Discount factor influence to policy estimation analysis

J. Kostlivá, Z. Straka, P. Švarný

We have:

- an unknown grid world of unknown size and structure
- robot/agents moves in unknown directions with unknown parameters
- a few episodes the robot tried

Today:

- We will compute the optimal policy
- Use different γ settings
- Study the boundary values for γ

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Example I

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Episode 1	**Episode 2**	**Episode 3**	**Episode 4**
$(B, \rightarrow, C, -1)$	$(B, \leftarrow, A, -1)$	$(C, \rightarrow, D, -1)$	$(C, \leftarrow, B, -1)$
$(C, \rightarrow, D, -1)$	$(A, \rightarrow, exit, 10)$	$(D, \rightarrow, exit, 6)$	$(B, \rightarrow, C, -1)$
$(D, \leftarrow, exit, 6)$			$(C, \leftarrow, B, -1)$
			$(B, \leftarrow, A, -1)$
			$(A, \leftarrow, exit, 10)$

each field in the table is an n-tuple (s, a, s', r)

Compute policy with

- $\gamma = 1$
- estimate γ which changes the policy computed for $\gamma = 1$
- $\gamma = 0$

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Episode 1	Episode 2	Episode 3	Episode 4
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each field in the table is an n-tuple (s, a, s', r)

State set: $S = \{A, B, C, D\}$, terminal states: $\{A, D\}$, non-terminal states: $\{B, C\}$

Action set: $A = \{\rightarrow, \leftarrow\}$

Reward function: $r(\{B, C\}) = -1$, $r(A) = 10$, $r(D) = 6$

Transition model: $p(C|B, \rightarrow) = p(A|B, \leftarrow) = p(D|C, \rightarrow) = p(B|C, \leftarrow) = 2/2 = 1$

World structure:

A	B	C	D

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$$\gamma = 1$$

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$p(C|B, \rightarrow) = p(A|B, \leftarrow) = 2/2 = p(D|C, \rightarrow) = p(B|C, \leftarrow) = 1$

Estimate optimal policy:

A: $\pi(B) = \leftarrow, \pi(C) = \leftarrow$

B: $\pi(B) = \leftarrow, \pi(C) = \rightarrow$

C: $\pi(B) = \rightarrow, \pi(C) = \leftarrow$

D: $\pi(B) = \rightarrow, \pi(C) = \rightarrow$

Let's find out :-)

Example I, $\gamma = 1$

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$r(\{B, C\}) = -1, \; r(A) = 10, \; r(D) = 6$

$p(C|B, \rightarrow) = p(A|B, \leftarrow) = 2/2 =$
$p(D|C, \rightarrow) = p(B|C, \leftarrow) = 1$

Compute:

A: $q(B, \leftarrow) = -1$

B: $q(B, \leftarrow) = 5$

C: $q(B, \leftarrow) = 9$

D: $q(B, \leftarrow) = 6$

Example I, $\gamma = 1$

Episode 1	Episode 2	Episode 3	Episode 4
$(B, \rightarrow, C, -1)$	$(B, \leftarrow, A, -1)$	$(C, \rightarrow, D, -1)$	$(C, \leftarrow, B, -1)$
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Compute:

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B: $q(B, \leftarrow) = 5$

C: $q(B, \leftarrow) = B \leftarrow A = 10 - 1 = 9$

D: $q(B, \leftarrow) = 6$

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- $q(B, \leftarrow) = 9$

Compute:

A: $q(B, \rightarrow) = -1$

B: $q(B, \rightarrow) = 7$

C: $q(B, \rightarrow) = 10$

D: $q(B, \rightarrow) = 6$

Example I, $\gamma = 1$

Episode 1	Episode 2	Episode 3	Episode 4
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Compute:

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B: $\pi(B) = \rightarrow$

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$p(D|C, \rightarrow) = p(B|C, \leftarrow) = 1$

- $\pi(B) = \leftarrow$

Compute:

A: $q(C, \rightarrow) = -1$

B: $q(C, \rightarrow) = C \rightarrow D = 6 - 1 = 5$

C: $q(C, \rightarrow) = 9$

D: $q(C, \rightarrow) = 6$

Example I, $\gamma = 1$

Episode 1	Episode 2	Episode 3	Episode 4
$(B, \rightarrow, C, -1)$ $(C, \rightarrow, D, -1)$ $(D, \leftarrow, exit, 6)$	$(B, \leftarrow, A, -1)$ $(A, \rightarrow, exit, 10)$	$(C, \rightarrow, D, -1)$ $(D, \rightarrow, exit, 6)$	$(C, \leftarrow, B, -1)$ $(B, \rightarrow, C, -1)$ $(C, \leftarrow, B, -1)$ $(B, \leftarrow, A, -1)$ $(A, \leftarrow, exit, 10)$

each field in the table is an n-tuple (s, a, s', r)

A	B	C	D

$S = \{A, B, C, D\}$

$A = \{\rightarrow, \leftarrow\}$

$r(\{B, C\}) = -1,\ r(A) = 10,\ r(D) = 6$

$p(C|B, \rightarrow) = p(A|B, \leftarrow) = 2/2 =$
$p(D|C, \rightarrow) = p(B|C, \leftarrow) = 1$

- $\pi(B) = \leftarrow$
  - $q(C, \rightarrow) = 5$

Compute:

A: $q(C, \leftarrow) = -1$

B: $q(C, \leftarrow) = 6$

C: $q(C, \leftarrow) = 10$

D: $q(C, \leftarrow) = 8$

Example I, $\gamma = 1$

Episode 1	Episode 2	Episode 3	Episode 4
$(B, \rightarrow, C, -1)$	$(B, \leftarrow, A, -1)$	$(C, \rightarrow, D, -1)$	$(C, \leftarrow, B, -1)$
$(C, \rightarrow, D, -1)$	$(A, \rightarrow, exit, 10)$	$(D, \rightarrow, exit, 6)$	$(B, \rightarrow, C, -1)$
$(D, \leftarrow, exit, 6)$			$(C, \leftarrow, B, -1)$
			$(B, \leftarrow, A, -1)$
			$(A, \leftarrow, exit, 10)$

each field in the table is an n-tuple (s, a, s', r)

A	B	C	D

$S = \{A, B, C, D\}$

$A = \{\rightarrow, \leftarrow\}$

$r(\{B, C\}) = -1,\ r(A) = 10,\ r(D) = 6$

$p(C|B, \rightarrow) = p(A|B, \leftarrow) = 2/2 =$
$p(D|C, \rightarrow) = p(B|C, \leftarrow) = 1$

- $\pi(B) = \leftarrow$
  - $q(C, \rightarrow) = 5$

Compute:

A: $q(C, \leftarrow) = -1$

B: $q(C, \leftarrow) = 6$

C: $q(C, \leftarrow) = 10$

D: $q(C, \leftarrow) = C \leftarrow B \leftarrow A = 10 - 1 - 1 = 8$

Example I, $\gamma = 1$

Episode 1	Episode 2	Episode 3	Episode 4
$(B, \rightarrow, C, -1)$	$(B, \leftarrow, A, -1)$	$(C, \rightarrow, D, -1)$	$(C, \leftarrow, B, -1)$
$(C, \rightarrow, D, -1)$	$(A, \rightarrow, exit, 10)$	$(D, \rightarrow, exit, 6)$	$(B, \rightarrow, C, -1)$
$(D, \leftarrow, exit, 6)$			$(C, \leftarrow, B, -1)$
			$(B, \leftarrow, A, -1)$
			$(A, \leftarrow, exit, 10)$

each field in the table is an n-tuple (s, a, s', r)

A	B	C	D

$S = \{A, B, C, D\}$

$A = \{\rightarrow, \leftarrow\}$

$r(\{B, C\}) = -1, \; r(A) = 10, \; r(D) = 6$

$p(C|B, \rightarrow) = p(A|B, \leftarrow) = 2/2 =$
$p(D|C, \rightarrow) = p(B|C, \leftarrow) = 1$

- $\pi(B) = \leftarrow$

- $q(C, \rightarrow) = 5$
- $q(C, \leftarrow) = 8$

Compute:

A: $\pi(C) = \leftarrow$

B: $\pi(C) = \rightarrow$

Example I, $\gamma = 1$

Episode 1	Episode 2	Episode 3	Episode 4
$(B, \rightarrow, C, -1)$ $(C, \rightarrow, D, -1)$ $(D, \leftarrow, exit, 6)$	$(B, \leftarrow, A, -1)$ $(A, \rightarrow, exit, 10)$	$(C, \rightarrow, D, -1)$ $(D, \rightarrow, exit, 6)$	$(C, \leftarrow, B, -1)$ $(B, \rightarrow, C, -1)$ $(C, \leftarrow, B, -1)$ $(B, \leftarrow, A, -1)$ $(A, \leftarrow, exit, 10)$

each field in the table is an n-tuple (s, a, s', r)

A	B	C	D

$S = \{A, B, C, D\}$

$A = \{\rightarrow, \leftarrow\}$

$r(\{B, C\}) = -1,\ r(A) = 10,\ r(D) = 6$

$p(C|B, \rightarrow) = p(A|B, \leftarrow) = 2/2 =$
$p(D|C, \rightarrow) = p(B|C, \leftarrow) = 1$

- $\pi(B) = \leftarrow$
  - $q(C, \rightarrow) = 5$
  - $q(C, \leftarrow) = 8$

Compute:

A: $\pi(C) = \leftarrow$

B: $\pi(C) = \rightarrow$

Example I, $\gamma = 1$

Episode 1	Episode 2	Episode 3	Episode 4
$(B, \rightarrow, C, -1)$ $(C, \rightarrow, D, -1)$ $(D, \leftarrow, exit, 6)$	$(B, \leftarrow, A, -1)$ $(A, \rightarrow, exit, 10)$	$(C, \rightarrow, D, -1)$ $(D, \rightarrow, exit, 6)$	$(C, \leftarrow, B, -1)$ $(B, \rightarrow, C, -1)$ $(C, \leftarrow, B, -1)$ $(B, \leftarrow, A, -1)$ $(A, \leftarrow, exit, 10)$

each field in the table is an n-tuple (s, a, s', r)

A	B	C	D

$S = \{A, B, C, D\}$

$A = \{\rightarrow, \leftarrow\}$

$r(\{B, C\}) = -1,\ r(A) = 10,\ r(D) = 6$

$p(C|B, \rightarrow) = p(A|B, \leftarrow) = 2/2 =$
$p(D|C, \rightarrow) = p(B|C, \leftarrow) = 1$

Evaluate policy for $\gamma = 1$:

A: $\pi(B) = \leftarrow, \pi(C) = \leftarrow$

B: $\pi(B) = \leftarrow, \pi(C) = \rightarrow$

C: $\pi(B) = \rightarrow, \pi(C) = \leftarrow$

D: $\pi(B) = \rightarrow, \pi(C) = \rightarrow$

Example I, $\gamma = 1$

Episode 1	Episode 2	Episode 3	Episode 4
$(B, \rightarrow, C, -1)$ $(C, \rightarrow, D, -1)$ $(D, \leftarrow, exit, 6)$	$(B, \leftarrow, A, -1)$ $(A, \rightarrow, exit, 10)$	$(C, \rightarrow, D, -1)$ $(D, \rightarrow, exit, 6)$	$(C, \leftarrow, B, -1)$ $(B, \rightarrow, C, -1)$ $(C, \leftarrow, B, -1)$ $(B, \leftarrow, A, -1)$ $(A, \leftarrow, exit, 10)$

each field in the table is an n-tuple (s, a, s', r)

A	B	C	D

$S = \{A, B, C, D\}$

$A = \{\rightarrow, \leftarrow\}$

$r(\{B, C\}) = -1,\ r(A) = 10,\ r(D) = 6$

$p(C|B, \rightarrow) = p(A|B, \leftarrow) = 2/2 =$
$p(D|C, \rightarrow) = p(B|C, \leftarrow) = 1$

Evaluate policy for $\gamma = 1$:

A: $\pi(B) = \leftarrow, \pi(C) = \leftarrow$

B: $\pi(B) = \leftarrow, \pi(C) = \rightarrow$

C: $\pi(B) = \rightarrow, \pi(C) = \leftarrow$

D: $\pi(B) = \rightarrow, \pi(C) = \rightarrow$

Example I

$$\gamma = ?$$

Example I, $\gamma =?$

Episode 1	Episode 2	Episode 3	Episode 4
$(B, \rightarrow, C, -1)$	$(B, \leftarrow, A, -1)$	$(C, \rightarrow, D, -1)$	$(C, \leftarrow, B, -1)$
$(C, \rightarrow, D, -1)$	$(A, \rightarrow, exit, 10)$	$(D, \rightarrow, exit, 6)$	$(B, \rightarrow, C, -1)$
$(D, \leftarrow, exit, 6)$			$(C, \leftarrow, B, -1)$
			$(B, \leftarrow, A, -1)$
			$(A, \leftarrow, exit, 10)$

each field in the table is an n-tuple (s, a, s', r)

A	B	C	D

$S = \{A, B, C, D\}$

$A = \{\rightarrow, \leftarrow\}$

$r(\{B, C\}) = -1,\ r(A) = 10,\ r(D) = 6$

$p(C|B, \rightarrow) = p(A|B, \leftarrow) = 2/2 =$
$p(D|C, \rightarrow) = p(B|C, \leftarrow) = 1$

- for $\gamma = 1$: $\pi(B) = \leftarrow, \pi(C) = \leftarrow$
- Task: determine γ which changes the policy computed for $\gamma = 1$

How?

