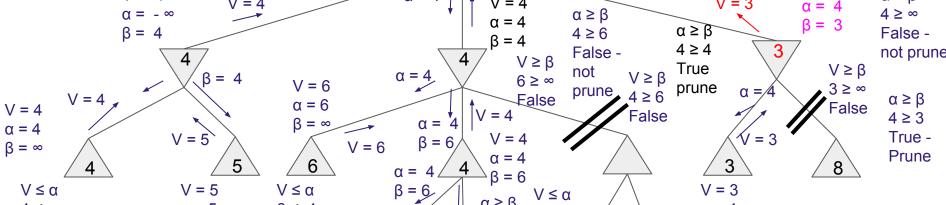
False $\beta = 4$

 $V \ge \beta \alpha = 4$

 $3 \ge 6$ $\beta = 3$

α≥β true prune | MAX : V≤α false change α to value V | MIN : V≥β false change β to value V $V \le \alpha$ $\alpha \geq \beta$ $\alpha \geq \beta$ $V \le \alpha$ V = 4 $\alpha \geq \beta$ 4 ≤ - ∞ 4 ≥ ∞ 4 ≥ ∞ $\alpha = 4$ 4 ≤ 4 $V \ge \beta$ - ∞ ≥ 4 False False -False β = ∞ True 4 ≥ ∞ False not prune not prune False not prune





 $\alpha \geq \beta$

4 ≥ 6

False -

not prune

 $\alpha = 4$

 $\beta = 6$

 $V \ge \beta \quad V = 4$

False $\beta = 4$

V = 4

 $6 \le 4$

False

V = 3

 $V \ge \beta \alpha = 4$

 $3 \ge 6$ $\beta = 3$

False

V = 3

3

 $\alpha = 5$

 $\beta = 4$

 $V \le \alpha$

5 ≤ - ∞

False

4 ≤ - ∞

False

 $V \le \alpha$

3 ≤ 4

True

 $\alpha = 4$

β = ∞

9

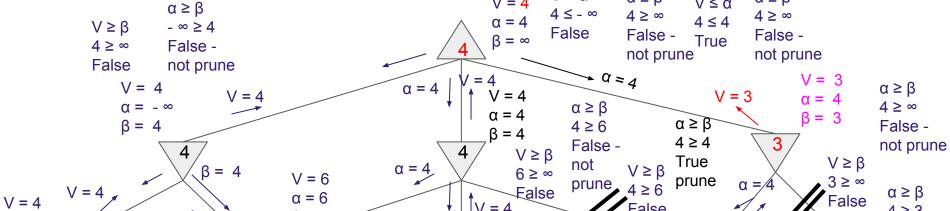
V ≤ α

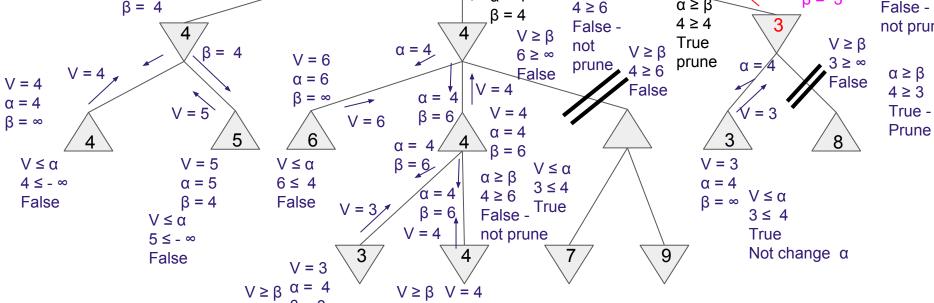
 $3 \leq 4$

True

Not change α

α≥β true prune | MAX : V≤α false change α to value V | MIN : V≥β false change β to value V $V \le \alpha$ $\alpha \geq \beta$ $\alpha \geq \beta$ $V \le \alpha$ V = 4 $\alpha \geq \beta$ 4 ≤ - ∞ 4 ≥ ∞ 4 ≥ ∞ $\alpha = 4$ 4 ≤ 4 $V \ge \beta$ - ∞ ≥ 4 False False -False β = ∞ True 4 ≥ ∞ False not prune not prune





False $\beta = 4$

 $3 \ge 6$ $\beta = 3$