A: try some value and verify

B: compute boundary values

C: guess

Example I, $\gamma =$?

Episode 1	Episode 2	Episode 3	Episode 4
$(B, \rightarrow, C, -1)$	$(B, \leftarrow, A, -1)$	$(C, \rightarrow, D, -1)$	$(C, \leftarrow, B, -1)$
$(C, \rightarrow, D, -1)$	$(A, \rightarrow, exit, 10)$	$(D, \rightarrow, exit, 6)$	$(B, \rightarrow, C, -1)$
$(D, \leftarrow, exit, 6)$			$(C, \leftarrow, B, -1)$
			$(B, \leftarrow, A, -1)$
			$(A, \leftarrow, exit, 10)$

each field in the table is an n-tuple (s, a, s', r)

A	B	C	D

$S = \{A, B, C, D\}$

$A = \{\rightarrow, \leftarrow\}$

$r(\{B, C\}) = -1,\ r(A) = 10,\ r(D) = 6$

$p(C|B, \rightarrow) = p(A|B, \leftarrow) = 2/2 =$
$p(D|C, \rightarrow) = p(B|C, \leftarrow) = 1$

- for $\gamma = 1$: $\pi(B) = \leftarrow, \pi(C) = \leftarrow$
- Task: determine γ which changes the policy computed for $\gamma = 1$

How?

A: try some value and verify

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C: guess

Example I, $\gamma = ?$

Episode 1	Episode 2	Episode 3	Episode 4
$(B, \rightarrow, C, -1)$	$(B, \leftarrow, A, -1)$	$(C, \rightarrow, D, -1)$	$(C, \leftarrow, B, -1)$
$(C, \rightarrow, D, -1)$	$(A, \rightarrow, exit, 10)$	$(D, \rightarrow, exit, 6)$	$(B, \rightarrow, C, -1)$
$(D, \leftarrow, exit, 6)$			$(C, \leftarrow, B, -1)$
			$(B, \leftarrow, A, -1)$
			$(A, \leftarrow, exit, 10)$

each field in the table is an n-tuple (s, a, s', r)

A	B	C	D

$S = \{A, B, C, D\}$

$A = \{\rightarrow, \leftarrow\}$

$r(\{B, C\}) = -1,\ r(A) = 10,\ r(D) = 6$

$p(C|B, \rightarrow) = p(A|B, \leftarrow) = 2/2 =$
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- Task: determine γ which changes the policy computed for $\gamma = 1$

How?

A: try some value and verify

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C: guess

Example I, $\gamma = ?$

Episode 1	Episode 2	Episode 3	Episode 4
$(B, \rightarrow, C, -1)$	$(B, \leftarrow, A, -1)$	$(C, \rightarrow, D, -1)$	$(C, \leftarrow, B, -1)$
$(C, \rightarrow, D, -1)$	$(A, \rightarrow, exit, 10)$	$(D, \rightarrow, exit, 6)$	$(B, \rightarrow, C, -1)$
$(D, \leftarrow, exit, 6)$			$(C, \leftarrow, B, -1)$
			$(B, \leftarrow, A, -1)$
			$(A, \leftarrow, exit, 10)$

each field in the table is an n-tuple (s, a, s', r)

A	B	C	D

$S = \{A, B, C, D\}$

$A = \{\rightarrow, \leftarrow\}$

$r(\{B, C\}) = -1,\ r(A) = 10,\ r(D) = 6$

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How?

A: try some value and verify

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Example I, $\gamma = ?$

Episode 1	Episode 2	Episode 3	Episode 4
$(B, \rightarrow, C, -1)$	$(B, \leftarrow, A, -1)$	$(C, \rightarrow, D, -1)$	$(C, \leftarrow, B, -1)$
$(C, \rightarrow, D, -1)$	$(A, \rightarrow, exit, 10)$	$(D, \rightarrow, exit, 6)$	$(B, \rightarrow, C, -1)$
$(D, \leftarrow, exit, 6)$			$(C, \leftarrow, B, -1)$
			$(B, \leftarrow, A, -1)$
			$(A, \leftarrow, exit, 10)$

each field in the table is an n-tuple (s, a, s', r)

A	B	C	D

$S = \{A, B, C, D\}$

$A = \{\rightarrow, \leftarrow\}$

$r(\{B, C\}) = -1, \; r(A) = 10, \; r(D) = 6$

$p(C|B, \rightarrow) = p(A|B, \leftarrow) = 2/2 =$
$p(D|C, \rightarrow) = p(B|C, \leftarrow) = 1$

- for $\gamma = 1$: $\pi(B) = \leftarrow, \pi(C) = \leftarrow$
- Task: determine γ which changes the policy computed for $\gamma = 1$

Can the policy in state B be changed?

A: Yes

B: No

Let's find out :-)

Example I, $\gamma =$?

Episode 1	Episode 2	Episode 3	Episode 4
$(B, \rightarrow, C, -1)$	$(B, \leftarrow, A, -1)$	$(C, \rightarrow, D, -1)$	$(C, \leftarrow, B, -1)$
$(C, \rightarrow, D, -1)$	$(A, \rightarrow, exit, 10)$	$(D, \rightarrow, exit, 6)$	$(B, \rightarrow, C, -1)$
$(D, \leftarrow, exit, 6)$			$(C, \leftarrow, B, -1)$
			$(B, \leftarrow, A, -1)$
			$(A, \leftarrow, exit, 10)$

each field in the table is an n-tuple (s, a, s', r)

A	B	C	D

$S = \{A, B, C, D\}$

$A = \{\rightarrow, \leftarrow\}$

$r(\{B, C\}) = -1,\ r(A) = 10,\ r(D) = 6$

$p(C|B, \rightarrow) = p(A|B, \leftarrow) = 2/2 =$
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- for $\gamma = 1$: $\pi(B) = \leftarrow, \pi(C) = \leftarrow$
- Task: determine γ which changes the policy computed for $\gamma = 1$

Can the policy in state B be changed?

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Let's find out :-)

Example I, $\gamma = ?$

Episode 1	Episode 2	Episode 3	Episode 4
$(B, \rightarrow, C, -1)$	$(B, \leftarrow, A, -1)$	$(C, \rightarrow, D, -1)$	$(C, \leftarrow, B, -1)$
$(C, \rightarrow, D, -1)$	$(A, \rightarrow, exit, 10)$	$(D, \rightarrow, exit, 6)$	$(B, \rightarrow, C, -1)$
$(D, \leftarrow, exit, 6)$			$(C, \leftarrow, B, -1)$
			$(B, \leftarrow, A, -1)$
			$(A, \leftarrow, exit, 10)$

each field in the table is an n-tuple (s, a, s', r)

A	B	C	D

$S = \{A, B, C, D\}$

$A = \{\rightarrow, \leftarrow\}$

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$p(C|B, \rightarrow) = p(A|B, \leftarrow) = 2/2 =$
$p(D|C, \rightarrow) = p(B|C, \leftarrow) = 1$

- for $\gamma = 1$: $\pi(B) = \leftarrow, \pi(C) = \leftarrow$
- Task: determine γ which changes the policy computed for $\gamma = 1$

Can the policy in state B be changed?

Compute:

A: $V(B) = \sum_{s'} p(s'|B, a)\{V(s')\}, s' \in \{A, C\}$

B: $V(B) = \max_a(r(B) + \gamma \cdot V(s')), s' \in \{A, C\}$

C: $V(B) = \arg\max_a \sum_{s'} \gamma \cdot V(s'), s' \in \{A, C\}$

D: $V(B) = r(B) + \gamma V(D)$

Example I, $\gamma =?$

Episode 1	Episode 2	Episode 3	Episode 4
$(B, \rightarrow, C, -1)$	$(B, \leftarrow, A, -1)$	$(C, \rightarrow, D, -1)$	$(C, \leftarrow, B, -1)$
$(C, \rightarrow, D, -1)$	$(A, \rightarrow, exit, 10)$	$(D, \rightarrow, exit, 6)$	$(B, \rightarrow, C, -1)$
$(D, \leftarrow, exit, 6)$			$(C, \leftarrow, B, -1)$
			$(B, \leftarrow, A, -1)$
			$(A, \leftarrow, exit, 10)$

each field in the table is an n-tuple (s, a, s', r)

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- for $\gamma = 1$: $\pi(B) = \leftarrow, \pi(C) = \leftarrow$
- Task: determine γ which changes the policy computed for $\gamma = 1$

Can the policy in state B be changed?
Compute:

A: $V(B) = \sum_{s'} p(s'|B, a)\{V(s')\}, s' \in \{A, C\}$

B: $V(B) = \max_a(r(B) + \gamma \cdot V(s')), s' \in \{A, C\}$

C: $V(B) = \arg\max_a \sum_{s'} \gamma \cdot V(s'), s' \in \{A, C\}$

D: $V(B) = r(B) + \gamma V(D)$

Example I, $\gamma = ?$

Episode 1	Episode 2	Episode 3	Episode 4
$(B, \rightarrow, C, -1)$ $(C, \rightarrow, D, -1)$ $(D, \leftarrow, exit, 6)$	$(B, \leftarrow, A, -1)$ $(A, \rightarrow, exit, 10)$	$(C, \rightarrow, D, -1)$ $(D, \rightarrow, exit, 6)$	$(C, \leftarrow, B, -1)$ $(B, \rightarrow, C, -1)$ $(C, \leftarrow, B, -1)$ $(B, \leftarrow, A, -1)$ $(A, \leftarrow, exit, 10)$

each field in the table is an n-tuple (s, a, s', r)

A	B	C	D

$S = \{A, B, C, D\}$

$A = \{\rightarrow, \leftarrow\}$

$r(\{B, C\}) = -1,\ r(A) = 10,\ r(D) = 6$

$p(C|B, \rightarrow) = p(A|B, \leftarrow) = 2/2 =$
$p(D|C, \rightarrow) = p(B|C, \leftarrow) = 1$

- for $\gamma = 1$: $\pi(B) = \leftarrow, \pi(C) = \leftarrow$
- Task: determine γ which changes the policy computed for $\gamma = 1$

Can the policy in state B be changed?
Compute:

A: $V(B) = \sum_{s'} p(s'|B, a)\{V(s')\}, s' \in \{A, C\}$

B: $V(B) = \max_a(r(B) + \gamma \cdot V(s')), s' \in \{A, C\}$

C: $V(B) = \arg\max_a \sum_{s'} \gamma \cdot V(s'), s' \in \{A, C\}$

D: $V(B) = r(B) + \gamma V(D)$

$\Rightarrow$ depends on $V(A), V(C)$

Example I, $\gamma = ?$

Episode 1	Episode 2	Episode 3	Episode 4
$(B, \rightarrow, C, -1)$ $(C, \rightarrow, D, -1)$ $(D, \leftarrow, exit, 6)$	$(B, \leftarrow, A, -1)$ $(A, \rightarrow, exit, 10)$	$(C, \rightarrow, D, -1)$ $(D, \rightarrow, exit, 6)$	$(C, \leftarrow, B, -1)$ $(B, \rightarrow, C, -1)$ $(C, \leftarrow, B, -1)$ $(B, \leftarrow, A, -1)$ $(A, \leftarrow, exit, 10)$

each field in the table is an n-tuple (s, a, s', r)

A	B	C	D

$S = \{A, B, C, D\}$

$A = \{\rightarrow, \leftarrow\}$

$r(\{B, C\}) = -1,\ r(A) = 10,\ r(D) = 6$

$p(C|B, \rightarrow) = p(A|B, \leftarrow) = 2/2 =$
$p(D|C, \rightarrow) = p(B|C, \leftarrow) = 1$

- for $\gamma = 1$: $\pi(B) = \leftarrow, \pi(C) = \leftarrow$
- Task: determine γ which changes the policy computed for $\gamma = 1$

Can the policy in state B be changed?
Compute:

A: $V(B) = \sum_{s'} p(s'|B, a)\{V(s')\}, s' \in \{A, C\}$

B: $V(B) = \max_a (r(B) + \gamma \cdot V(s')), s' \in \{A, C\}$

C: $V(B) = \arg\max_a \sum_{s'} \gamma \cdot V(s'), s' \in \{A, C\}$

D: $V(B) = r(B) + \gamma V(D)$

$\Rightarrow$ depends on $V(A), V(C)$

Example I, $\gamma = ?$

Episode 1	Episode 2	Episode 3	Episode 4
$(B, \rightarrow, C, -1)$	$(B, \leftarrow, A, -1)$	$(C, \rightarrow, D, -1)$	$(C, \leftarrow, B, -1)$
$(C, \rightarrow, D, -1)$	$(A, \rightarrow, exit, 10)$	$(D, \rightarrow, exit, 6)$	$(B, \rightarrow, C, -1)$
$(D, \leftarrow, exit, 6)$			$(C, \leftarrow, B, -1)$
			$(B, \leftarrow, A, -1)$
			$(A, \leftarrow, exit, 10)$

each field in the table is an n-tuple (s, a, s', r)

A	B	C	D

$S = \{A, B, C, D\}$

$A = \{\rightarrow, \leftarrow\}$

$r(\{B, C\}) = -1,\ r(A) = 10,\ r(D) = 6$

$p(C|B, \rightarrow) = p(A|B, \leftarrow) = 2/2 =$
$p(D|C, \rightarrow) = p(B|C, \leftarrow) = 1$

- for $\gamma = 1$: $\pi(B) = \leftarrow, \pi(C) = \leftarrow$
- Task: determine γ which changes the policy computed for $\gamma = 1$

Can the policy in state B be changed?
Determine:

A: $V(A) < V(C)$

B: $V(A) = V(C)$

C: $V(A) > V(C)$

Example I, $\gamma = ?$

Episode 1	Episode 2	Episode 3	Episode 4
$(B, \rightarrow, C, -1)$	$(B, \leftarrow, A, -1)$	$(C, \rightarrow, D, -1)$	$(C, \leftarrow, B, -1)$
$(C, \rightarrow, D, -1)$	$(A, \rightarrow, exit, 10)$	$(D, \rightarrow, exit, 6)$	$(B, \rightarrow, C, -1)$
$(D, \leftarrow, exit, 6)$			$(C, \leftarrow, B, -1)$
			$(B, \leftarrow, A, -1)$
			$(A, \leftarrow, exit, 10)$

each field in the table is an n-tuple (s, a, s', r)

A	B	C	D

$S = \{A, B, C, D\}$

$A = \{\rightarrow, \leftarrow\}$

$r(\{B, C\}) = -1,\ r(A) = 10,\ r(D) = 6$

$p(C|B, \rightarrow) = p(A|B, \leftarrow) = 2/2 = p(D|C, \rightarrow) = p(B|C, \leftarrow) = 1$

- for $\gamma = 1$: $\pi(B) = \leftarrow, \pi(C) = \leftarrow$
- Task: determine γ which changes the policy computed for $\gamma = 1$

Can the policy in state B be changed?
Determine:

A: $V(A) < V(C)$

B: $V(A) = V(C)$

C: $V(A) > V(C); V(A) = 10, V(C) < 10$

$\Rightarrow \pi(B) = \leftarrow$

$V(B) = r(B) + \gamma \cdot V(A) = -1 + 10\gamma$

Example I, $\gamma = ?$

Episode 1	Episode 2	Episode 3	Episode 4
$(B, \rightarrow, C, -1)$	$(B, \leftarrow, A, -1)$	$(C, \rightarrow, D, -1)$	$(C, \leftarrow, B, -1)$
$(C, \rightarrow, D, -1)$	$(A, \rightarrow, exit, 10)$	$(D, \rightarrow, exit, 6)$	$(B, \rightarrow, C, -1)$
$(D, \leftarrow, exit, 6)$			$(C, \leftarrow, B, -1)$
			$(B, \leftarrow, A, -1)$
			$(A, \leftarrow, exit, 10)$

each field in the table is an n-tuple (s, a, s', r)

A	B	C	D

$S = \{A, B, C, D\}$

$A = \{\rightarrow, \leftarrow\}$

$r(\{B, C\}) = -1,\ r(A) = 10,\ r(D) = 6$

$p(C|B, \rightarrow) = p(A|B, \leftarrow) = 2/2 =$
$p(D|C, \rightarrow) = p(B|C, \leftarrow) = 1$

- for $\gamma = 1$: $\pi(B) = \leftarrow, \pi(C) = \leftarrow$
- Task: determine γ which changes the policy computed for $\gamma = 1$

Can the policy in state B be changed?
Determine:

A: $V(A) < V(C)$

B: $V(A) = V(C)$

C: $V(A) > V(C); V(A) = 10, V(C) < 10$

$\Rightarrow$ $\pi(B) = \leftarrow$

$V(B) = r(B) + \gamma \cdot V(A) = -1 + 10\gamma$

Example I, $\gamma = ?$

Episode 1	Episode 2	Episode 3	Episode 4
$(B, \rightarrow, C, -1)$	$(B, \leftarrow, A, -1)$	$(C, \rightarrow, D, -1)$	$(C, \leftarrow, B, -1)$
$(C, \rightarrow, D, -1)$	$(A, \rightarrow, exit, 10)$	$(D, \rightarrow, exit, 6)$	$(B, \rightarrow, C, -1)$
$(D, \leftarrow, exit, 6)$			$(C, \leftarrow, B, -1)$
			$(B, \leftarrow, A, -1)$
			$(A, \leftarrow, exit, 10)$

each field in the table is an n-tuple (s, a, s', r)

A	B	C	D

$S = \{A, B, C, D\}$

$A = \{\rightarrow, \leftarrow\}$

$r(\{B, C\}) = -1,\ r(A) = 10,\ r(D) = 6$

$p(C|B, \rightarrow) = p(A|B, \leftarrow) = 2/2 =$
$p(D|C, \rightarrow) = p(B|C, \leftarrow) = 1$

- for $\gamma = 1$: $\pi(B) = \leftarrow, \pi(C) = \leftarrow$
- Task: determine γ which changes the policy computed for $\gamma = 1$

State B: $\pi(B) = \leftarrow$, $V(B) = -1 + 10\gamma$

$\Rightarrow$ Policy in state C has to be changed.

How?

A: $q(C, \rightarrow) > q(C, \leftarrow)$

B: $V(C) > V(B)$

C: $\pi(C) > \pi(B)$

D: $r(C) > r(B)$

Example I, $\gamma = ?$

Episode 1	Episode 2	Episode 3	Episode 4
$(B, \rightarrow, C, -1)$	$(B, \leftarrow, A, -1)$	$(C, \rightarrow, D, -1)$	$(C, \leftarrow, B, -1)$
$(C, \rightarrow, D, -1)$	$(A, \rightarrow, exit, 10)$	$(D, \rightarrow, exit, 6)$	$(B, \rightarrow, C, -1)$
$(D, \leftarrow, exit, 6)$			$(C, \leftarrow, B, -1)$
			$(B, \leftarrow, A, -1)$
			$(A, \leftarrow, exit, 10)$

each field in the table is an n-tuple (s, a, s', r)

A	B	C	D

$S = \{A, B, C, D\}$

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$r(\{B, C\}) = -1,\ r(A) = 10,\ r(D) = 6$

$p(C|B, \rightarrow) = p(A|B, \leftarrow) = 2/2 =$
$p(D|C, \rightarrow) = p(B|C, \leftarrow) = 1$

- for $\gamma = 1$: $\pi(B) = \leftarrow, \pi(C) = \leftarrow$
- Task: determine γ which changes the policy computed for $\gamma = 1$

State B: $\pi(B) = \leftarrow$, $V(B) = -1 + 10\gamma$
$\Rightarrow$ Policy in state C has to be changed.

How?

A: $q(C, \rightarrow) > q(C, \leftarrow)$

B: $V(C) > V(B)$

C: $\pi(C) > \pi(B)$

D: $r(C) > r(B)$

Example I, $\gamma = ?$

Episode 1	Episode 2	Episode 3	Episode 4
$(B, \rightarrow, C, -1)$	$(B, \leftarrow, A, -1)$	$(C, \rightarrow, D, -1)$	$(C, \leftarrow, B, -1)$
$(C, \rightarrow, D, -1)$	$(A, \rightarrow, exit, 10)$	$(D, \rightarrow, exit, 6)$	$(B, \rightarrow, C, -1)$
$(D, \leftarrow, exit, 6)$			$(C, \leftarrow, B, -1)$
			$(B, \leftarrow, A, -1)$
			$(A, \leftarrow, exit, 10)$

each field in the table is an n-tuple (s, a, s', r)

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$S = \{A, B, C, D\}$

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$r(\{B, C\}) = -1,\ r(A) = 10,\ r(D) = 6$

$p(C|B, \rightarrow) = p(A|B, \leftarrow) = 2/2 =$
$p(D|C, \rightarrow) = p(B|C, \leftarrow) = 1$

- for $\gamma = 1$: $\pi(B) = \leftarrow, \pi(C) = \leftarrow$
- Task: determine γ which changes the policy computed for $\gamma = 1$

State B: $\pi(B) = \leftarrow$, $V(B) = -1 + 10\gamma$
$\Rightarrow$ Policy in state C has to be changed.
How?

A: $q(C, \rightarrow) > q(C, \leftarrow)$

B: $V(C) > V(B)$

C: $\pi(C) > \pi(B)$

D: $r(C) > r(B)$

Example I, $\gamma = ?$

Episode 1	Episode 2	Episode 3	Episode 4
$(B, \rightarrow, C, -1)$	$(B, \leftarrow, A, -1)$	$(C, \rightarrow, D, -1)$	$(C, \leftarrow, B, -1)$
$(C, \rightarrow, D, -1)$	$(A, \rightarrow, exit, 10)$	$(D, \rightarrow, exit, 6)$	$(B, \rightarrow, C, -1)$
$(D, \leftarrow, exit, 6)$			$(C, \leftarrow, B, -1)$
			$(B, \leftarrow, A, -1)$
			$(A, \leftarrow, exit, 10)$

each field in the table is an n-tuple (s, a, s', r)

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$p(D|C, \rightarrow) = p(B|C, \leftarrow) = 1$

- for $\gamma = 1$: $\pi(B) = \leftarrow, \pi(C) = \leftarrow$
- Task: determine γ which changes the policy computed for $\gamma = 1$

State B: $\pi(B) = \leftarrow$, $V(B) = -1 + 10\gamma$
$\Rightarrow$ Policy in state C has to be changed.
How?

A: $q(C, \rightarrow) > q(C, \leftarrow)$

B: $V(C) > V(B)$

C: $\pi(C) > \pi(B)$

D: $r(C) > r(B)$

Example I, $\gamma = ?$

Episode 1	Episode 2	Episode 3	Episode 4
$(B, \rightarrow, C, -1)$ $(C, \rightarrow, D, -1)$ $(D, \leftarrow, exit, 6)$	$(B, \leftarrow, A, -1)$ $(A, \rightarrow, exit, 10)$	$(C, \rightarrow, D, -1)$ $(D, \rightarrow, exit, 6)$	$(C, \leftarrow, B, -1)$ $(B, \rightarrow, C, -1)$ $(C, \leftarrow, B, -1)$ $(B, \leftarrow, A, -1)$ $(A, \leftarrow, exit, 10)$

each field in the table is an n-tuple (s, a, s', r)

A	B	C	D

$S = \{A, B, C, D\}$

$A = \{\rightarrow, \leftarrow\}$

$r(\{B, C\}) = -1, \; r(A) = 10, \; r(D) = 6$

$p(C|B, \rightarrow) = p(A|B, \leftarrow) = 2/2 = p(D|C, \rightarrow) = p(B|C, \leftarrow) = 1$

- for $\gamma = 1$: $\pi(B) = \leftarrow, \pi(C) = \leftarrow$
- Task: determine γ which changes the policy computed for $\gamma = 1$

State B: $\pi(B) = \leftarrow, V(B) = -1 + 10\gamma$
$\Rightarrow$ Policy in state C has to be changed.
Compute:

A: $q(C, \rightarrow) = r(C) + V(D)$

B: $q(C, \rightarrow) = r(C) + \gamma \cdot V(B)$

C: $q(C, \rightarrow) = r(C) + \gamma \cdot V(D)$

D: $q(C, \rightarrow) = r(C) + V(B)$

Example I, $\gamma =?$

Episode 1	Episode 2	Episode 3	Episode 4
$(B, \rightarrow, C, -1)$	$(B, \leftarrow, A, -1)$	$(C, \rightarrow, D, -1)$	$(C, \leftarrow, B, -1)$
$(C, \rightarrow, D, -1)$	$(A, \rightarrow, exit, 10)$	$(D, \rightarrow, exit, 6)$	$(B, \rightarrow, C, -1)$
$(D, \leftarrow, exit, 6)$			$(C, \leftarrow, B, -1)$
			$(B, \leftarrow, A, -1)$
			$(A, \leftarrow, exit, 10)$

each field in the table is an n-tuple (s, a, s', r)

A	B	C	D

$S = \{A, B, C, D\}$

$A = \{\rightarrow, \leftarrow\}$

$r(\{B, C\}) = -1,\ r(A) = 10,\ r(D) = 6$

$p(C|B, \rightarrow) = p(A|B, \leftarrow) = 2/2 =$
$p(D|C, \rightarrow) = p(B|C, \leftarrow) = 1$

- for $\gamma = 1$: $\pi(B) = \leftarrow, \pi(C) = \leftarrow$
- Task: determine γ which changes the policy computed for $\gamma = 1$

State B: $\pi(B) = \leftarrow, V(B) = -1 + 10\gamma$
$\Rightarrow$ Policy in state C has to be changed.
Compute:

A: $q(C, \rightarrow) = r(C) + V(D)$

B: $q(C, \rightarrow) = r(C) + \gamma \cdot V(B)$

C: $q(C, \rightarrow) = r(C) + \gamma \cdot V(D) = -1 + 6\gamma$

D: $q(C, \rightarrow) = r(C) + V(B)$

Example I, $\gamma =?$

Episode 1	Episode 2	Episode 3	Episode 4
$(B, \rightarrow, C, -1)$	$(B, \leftarrow, A, -1)$	$(C, \rightarrow, D, -1)$	$(C, \leftarrow, B, -1)$
$(C, \rightarrow, D, -1)$	$(A, \rightarrow, exit, 10)$	$(D, \rightarrow, exit, 6)$	$(B, \rightarrow, C, -1)$
$(D, \leftarrow, exit, 6)$			$(C, \leftarrow, B, -1)$
			$(B, \leftarrow, A, -1)$
			$(A, \leftarrow, exit, 10)$

each field in the table is an n-tuple (s, a, s', r)

A	B	C	D

$S = \{A, B, C, D\}$

$A = \{\rightarrow, \leftarrow\}$

$r(\{B, C\}) = -1,\ r(A) = 10,\ r(D) = 6$

$p(C|B, \rightarrow) = p(A|B, \leftarrow) = 2/2 =$
$p(D|C, \rightarrow) = p(B|C, \leftarrow) = 1$

- for $\gamma = 1$: $\pi(B) = \leftarrow, \pi(C) = \leftarrow$
- Task: determine γ which changes the policy computed for $\gamma = 1$

State B: $\pi(B) = \leftarrow$, $V(B) = -1 + 10\gamma$

$\Rightarrow$ Policy in state C has to be changed.

- $q(C, \rightarrow) = -1 + 6\gamma$

Compute:

A: $q(C, \leftarrow) = r(C) + V(D)$

B: $q(C, \leftarrow) = r(C) + \gamma \cdot V(B)$

C: $q(C, \leftarrow) = r(C) + \gamma \cdot V(D)$

D: $q(C, \leftarrow) = r(C) + V(B)$

Example I, $\gamma =?$

Episode 1	Episode 2	Episode 3	Episode 4
$(B, \rightarrow, C, -1)$	$(B, \leftarrow, A, -1)$	$(C, \rightarrow, D, -1)$	$(C, \leftarrow, B, -1)$
$(C, \rightarrow, D, -1)$	$(A, \rightarrow, exit, 10)$	$(D, \rightarrow, exit, 6)$	$(B, \rightarrow, C, -1)$
$(D, \leftarrow, exit, 6)$			$(C, \leftarrow, B, -1)$
			$(B, \leftarrow, A, -1)$
			$(A, \leftarrow, exit, 10)$

each field in the table is an n-tuple (s, a, s', r)

A	B	C	D

$S = \{A, B, C, D\}$

$A = \{\rightarrow, \leftarrow\}$

$r(\{B, C\}) = -1,\ r(A) = 10,\ r(D) = 6$

$p(C|B, \rightarrow) = p(A|B, \leftarrow) = 2/2 = p(D|C, \rightarrow) = p(B|C, \leftarrow) = 1$

- for $\gamma = 1$: $\pi(B) = \leftarrow, \pi(C) = \leftarrow$
- Task: determine γ which changes the policy computed for $\gamma = 1$

State B: $\pi(B) = \leftarrow$, $V(B) = -1 + 10\gamma$

$\Rightarrow$ Policy in state C has to be changed.

- $q(C, \rightarrow) = -1 + 6\gamma$

Compute:

A: $q(C, \leftarrow) = r(C) + V(D)$

B: $q(C, \leftarrow) = r(C) + \gamma \cdot V(B) = -1 + \gamma(-1 + 10\gamma)$

C: $q(C, \leftarrow) = r(C) + \gamma \cdot V(D)$

D: $q(C, \leftarrow) = r(C) + V(B)$

Example I, $\gamma = ?$

Episode 1	Episode 2	Episode 3	Episode 4
$(B, \rightarrow, C, -1)$	$(B, \leftarrow, A, -1)$	$(C, \rightarrow, D, -1)$	$(C, \leftarrow, B, -1)$
$(C, \rightarrow, D, -1)$	$(A, \rightarrow, exit, 10)$	$(D, \rightarrow, exit, 6)$	$(B, \rightarrow, C, -1)$
$(D, \leftarrow, exit, 6)$			$(C, \leftarrow, B, -1)$
			$(B, \leftarrow, A, -1)$
			$(A, \leftarrow, exit, 10)$

each field in the table is an n-tuple (s, a, s', r)

A	B	C	D

$S = \{A, B, C, D\}$

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$p(C|B, \rightarrow) = p(A|B, \leftarrow) = 2/2 =$
$p(D|C, \rightarrow) = p(B|C, \leftarrow) = 1$

- for $\gamma = 1$: $\pi(B) = \leftarrow, \pi(C) = \leftarrow$
- Task: determine γ which changes the policy computed for $\gamma = 1$

State B: $\pi(B) = \leftarrow, V(B) = -1 + 10\gamma$
$\Rightarrow$ Policy in state C has to be changed.

- $q(C, \rightarrow) = -1 + 6\gamma$
- $q(C, \leftarrow) = -1 + \gamma(-1 + 10\gamma)$

To change the policy, we need:
$q(C, \rightarrow) > q(C, \leftarrow)$

Example I, $\gamma = ?$

Episode 1	Episode 2	Episode 3	Episode 4
$(B, \rightarrow, C, -1)$	$(B, \leftarrow, A, -1)$	$(C, \rightarrow, D, -1)$	$(C, \leftarrow, B, -1)$
$(C, \rightarrow, D, -1)$	$(A, \rightarrow, exit, 10)$	$(D, \rightarrow, exit, 6)$	$(B, \rightarrow, C, -1)$
$(D, \leftarrow, exit, 6)$			$(C, \leftarrow, B, -1)$
			$(B, \leftarrow, A, -1)$
			$(A, \leftarrow, exit, 10)$

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- for $\gamma = 1$: $\pi(B) = \leftarrow, \pi(C) = \leftarrow$
- Task: determine γ which changes the policy computed for $\gamma = 1$

$$
\begin{aligned}
q(C, \rightarrow) &> q(C, \leftarrow) \\
-1 + 6\gamma &> -1 + \gamma(-1 + 10\gamma) \\
-1 + 6\gamma &> -1 - \gamma + 10\gamma^2 \\
7\gamma - 10\gamma^2 &> 0
\end{aligned}
$$

$\Rightarrow \gamma_1 = 0, \gamma_2 = 0.7$

$\Rightarrow \pi(B) = \leftarrow, \pi(C) = \leftarrow$; for $\gamma \in]0.7, 1]$

$\pi(B) = \leftarrow, \pi(C) = \rightarrow$; for $\gamma \in]0, 0.7[$

Example I, $\gamma =?$

Episode 1	Episode 2	Episode 3	Episode 4
$(B, \rightarrow, C, -1)$	$(B, \leftarrow, A, -1)$	$(C, \rightarrow, D, -1)$	$(C, \leftarrow, B, -1)$
$(C, \rightarrow, D, -1)$	$(A, \rightarrow, exit, 10)$	$(D, \rightarrow, exit, 6)$	$(B, \rightarrow, C, -1)$
$(D, \leftarrow, exit, 6)$			$(C, \leftarrow, B, -1)$
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- for $\gamma = 1$: $\pi(B) = \leftarrow, \pi(C) = \leftarrow$
- Task: determine γ which changes the policy computed for $\gamma = 1$

$$
\begin{aligned}
q(C, \rightarrow) &> q(C, \leftarrow) \\
-1 + 6\gamma &> -1 + \gamma(-1 + 10\gamma) \\
-1 + 6\gamma &> -1 - \gamma + 10\gamma^2 \\
7\gamma - 10\gamma^2 &> 0
\end{aligned}
$$

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$\pi(B) = \leftarrow, \pi(C) = \rightarrow$; for $\gamma \in]0, 0.7[$

Example I, $\gamma = ?$

Episode 1	Episode 2	Episode 3	Episode 4
$(B, \rightarrow, C, -1)$	$(B, \leftarrow, A, -1)$	$(C, \rightarrow, D, -1)$	$(C, \leftarrow, B, -1)$
$(C, \rightarrow, D, -1)$	$(A, \rightarrow, exit, 10)$	$(D, \rightarrow, exit, 6)$	$(B, \rightarrow, C, -1)$
$(D, \leftarrow, exit, 6)$			$(C, \leftarrow, B, -1)$
			$(B, \leftarrow, A, -1)$
			$(A, \leftarrow, exit, 10)$

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- for $\gamma = 1$: $\pi(B) = \leftarrow, \pi(C) = \leftarrow$
- Task: determine γ which changes the policy computed for $\gamma = 1$

$$
\begin{aligned}
q(C, \rightarrow) &> q(C, \leftarrow) \\
-1 + 6\gamma &> -1 + \gamma(-1 + 10\gamma) \\
-1 + 6\gamma &> -1 - \gamma + 10\gamma^2 \\
7\gamma - 10\gamma^2 &> 0
\end{aligned}
$$

$\Rightarrow \gamma_1 = 0, \gamma_2 = 0.7$

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$\pi(B) = \leftarrow, \pi(C) = \rightarrow$; for $\gamma \in]0, 0.7[$

Example I, $\gamma = ?$

Episode 1	Episode 2	Episode 3	Episode 4
$(B, \rightarrow, C, -1)$	$(B, \leftarrow, A, -1)$	$(C, \rightarrow, D, -1)$	$(C, \leftarrow, B, -1)$
$(C, \rightarrow, D, -1)$	$(A, \rightarrow, exit, 10)$	$(D, \rightarrow, exit, 6)$	$(B, \rightarrow, C, -1)$
$(D, \leftarrow, exit, 6)$			$(C, \leftarrow, B, -1)$
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- for $\gamma = 1$: $\pi(B) = \leftarrow, \pi(C) = \leftarrow$
- Task: determine γ which changes the policy computed for $\gamma = 1$

$$\begin{aligned} q(C, \rightarrow) &> q(C, \leftarrow) \\ -1 + 6\gamma &> -1 + \gamma(-1 + 10\gamma) \\ -1 + 6\gamma &> -1 - \gamma + 10\gamma^2 \\ 7\gamma - 10\gamma^2 &> 0 \end{aligned}$$

$\Rightarrow \gamma_1 = 0, \gamma_2 = 0.7$

$\Rightarrow \pi(B) = \leftarrow, \pi(C) = \leftarrow$; for $\gamma \in]0.7, 1]$

$\pi(B) = \leftarrow, \pi(C) = \rightarrow$; for $\gamma \in]0, 0.7[$

Example I, $\gamma =?$

Episode 1	Episode 2	Episode 3	Episode 4
$(B, \rightarrow, C, -1)$ $(C, \rightarrow, D, -1)$ $(D, \leftarrow, exit, 6)$	$(B, \leftarrow, A, -1)$ $(A, \rightarrow, exit, 10)$	$(C, \rightarrow, D, -1)$ $(D, \rightarrow, exit, 6)$	$(C, \leftarrow, B, -1)$ $(B, \rightarrow, C, -1)$ $(C, \leftarrow, B, -1)$ $(B, \leftarrow, A, -1)$ $(A, \leftarrow, exit, 10)$

each field in the table is an n-tuple (s, a, s', r)

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$S = \{A, B, C, D\}$

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$r(\{B, C\}) = -1,\ r(A) = 10,\ r(D) = 6$

$p(C|B, \rightarrow) = p(A|B, \leftarrow) = 2/2 =$
$p(D|C, \rightarrow) = p(B|C, \leftarrow) = 1$

- for $\gamma = 1$: $\pi(B) = \leftarrow, \pi(C) = \leftarrow$
- Task: determine γ which changes the policy computed for $\gamma = 1$

$$
\begin{aligned}
q(C, \rightarrow) &> q(C, \leftarrow) \\
-1 + 6\gamma &> -1 + \gamma(-1 + 10\gamma) \\
-1 + 6\gamma &> -1 - \gamma + 10\gamma^2 \\
7\gamma - 10\gamma^2 &> 0
\end{aligned}
$$

$\Rightarrow \gamma_1 = 0, \gamma_2 = 0.7$

$\Rightarrow \pi(B) = \leftarrow, \pi(C) = \leftarrow$; for $\gamma \in]0.7, 1]$

$\pi(B) = \leftarrow, \pi(C) = \rightarrow$; for $\gamma \in]0, 0.7[$

Example I, $\gamma =?$

Episode 1	Episode 2	Episode 3	Episode 4
$(B, \rightarrow, C, -1)$	$(B, \leftarrow, A, -1)$	$(C, \rightarrow, D, -1)$	$(C, \leftarrow, B, -1)$
$(C, \rightarrow, D, -1)$	$(A, \rightarrow, exit, 10)$	$(D, \rightarrow, exit, 6)$	$(B, \rightarrow, C, -1)$
$(D, \leftarrow, exit, 6)$			$(C, \leftarrow, B, -1)$
			$(B, \leftarrow, A, -1)$
			$(A, \leftarrow, exit, 10)$

each field in the table is an n-tuple (s, a, s', r)

A	B	C	D

$S = \{A, B, C, D\}$

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$r(\{B, C\}) = -1,\ r(A) = 10,\ r(D) = 6$

$p(C|B, \rightarrow) = p(A|B, \leftarrow) = 2/2 =$
$p(D|C, \rightarrow) = p(B|C, \leftarrow) = 1$

- for $\gamma = 1$: $\pi(B) = \leftarrow, \pi(C) = \leftarrow$
- Task: determine γ which changes the policy computed for $\gamma = 1$

$$\begin{aligned} q(C, \rightarrow) &> q(C, \leftarrow) \\ -1 + 6\gamma &> -1 + \gamma(-1 + 10\gamma) \\ -1 + 6\gamma &> -1 - \gamma + 10\gamma^2 \\ 7\gamma - 10\gamma^2 &> 0 \end{aligned}$$

$\Rightarrow \gamma_1 = 0, \gamma_2 = 0.7$

$\Rightarrow\ \pi(B) = \leftarrow, \pi(C) = \leftarrow$; for $\gamma \in]0.7, 1]$

$\pi(B) = \leftarrow, \pi(C) = \rightarrow$; for $\gamma \in]0, 0.7[$

Example I

$$\gamma = 0$$

Example I, $\gamma = 0$

Episode 1	Episode 2	Episode 3	Episode 4
$(B, \rightarrow, C, -1)$	$(B, \leftarrow, A, -1)$	$(C, \rightarrow, D, -1)$	$(C, \leftarrow, B, -1)$
$(C, \rightarrow, D, -1)$	$(A, \rightarrow, exit, 10)$	$(D, \rightarrow, exit, 6)$	$(B, \rightarrow, C, -1)$
$(D, \leftarrow, exit, 6)$			$(C, \leftarrow, B, -1)$
			$(B, \leftarrow, A, -1)$
			$(A, \leftarrow, exit, 10)$

each field in the table is an n-tuple (s, a, s', r)

A	B	C	D

$S = \{A, B, C, D\}$

$A = \{\rightarrow, \leftarrow\}$

$r(\{B, C\}) = -1,\ r(A) = 10,\ r(D) = 6$

$p(C|B, \rightarrow) = p(A|B, \leftarrow) = 2/2 =$
$p(D|C, \rightarrow) = p(B|C, \leftarrow) = 1$

For $\gamma = 0$:

Compute:

A: $V(B) = 9$

B: $V(B) = 5$

C: $V(B) = -1$

D: $V(B) = 0$

Example I, $\gamma = 0$

Episode 1	Episode 2	Episode 3	Episode 4
$(B, \rightarrow, C, -1)$	$(B, \leftarrow, A, -1)$	$(C, \rightarrow, D, -1)$	$(C, \leftarrow, B, -1)$
$(C, \rightarrow, D, -1)$	$(A, \rightarrow, exit, 10)$	$(D, \rightarrow, exit, 6)$	$(B, \rightarrow, C, -1)$
$(D, \leftarrow, exit, 6)$			$(C, \leftarrow, B, -1)$
			$(B, \leftarrow, A, -1)$
			$(A, \leftarrow, exit, 10)$

each field in the table is an n-tuple (s, a, s', r)

A	B	C	D

$S = \{A, B, C, D\}$

$A = \{\rightarrow, \leftarrow\}$

$r(\{B, C\}) = -1, \ r(A) = 10, \ r(D) = 6$

$p(C|B, \rightarrow) = p(A|B, \leftarrow) = 2/2 =$
$p(D|C, \rightarrow) = p(B|C, \leftarrow) = 1$

For $\gamma = 0$:

Compute:

A: $V(B) = 9$

B: $V(B) = 5$

C: $V(B) = r(B) + \gamma \max_a V(s') = -1 + 0 = -1$

D: $V(B) = 0$

Example I, $\gamma = 0$

Episode 1	Episode 2	Episode 3	Episode 4
$(B, \rightarrow, C, -1)$ $(C, \rightarrow, D, -1)$ $(D, \leftarrow, exit, 6)$	$(B, \leftarrow, A, -1)$ $(A, \rightarrow, exit, 10)$	$(C, \rightarrow, D, -1)$ $(D, \rightarrow, exit, 6)$	$(C, \leftarrow, B, -1)$ $(B, \rightarrow, C, -1)$ $(C, \leftarrow, B, -1)$ $(B, \leftarrow, A, -1)$ $(A, \leftarrow, exit, 10)$

each field in the table is an n-tuple (s, a, s', r)

A	B	C	D

$S = \{A, B, C, D\}$

$A = \{\rightarrow, \leftarrow\}$

$r(\{B, C\}) = -1,\ r(A) = 10,\ r(D) = 6$

$p(C|B, \rightarrow) = p(A|B, \leftarrow) = 2/2 =$
$p(D|C, \rightarrow) = p(B|C, \leftarrow) = 1$

For $\gamma = 0$:

- $V(B) = -1$ for $\{\leftarrow, \rightarrow\}$

Compute:

A: $V(C) = 9$

B: $V(C) = 5$

C: $V(C) = -1$

D: $V(C) = 0$

Example I, $\gamma = 0$

Episode 1	Episode 2	Episode 3	Episode 4
$(B, \rightarrow, C, -1)$	$(B, \leftarrow, A, -1)$	$(C, \rightarrow, D, -1)$	$(C, \leftarrow, B, -1)$
$(C, \rightarrow, D, -1)$	$(A, \rightarrow, exit, 10)$	$(D, \rightarrow, exit, 6)$	$(B, \rightarrow, C, -1)$
$(D, \leftarrow, exit, 6)$			$(C, \leftarrow, B, -1)$
			$(B, \leftarrow, A, -1)$
			$(A, \leftarrow, exit, 10)$

each field in the table is an n-tuple (s, a, s', r)

A	B	C	D

$S = \{A, B, C, D\}$

$A = \{\rightarrow, \leftarrow\}$

$r(\{B, C\}) = -1,\ r(A) = 10,\ r(D) = 6$

$p(C|B, \rightarrow) = p(A|B, \leftarrow) = 2/2 = p(D|C, \rightarrow) = p(B|C, \leftarrow) = 1$

For $\gamma = 0$:

- $V(B) = -1$ for $\{\leftarrow, \rightarrow\}$

Compute:

A: $V(C) = 9$

B: $V(C) = 5$

C: $V(C) = r(C) + \gamma \max_a V(s') = -1 + 0 = -1$

D: $V(C) = 0$

Example I, $\gamma = 0$

Episode 1	Episode 2	Episode 3	Episode 4
$(B, \rightarrow, C, -1)$	$(B, \leftarrow, A, -1)$	$(C, \rightarrow, D, -1)$	$(C, \leftarrow, B, -1)$
$(C, \rightarrow, D, -1)$	$(A, \rightarrow, exit, 10)$	$(D, \rightarrow, exit, 6)$	$(B, \rightarrow, C, -1)$
$(D, \leftarrow, exit, 6)$			$(C, \leftarrow, B, -1)$
			$(B, \leftarrow, A, -1)$
			$(A, \leftarrow, exit, 10)$

each field in the table is an n-tuple (s, a, s', r)

A	B	C	D

$S = \{A, B, C, D\}$

$A = \{\rightarrow, \leftarrow\}$

$r(\{B, C\}) = -1,\ r(A) = 10,\ r(D) = 6$

$p(C|B, \rightarrow) = p(A|B, \leftarrow) = 2/2 =$
$p(D|C, \rightarrow) = p(B|C, \leftarrow) = 1$

For $\gamma = 0$:

- $V(B) = -1$ for $\{\leftarrow, \rightarrow\}$
- $V(C) = -1$ for $\{\leftarrow, \rightarrow\}$

$\Rightarrow \ \pi(B) = \{\leftarrow, \rightarrow\}$

$\pi(C) = \{\leftarrow, \rightarrow\}$

Example I, $\gamma = 0$

Episode 1	Episode 2	Episode 3	Episode 4
$(B, \rightarrow, C, -1)$ $(C, \rightarrow, D, -1)$ $(D, \leftarrow, exit, 6)$	$(B, \leftarrow, A, -1)$ $(A, \rightarrow, exit, 10)$	$(C, \rightarrow, D, -1)$ $(D, \rightarrow, exit, 6)$	$(C, \leftarrow, B, -1)$ $(B, \rightarrow, C, -1)$ $(C, \leftarrow, B, -1)$ $(B, \leftarrow, A, -1)$ $(A, \leftarrow, exit, 10)$

each field in the table is an n-tuple (s, a, s', r)

A	B	C	D

$S = \{A, B, C, D\}$

$A = \{\rightarrow, \leftarrow\}$

$r(\{B, C\}) = -1,\ r(A) = 10,\ r(D) = 6$

$p(C|B, \rightarrow) = p(A|B, \leftarrow) = 2/2 =$
$p(D|C, \rightarrow) = p(B|C, \leftarrow) = 1$

For $\gamma = 0$:

- $V(B) = -1$ for $\{\leftarrow, \rightarrow\}$
- $V(C) = -1$ for $\{\leftarrow, \rightarrow\}$

$\Rightarrow\ \pi(B) = \{\leftarrow, \rightarrow\}$

$\pi(C) = \{\leftarrow, \rightarrow\}$

Example I

summary

Example I, summary

Episode 1	Episode 2	Episode 3	Episode 4
$(B, \rightarrow, C, -1)$	$(B, \leftarrow, A, -1)$	$(C, \rightarrow, D, -1)$	$(C, \leftarrow, B, -1)$
$(C, \rightarrow, D, -1)$	$(A, \rightarrow, exit, 10)$	$(D, \rightarrow, exit, 6)$	$(B, \rightarrow, C, -1)$
$(D, \leftarrow, exit, 6)$			$(C, \leftarrow, B, -1)$
			$(B, \leftarrow, A, -1)$
			$(A, \leftarrow, exit, 10)$

each field in the table is an n-tuple (s, a, s', r)

A	B	C	D

$S = \{A, B, C, D\}$

$A = \{\rightarrow, \leftarrow\}$

$r(\{B, C\}) = -1, \; r(A) = 10, \; r(D) = 6$

$p(C|B, \rightarrow) = p(A|B, \leftarrow) = 2/2 =$
$p(D|C, \rightarrow) = p(B|C, \leftarrow) = 1$

For $\gamma = 1$: $\pi(B) = \leftarrow$
$\pi(C) = \leftarrow$

For $\gamma \in]0.7, 1]$: $\pi(B) = \leftarrow$
$\pi(C) = \leftarrow$

For $\gamma \in]0, 0.7[$: $\pi(B) = \leftarrow$
$\pi(C) = \rightarrow$

For $\gamma = 0$: $\pi(B) = \{\leftarrow, \rightarrow\}$
$\pi(C) = \{\leftarrow, \rightarrow\}$

Example II

Example II

Episode 1	Episode 2	Episode 3	Episode 4
$(B, \rightarrow, C, -3)$	$(B, \leftarrow, A, -1)$	$(C, \rightarrow, D, -3)$	$(C, \leftarrow, B, -1)$
$(C, \rightarrow, D, -3)$	$(A, \rightarrow, exit, 6)$	$(D, \rightarrow, exit, 6)$	$(B, \rightarrow, C, -3)$
$(D, \leftarrow, exit, 6)$			$(C, \leftarrow, B, -1)$
			$(B, \leftarrow, A, -1)$
			$(A, \leftarrow, exit, 6)$

each field in the table is an n-tuple (s, a, s', r)

Compute policy with

- $\gamma = 1$
- estimate γ that changes the policy for $\gamma = 1$
- $\gamma = 0$

Example II

Episode 1	Episode 2	Episode 3	Episode 4
$(B, \rightarrow, C, -3)$	$(B, \leftarrow, A, -1)$	$(C, \rightarrow, D, -3)$	$(C, \leftarrow, B, -1)$
$(C, \rightarrow, D, -3)$	$(A, \rightarrow, exit, 6)$	$(D, \rightarrow, exit, 6)$	$(B, \rightarrow, C, -3)$
$(D, \leftarrow, exit, 6)$			$(C, \leftarrow, B, -1)$
			$(B, \leftarrow, A, -1)$
			$(A, \leftarrow, exit, 6)$

each field in the table is an n-tuple (s, a, s', r)

Compute policy with

- $\gamma = 1$
- estimate γ that changes the policy for $\gamma = 1$
- $\gamma = 0$

Example II

Episode 1	Episode 2	Episode 3	Episode 4
$(B, \rightarrow, C, -3)$	$(B, \leftarrow, A, -1)$	$(C, \rightarrow, D, -3)$	$(C, \leftarrow, B, -1)$
$(C, \rightarrow, D, -3)$	$(A, \rightarrow, exit, 6)$	$(D, \rightarrow, exit, 6)$	$(B, \rightarrow, C, -3)$
$(D, \leftarrow, exit, 6)$			$(C, \leftarrow, B, -1)$
			$(B, \leftarrow, A, -1)$
			$(A, \leftarrow, exit, 6)$

each field in the table is an n-tuple (s, a, s', r)

State set: $S = \{A, B, C, D\}$, terminal states: $\{A, D\}$, non-terminal states: $\{B, C\}$

Action set: $A = \{\rightarrow, \leftarrow\}$

Reward function: $r(\{B, C\}, \leftarrow) = -1$, $r(\{B, C\}, \rightarrow) = -3$, $r(\{A, D\}) = 6$

Transition model: $p(C|B, \rightarrow) = p(A|B, \leftarrow) = p(D|C, \rightarrow) = p(B|C, \leftarrow) = 2/2 = 1$

World structure:

A	B	C	D

Example II

Episode 1	**Episode 2**	**Episode 3**	**Episode 4**
$(B, \rightarrow, C, -3)$	$(B, \leftarrow, A, -1)$	$(C, \rightarrow, D, -3)$	$(C, \leftarrow, B, -1)$
$(C, \rightarrow, D, -3)$	$(A, \rightarrow, exit, 6)$	$(D, \rightarrow, exit, 6)$	$(B, \rightarrow, C, -3)$
$(D, \leftarrow, exit, 6)$			$(C, \leftarrow, B, -1)$
			$(B, \leftarrow, A, -1)$
			$(A, \leftarrow, exit, 6)$

each field in the table is an n-tuple (s, a, s', r)

State set: $S = \{A, B, C, D\}$, terminal states: $\{A, D\}$, non-terminal states: $\{B, C\}$

Action set: $A = \{\rightarrow, \leftarrow\}$

Reward function: $r(\{B, C\}, \leftarrow) = -1$, $r(\{B, C\}, \rightarrow) = -3$, $r(\{A, D\}) = 6$

Transition model: $p(C|B, \rightarrow) = p(A|B, \leftarrow) = p(D|C, \rightarrow) = p(B|C, \leftarrow) = 2/2 = 1$

World structure:

A	B	C	D

Example II

Episode 1	Episode 2	Episode 3	Episode 4
$(B, \rightarrow, C, -3)$	$(B, \leftarrow, A, -1)$	$(C, \rightarrow, D, -3)$	$(C, \leftarrow, B, -1)$
$(C, \rightarrow, D, -3)$	$(A, \rightarrow, exit, 6)$	$(D, \rightarrow, exit, 6)$	$(B, \rightarrow, C, -3)$
$(D, \leftarrow, exit, 6)$			$(C, \leftarrow, B, -1)$
			$(B, \leftarrow, A, -1)$
			$(A, \leftarrow, exit, 6)$

each field in the table is an n-tuple (s, a, s', r)

State set: $S = \{A, B, C, D\}$, terminal states: $\{A, D\}$, non-terminal states: $\{B, C\}$

Action set: $A = \{\rightarrow, \leftarrow\}$

Reward function: $r(\{B, C\}, \leftarrow) = -1$, $r(\{B, C\}, \rightarrow) = -3$, $r(\{A, D\}) = 6$

Transition model: $p(C|B, \rightarrow) = p(A|B, \leftarrow) = p(D|C, \rightarrow) = p(B|C, \leftarrow) = 2/2 = 1$

World structure:

A	B	C	D

Example II

Episode 1	Episode 2	Episode 3	Episode 4
$(B, \rightarrow, C, -3)$	$(B, \leftarrow, A, -1)$	$(C, \rightarrow, D, -3)$	$(C, \leftarrow, B, -1)$
$(C, \rightarrow, D, -3)$	$(A, \rightarrow, exit, 6)$	$(D, \rightarrow, exit, 6)$	$(B, \rightarrow, C, -3)$
$(D, \leftarrow, exit, 6)$			$(C, \leftarrow, B, -1)$
			$(B, \leftarrow, A, -1)$
			$(A, \leftarrow, exit, 6)$

each field in the table is an n-tuple (s, a, s', r)

State set: $S = \{A, B, C, D\}$, terminal states: $\{A, D\}$, non-terminal states: $\{B, C\}$
Action set: $A = \{\rightarrow, \leftarrow\}$
Reward function: $r(\{B, C\}, \leftarrow) = -1$, $r(\{B, C\}, \rightarrow) = -3$, $r(\{A, D\}) = 6$
Transition model: $p(C|B, \rightarrow) = p(A|B, \leftarrow) = p(D|C, \rightarrow) = p(B|C, \leftarrow) = 2/2 = 1$
World structure:

A	B	C	D

Example II

Episode 1	Episode 2	Episode 3	Episode 4
$(B, \rightarrow, C, -3)$ $(C, \rightarrow, D, -3)$ $(D, \leftarrow, exit, 6)$	$(B, \leftarrow, A, -1)$ $(A, \rightarrow, exit, 6)$	$(C, \rightarrow, D, -3)$ $(D, \rightarrow, exit, 6)$	$(C, \leftarrow, B, -1)$ $(B, \rightarrow, C, -3)$ $(C, \leftarrow, B, -1)$ $(B, \leftarrow, A, -1)$ $(A, \leftarrow, exit, 6)$

each field in the table is an n-tuple (s, a, s', r)

State set: $S = \{A, B, C, D\}$, terminal states: $\{A, D\}$, non-terminal states: $\{B, C\}$
Action set: $A = \{\rightarrow, \leftarrow\}$
Reward function: $r(\{B, C\}, \leftarrow) = -1$, $r(\{B, C\}, \rightarrow) = -3$, $r(\{A, D\}) = 6$
Transition model: $p(C|B, \rightarrow) = p(A|B, \leftarrow) = p(D|C, \rightarrow) = p(B|C, \leftarrow) = 2/2 = 1$
World structure:

A	B	C	D

Example II

Episode 1	**Episode 2**	**Episode 3**	**Episode 4**
$(B, \rightarrow, C, -3)$	$(B, \leftarrow, A, -1)$	$(C, \rightarrow, D, -3)$	$(C, \leftarrow, B, -1)$
$(C, \rightarrow, D, -3)$	$(A, \rightarrow, exit, 6)$	$(D, \rightarrow, exit, 6)$	$(B, \rightarrow, C, -3)$
$(D, \leftarrow, exit, 6)$			$(C, \leftarrow, B, -1)$
			$(B, \leftarrow, A, -1)$
			$(A, \leftarrow, exit, 6)$

each field in the table is an n-tuple (s, a, s', r)

State set: $S = \{A, B, C, D\}$, terminal states: $\{A, D\}$, non-terminal states: $\{B, C\}$
Action set: $A = \{\rightarrow, \leftarrow\}$
Reward function: $r(\{B, C\}, \leftarrow) = -1$, $r(\{B, C\}, \rightarrow) = -3$, $r(\{A, D\}) = 6$
Transition model: $p(C|B, \rightarrow) = p(A|B, \leftarrow) = p(D|C, \rightarrow) = p(B|C, \leftarrow) = 2/2 = 1$
World structure:

A	B	C	D

Example II

Episode 1	Episode 2	Episode 3	Episode 4
$(B, \rightarrow, C, -3)$	$(B, \leftarrow, A, -1)$	$(C, \rightarrow, D, -3)$	$(C, \leftarrow, B, -1)$
$(C, \rightarrow, D, -3)$	$(A, \rightarrow, exit, 6)$	$(D, \rightarrow, exit, 6)$	$(B, \rightarrow, C, -3)$
$(D, \leftarrow, exit, 6)$			$(C, \leftarrow, B, -1)$
			$(B, \leftarrow, A, -1)$
			$(A, \leftarrow, exit, 6)$

each field in the table is an n-tuple (s, a, s', r)

State set: $S = \{A, B, C, D\}$, terminal states: $\{A, D\}$, non-terminal states: $\{B, C\}$
Action set: $A = \{\rightarrow, \leftarrow\}$
Reward function: $r(\{B, C\}, \leftarrow) = -1$, $r(\{B, C\}, \rightarrow) = -3$, $r(\{A, D\}) = 6$
Transition model: $p(C|B, \rightarrow) = p(A|B, \leftarrow) = p(D|C, \rightarrow) = p(B|C, \leftarrow) = 2/2 = 1$
World structure:

A	B	C	D

Example II

Episode 1	Episode 2	Episode 3	Episode 4
$(B, \rightarrow, C, -3)$	$(B, \leftarrow, A, -1)$	$(C, \rightarrow, D, -3)$	$(C, \leftarrow, B, -1)$
$(C, \rightarrow, D, -3)$	$(A, \rightarrow, exit, 6)$	$(D, \rightarrow, exit, 6)$	$(B, \rightarrow, C, -3)$
$(D, \leftarrow, exit, 6)$			$(C, \leftarrow, B, -1)$
			$(B, \leftarrow, A, -1)$
			$(A, \leftarrow, exit, 6)$

each field in the table is an n-tuple (s, a, s', r)

State set: $S = \{A, B, C, D\}$, terminal states: $\{A, D\}$, non-terminal states: $\{B, C\}$
Action set: $A = \{\rightarrow, \leftarrow\}$
Reward function: $r(\{B, C\}, \leftarrow) = -1$, $r(\{B, C\}, \rightarrow) = -3$, $r(\{A, D\}) = 6$
Transition model: $p(C|B, \rightarrow) = p(A|B, \leftarrow) = p(D|C, \rightarrow) = p(B|C, \leftarrow) = 2/2 = 1$
World structure:

A	B	C	D

Example II

Episode 1	Episode 2	Episode 3	Episode 4
$(B, \rightarrow, C, -3)$	$(B, \leftarrow, A, -1)$	$(C, \rightarrow, D, -3)$	$(C, \leftarrow, B, -1)$
$(C, \rightarrow, D, -3)$	$(A, \rightarrow, exit, 6)$	$(D, \rightarrow, exit, 6)$	$(B, \rightarrow, C, -3)$
$(D, \leftarrow, exit, 6)$			$(C, \leftarrow, B, -1)$
			$(B, \leftarrow, A, -1)$
			$(A, \leftarrow, exit, 6)$

each field in the table is an n-tuple (s, a, s', r)

State set: $S = \{A, B, C, D\}$, terminal states: $\{A, D\}$, non-terminal states: $\{B, C\}$
Action set: $A = \{\rightarrow, \leftarrow\}$
Reward function: $r(\{B, C\}, \leftarrow) = -1$, $r(\{B, C\}, \rightarrow) = -3$, $r(\{A, D\}) = 6$
Transition model: $p(C|B, \rightarrow) = p(A|B, \leftarrow) = p(D|C, \rightarrow) = p(B|C, \leftarrow) = 2/2 = 1$

World structure:

A	B	C	D

Example II

Episode 1	Episode 2	Episode 3	Episode 4
$(B, \rightarrow, C, -3)$	$(B, \leftarrow, A, -1)$	$(C, \rightarrow, D, -3)$	$(C, \leftarrow, B, -1)$
$(C, \rightarrow, D, -3)$	$(A, \rightarrow, exit, 6)$	$(D, \rightarrow, exit, 6)$	$(B, \rightarrow, C, -3)$
$(D, \leftarrow, exit, 6)$			$(C, \leftarrow, B, -1)$
			$(B, \leftarrow, A, -1)$
			$(A, \leftarrow, exit, 6)$

each field in the table is an n-tuple (s, a, s', r)

State set: $S = \{A, B, C, D\}$, terminal states: $\{A, D\}$, non-terminal states: $\{B, C\}$
Action set: $A = \{\rightarrow, \leftarrow\}$
Reward function: $r(\{B, C\}, \leftarrow) = -1$, $r(\{B, C\}, \rightarrow) = -3$, $r(\{A, D\}) = 6$
Transition model: $p(C|B, \rightarrow) = p(A|B, \leftarrow) = p(D|C, \rightarrow) = p(B|C, \leftarrow) = 2/2 = 1$
World structure:

A	B	C	D

Example II

Episode 1	Episode 2	Episode 3	Episode 4
$(B, \rightarrow, C, -3)$	$(B, \leftarrow, A, -1)$	$(C, \rightarrow, D, -3)$	$(C, \leftarrow, B, -1)$
$(C, \rightarrow, D, -3)$	$(A, \rightarrow, exit, 6)$	$(D, \rightarrow, exit, 6)$	$(B, \rightarrow, C, -3)$
$(D, \leftarrow, exit, 6)$			$(C, \leftarrow, B, -1)$
			$(B, \leftarrow, A, -1)$
			$(A, \leftarrow, exit, 6)$

each field in the table is an n-tuple (s, a, s', r)

State set: $S = \{A, B, C, D\}$, terminal states: $\{A, D\}$, non-terminal states: $\{B, C\}$
Action set: $A = \{\rightarrow, \leftarrow\}$
Reward function: $r(\{B, C\}, \leftarrow) = -1$, $r(\{B, C\}, \rightarrow) = -3$, $r(\{A, D\}) = 6$
Transition model: $p(C|B, \rightarrow) = p(A|B, \leftarrow) = p(D|C, \rightarrow) = p(B|C, \leftarrow) = 2/2 = 1$
World structure:

A	B	C	D

Example II

$$\gamma = 1$$

Example II, $\gamma = 1$

Episode 1	**Episode 2**	**Episode 3**	**Episode 4**
$(B, \rightarrow, C, -3)$ $(C, \rightarrow, D, -3)$ $(D, \leftarrow, exit, 6)$	$(B, \leftarrow, A, -1)$ $(A, \rightarrow, exit, 6)$	$(C, \rightarrow, D, -3)$ $(D, \rightarrow, exit, 6)$	$(C, \leftarrow, B, -1)$ $(B, \rightarrow, C, -3)$ $(C, \leftarrow, B, -1)$ $(B, \leftarrow, A, -1)$ $(A, \leftarrow, exit, 6)$

each field in the table is an n-tuple (s, a, s', r)

A	B	C	D

$S = \{A, B, C, D\}$

$A = \{\rightarrow, \leftarrow\}$

$r(\{B, C\}, \leftarrow) = -1,\ r(\{A, D\}) = 6,$
$r(\{B, C\}, \rightarrow) = -3$

$p(C|B, \rightarrow) = p(A|B, \leftarrow) = 2/2 =$
$p(D|C, \rightarrow) = p(B|C, \leftarrow) = 1$

Estimate optimal policy:

A: $\pi(B) = \leftarrow, \pi(C) = \leftarrow$

B: $\pi(B) = \leftarrow, \pi(C) = \rightarrow$

C: $\pi(B) = \rightarrow, \pi(C) = \leftarrow$

D: $\pi(B) = \rightarrow, \pi(C) = \rightarrow$

Let's find out :-)

Example II, $\gamma = 1$

Episode 1	Episode 2	Episode 3	Episode 4
$(B, \rightarrow, C, -3)$ $(C, \rightarrow, D, -3)$ $(D, \leftarrow, exit, 6)$	$(B, \leftarrow, A, -1)$ $(A, \rightarrow, exit, 6)$	$(C, \rightarrow, D, -3)$ $(D, \rightarrow, exit, 6)$	$(C, \leftarrow, B, -1)$ $(B, \rightarrow, C, -3)$ $(C, \leftarrow, B, -1)$ $(B, \leftarrow, A, -1)$ $(A, \leftarrow, exit, 6)$

each field in the table is an n-tuple (s, a, s', r)

A	B	C	D

$S = \{A, B, C, D\}$
$A = \{\rightarrow, \leftarrow\}$
$r(\{B, C\}, \leftarrow) = -1,\ r(\{A, D\}) = 6,$
$r(\{B, C\}, \rightarrow) = -3$
$p(C|B, \rightarrow) = p(A|B, \leftarrow) = 2/2 =$
$p(D|C, \rightarrow) = p(B|C, \leftarrow) = 1$

Estimate optimal policy:

A: $\pi(B) = \leftarrow, \pi(C) = \leftarrow$

B: $\pi(B) = \leftarrow, \pi(C) = \rightarrow$

C: $\pi(B) = \rightarrow, \pi(C) = \leftarrow$

D: $\pi(B) = \rightarrow, \pi(C) = \rightarrow$

Let's find out :-)

Example II, $\gamma = 1$

Episode 1	Episode 2	Episode 3	Episode 4
$(B, \rightarrow, C, -3)$	$(B, \leftarrow, A, -1)$	$(C, \rightarrow, D, -3)$	$(C, \leftarrow, B, -1)$
$(C, \rightarrow, D, -3)$	$(A, \rightarrow, exit, 6)$	$(D, \rightarrow, exit, 6)$	$(B, \rightarrow, C, -3)$
$(D, \leftarrow, exit, 6)$			$(C, \leftarrow, B, -1)$
			$(B, \leftarrow, A, -1)$
			$(A, \leftarrow, exit, 6)$

each field in the table is an n-tuple (s, a, s', r)

A	B	C	D

$S = \{A, B, C, D\}$

$A = \{\rightarrow, \leftarrow\}$

$r(\{B, C\}, \leftarrow) = -1, \; r(\{A, D\}) = 6, \; r(\{B, C\}, \rightarrow) = -3$

$p(C|B, \rightarrow) = p(A|B, \leftarrow) = 2/2 = p(D|C, \rightarrow) = p(B|C, \leftarrow) = 1$

Compute:

A: $q(B, \leftarrow) = -1$

B: $q(B, \leftarrow) = 5$

C: $q(B, \leftarrow) = -3$

D: $q(B, \leftarrow) = 6$

Example II, $\gamma = 1$

Episode 1	Episode 2	Episode 3	Episode 4
$(B, \rightarrow, C, -3)$	$(B, \leftarrow, A, -1)$	$(C, \rightarrow, D, -3)$	$(C, \leftarrow, B, -1)$
$(C, \rightarrow, D, -3)$	$(A, \rightarrow, exit, 6)$	$(D, \rightarrow, exit, 6)$	$(B, \rightarrow, C, -3)$
$(D, \leftarrow, exit, 6)$			$(C, \leftarrow, B, -1)$
			$(B, \leftarrow, A, -1)$
			$(A, \leftarrow, exit, 6)$

each field in the table is an n-tuple (s, a, s', r)

A	B	C	D

$S = \{A, B, C, D\}$

$A = \{\rightarrow, \leftarrow\}$

$r(\{B, C\}, \leftarrow) = -1, \; r(\{A, D\}) = 6, \; r(\{B, C\}, \rightarrow) = -3$

$p(C|B, \rightarrow) = p(A|B, \leftarrow) = 2/2 = p(D|C, \rightarrow) = p(B|C, \leftarrow) = 1$

Compute:

A: $q(B, \leftarrow) = -1$

B: $q(B, \leftarrow) = B \leftarrow A = 6 - 1 = 5$

C: $q(B, \leftarrow) = -3$

D: $q(B, \leftarrow) = 6$

Example II, $\gamma = 1$

Episode 1	Episode 2	Episode 3	Episode 4
$(B, \rightarrow, C, -3)$	$(B, \leftarrow, A, -1)$	$(C, \rightarrow, D, -3)$	$(C, \leftarrow, B, -1)$
$(C, \rightarrow, D, -3)$	$(A, \rightarrow, exit, 6)$	$(D, \rightarrow, exit, 6)$	$(B, \rightarrow, C, -3)$
$(D, \leftarrow, exit, 6)$			$(C, \leftarrow, B, -1)$
			$(B, \leftarrow, A, -1)$
			$(A, \leftarrow, exit, 6)$

each field in the table is an n-tuple (s, a, s', r)

A	B	C	D

$S = \{A, B, C, D\}$
$A = \{\rightarrow, \leftarrow\}$
$r(\{B, C\}, \leftarrow) = -1,\ r(\{A, D\}) = 6,$
$r(\{B, C\}, \rightarrow) = -3$
$p(C|B, \rightarrow) = p(A|B, \leftarrow) = 2/2 =$
$p(D|C, \rightarrow) = p(B|C, \leftarrow) = 1$

- $q(B, \leftarrow) = 5$

Compute:

A: $q(B, \rightarrow) = -1$

B: $q(B, \rightarrow) = 0$

C: $q(B, \rightarrow) = 1$

D: $q(B, \rightarrow) = -3$

Example II, $\gamma = 1$

Episode 1	Episode 2	Episode 3	Episode 4
$(B, \rightarrow, C, -3)$	$(B, \leftarrow, A, -1)$	$(C, \rightarrow, D, -3)$	$(C, \leftarrow, B, -1)$
$(C, \rightarrow, D, -3)$	$(A, \rightarrow, exit, 6)$	$(D, \rightarrow, exit, 6)$	$(B, \rightarrow, C, -3)$
$(D, \leftarrow, exit, 6)$			$(C, \leftarrow, B, -1)$
			$(B, \leftarrow, A, -1)$
			$(A, \leftarrow, exit, 6)$

each field in the table is an n-tuple (s, a, s', r)

A	B	C	D

$S = \{A, B, C, D\}$
$A = \{\rightarrow, \leftarrow\}$
$r(\{B, C\}, \leftarrow) = -1,\ r(\{A, D\}) = 6,$
$r(\{B, C\}, \rightarrow) = -3$
$p(C|B, \rightarrow) = p(A|B, \leftarrow) = 2/2 = p(D|C, \rightarrow) = p(B|C, \leftarrow) = 1$

- $q(B, \leftarrow) = 5$

Compute:

A: $q(B, \rightarrow) = -1$

B: $q(B, \rightarrow) = 0$

C: $q(B, \rightarrow) = B \rightarrow C \leftarrow B \leftarrow A = 6 - 3 - 1 - 1 = 1$

D: $q(B, \rightarrow) = -3$

Example II, $\gamma = 1$

Episode 1	Episode 2	Episode 3	Episode 4
$(B, \rightarrow, C, -3)$	$(B, \leftarrow, A, -1)$	$(C, \rightarrow, D, -3)$	$(C, \leftarrow, B, -1)$
$(C, \rightarrow, D, -3)$	$(A, \rightarrow, exit, 6)$	$(D, \rightarrow, exit, 6)$	$(B, \rightarrow, C, -3)$
$(D, \leftarrow, exit, 6)$			$(C, \leftarrow, B, -1)$
			$(B, \leftarrow, A, -1)$
			$(A, \leftarrow, exit, 6)$

each field in the table is an n-tuple (s, a, s', r)

A	B	C	D

$S = \{A, B, C, D\}$
$A = \{\rightarrow, \leftarrow\}$
$r(\{B, C\}, \leftarrow) = -1, \; r(\{A, D\}) = 6,$
$r(\{B, C\}, \rightarrow) = -3$
$p(C|B, \rightarrow) = p(A|B, \leftarrow) = 2/2 =$
$p(D|C, \rightarrow) = p(B|C, \leftarrow) = 1$

- $q(B, \leftarrow) = 5$
- $q(B, \rightarrow) = 1$

Compute:

A: $\pi(B) = \leftarrow$

B: $\pi(B) = \rightarrow$

Example II, $\gamma = 1$

Episode 1	**Episode 2**	**Episode 3**	**Episode 4**
$(B, \rightarrow, C, -3)$	$(B, \leftarrow, A, -1)$	$(C, \rightarrow, D, -3)$	$(C, \leftarrow, B, -1)$
$(C, \rightarrow, D, -3)$	$(A, \rightarrow, exit, 6)$	$(D, \rightarrow, exit, 6)$	$(B, \rightarrow, C, -3)$
$(D, \leftarrow, exit, 6)$			$(C, \leftarrow, B, -1)$
			$(B, \leftarrow, A, -1)$
			$(A, \leftarrow, exit, 6)$

each field in the table is an n-tuple (s, a, s', r)

A	B	C	D

$S = \{A, B, C, D\}$
$A = \{\rightarrow, \leftarrow\}$
$r(\{B, C\}, \leftarrow) = -1$, $r(\{A, D\}) = 6$, $r(\{B, C\}, \rightarrow) = -3$
$p(C|B, \rightarrow) = p(A|B, \leftarrow) = 2/2 = p(D|C, \rightarrow) = p(B|C, \leftarrow) = 1$

- $q(B, \leftarrow) = 5$
- $q(B, \rightarrow) = 1$

Compute:

A: $\pi(B) = \leftarrow$

B: $\pi(B) = \rightarrow$

Example II, $\gamma = 1$

Episode 1	Episode 2	Episode 3	Episode 4
$(B, \rightarrow, C, -3)$	$(B, \leftarrow, A, -1)$	$(C, \rightarrow, D, -3)$	$(C, \leftarrow, B, -1)$
$(C, \rightarrow, D, -3)$	$(A, \rightarrow, exit, 6)$	$(D, \rightarrow, exit, 6)$	$(B, \rightarrow, C, -3)$
$(D, \leftarrow, exit, 6)$			$(C, \leftarrow, B, -1)$
			$(B, \leftarrow, A, -1)$
			$(A, \leftarrow, exit, 6)$

each field in the table is an n-tuple (s, a, s', r)

A	B	C	D

$S = \{A, B, C, D\}$
$A = \{\rightarrow, \leftarrow\}$
$r(\{B, C\}, \leftarrow) = -1, \; r(\{A, D\}) = 6,$
$r(\{B, C\}, \rightarrow) = -3$
$p(C|B, \rightarrow) = p(A|B, \leftarrow) = 2/2 =$
$p(D|C, \rightarrow) = p(B|C, \leftarrow) = 1$

- $\pi(B) = \leftarrow$

Compute:

A: $q(C, \rightarrow) = -1$

B: $q(C, \rightarrow) = -3$

C: $q(C, \rightarrow) = 3$

D: $q(C, \rightarrow) = 6$

Example II, $\gamma = 1$

Episode 1	Episode 2	Episode 3	Episode 4
$(B, \rightarrow, C, -3)$ $(C, \rightarrow, D, -3)$ $(D, \leftarrow, exit, 6)$	$(B, \leftarrow, A, -1)$ $(A, \rightarrow, exit, 6)$	$(C, \rightarrow, D, -3)$ $(D, \rightarrow, exit, 6)$	$(C, \leftarrow, B, -1)$ $(B, \rightarrow, C, -3)$ $(C, \leftarrow, B, -1)$ $(B, \leftarrow, A, -1)$ $(A, \leftarrow, exit, 6)$

each field in the table is an n-tuple (s, a, s', r)

A	B	C	D

$S = \{A, B, C, D\}$
$A = \{\rightarrow, \leftarrow\}$
$r(\{B, C\}, \leftarrow) = -1,\ r(\{A, D\}) = 6,$
$r(\{B, C\}, \rightarrow) = -3$
$p(C|B, \rightarrow) = p(A|B, \leftarrow) = 2/2 =$
$p(D|C, \rightarrow) = p(B|C, \leftarrow) = 1$

- $\pi(B) = \leftarrow$

Compute:

A: $q(C, \rightarrow) = -1$

B: $q(C, \rightarrow) = -3$

C: $q(C, \rightarrow) = C \rightarrow D = 6 - 3 = 3$

D: $q(C, \rightarrow) = 6$

Example II, $\gamma = 1$

Episode 1	Episode 2	Episode 3	Episode 4
$(B, \rightarrow, C, -3)$	$(B, \leftarrow, A, -1)$	$(C, \rightarrow, D, -3)$	$(C, \leftarrow, B, -1)$
$(C, \rightarrow, D, -3)$	$(A, \rightarrow, exit, 6)$	$(D, \rightarrow, exit, 6)$	$(B, \rightarrow, C, -3)$
$(D, \leftarrow, exit, 6)$			$(C, \leftarrow, B, -1)$
			$(B, \leftarrow, A, -1)$
			$(A, \leftarrow, exit, 6)$

each field in the table is an n-tuple (s, a, s', r)

A	B	C	D

$S = \{A, B, C, D\}$
$A = \{\rightarrow, \leftarrow\}$
$r(\{B, C\}, \leftarrow) = -1$, $r(\{A, D\}) = 6$, $r(\{B, C\}, \rightarrow) = -3$
$p(C|B, \rightarrow) = p(A|B, \leftarrow) = 2/2 = p(D|C, \rightarrow) = p(B|C, \leftarrow) = 1$

- $\pi(B) = \leftarrow$
  - $q(C, \rightarrow) = 3$

Compute:

A: $q(C, \leftarrow) = -1$

B: $q(C, \leftarrow) = 6$

C: $q(C, \leftarrow) = -3$

D: $q(C, \leftarrow) = 4$

Example II, $\gamma = 1$

Episode 1	Episode 2	Episode 3	Episode 4
$(B, \rightarrow, C, -3)$	$(B, \leftarrow, A, -1)$	$(C, \rightarrow, D, -3)$	$(C, \leftarrow, B, -1)$
$(C, \rightarrow, D, -3)$	$(A, \rightarrow, exit, 6)$	$(D, \rightarrow, exit, 6)$	$(B, \rightarrow, C, -3)$
$(D, \leftarrow, exit, 6)$			$(C, \leftarrow, B, -1)$
			$(B, \leftarrow, A, -1)$
			$(A, \leftarrow, exit, 6)$

each field in the table is an n-tuple (s, a, s', r)

A	B	C	D

$S = \{A, B, C, D\}$
$A = \{\rightarrow, \leftarrow\}$
$r(\{B, C\}, \leftarrow) = -1, \; r(\{A, D\}) = 6,$
$r(\{B, C\}, \rightarrow) = -3$
$p(C|B, \rightarrow) = p(A|B, \leftarrow) = 2/2 =$
$p(D|C, \rightarrow) = p(B|C, \leftarrow) = 1$

- $\pi(B) = \leftarrow$

- $q(C, \rightarrow) = 3$

Compute:

A: $q(C, \leftarrow) = -1$

B: $q(C, \leftarrow) = 6$

C: $q(C, \leftarrow) = -3$

D: $q(C, \leftarrow) = C \leftarrow B \leftarrow A = 6 - 1 - 1 = 4$

Example II, $\gamma = 1$

Episode 1	Episode 2	Episode 3	Episode 4
$(B, \rightarrow, C, -3)$	$(B, \leftarrow, A, -1)$	$(C, \rightarrow, D, -3)$	$(C, \leftarrow, B, -1)$
$(C, \rightarrow, D, -3)$	$(A, \rightarrow, exit, 6)$	$(D, \rightarrow, exit, 6)$	$(B, \rightarrow, C, -3)$
$(D, \leftarrow, exit, 6)$			$(C, \leftarrow, B, -1)$
			$(B, \leftarrow, A, -1)$
			$(A, \leftarrow, exit, 6)$

each field in the table is an n-tuple (s, a, s', r)

A	B	C	D

$S = \{A, B, C, D\}$
$A = \{\rightarrow, \leftarrow\}$
$r(\{B, C\}, \leftarrow) = -1, \ r(\{A, D\}) = 6,$
$r(\{B, C\}, \rightarrow) = -3$
$p(C|B, \rightarrow) = p(A|B, \leftarrow) = 2/2 =$
$p(D|C, \rightarrow) = p(B|C, \leftarrow) = 1$

- $\pi(B) = \leftarrow$
  - $q(C, \rightarrow) = 3$
  - $q(C, \leftarrow) = 4$

Compute:

A: $\pi(C) = \leftarrow$

B: $\pi(C) = \rightarrow$

Example II, $\gamma = 1$

Episode 1	Episode 2	Episode 3	Episode 4
$(B, \rightarrow, C, -3)$ $(C, \rightarrow, D, -3)$ $(D, \leftarrow, exit, 6)$	$(B, \leftarrow, A, -1)$ $(A, \rightarrow, exit, 6)$	$(C, \rightarrow, D, -3)$ $(D, \rightarrow, exit, 6)$	$(C, \leftarrow, B, -1)$ $(B, \rightarrow, C, -3)$ $(C, \leftarrow, B, -1)$ $(B, \leftarrow, A, -1)$ $(A, \leftarrow, exit, 6)$

each field in the table is an n-tuple (s, a, s', r)

A	B	C	D

$S = \{A, B, C, D\}$
$A = \{\rightarrow, \leftarrow\}$
$r(\{B, C\}, \leftarrow) = -1,\ r(\{A, D\}) = 6,$
$r(\{B, C\}, \rightarrow) = -3$
$p(C|B, \rightarrow) = p(A|B, \leftarrow) = 2/2 = p(D|C, \rightarrow) = p(B|C, \leftarrow) = 1$

- $\pi(B) = \leftarrow$
  - $q(C, \rightarrow) = 3$
  - $q(C, \leftarrow) = 4$

Compute:

A: $\pi(C) = \leftarrow$

B: $\pi(C) = \rightarrow$

Example II, $\gamma = 1$

Episode 1	Episode 2	Episode 3	Episode 4
$(B, \rightarrow, C, -3)$	$(B, \leftarrow, A, -1)$	$(C, \rightarrow, D, -3)$	$(C, \leftarrow, B, -1)$
$(C, \rightarrow, D, -3)$	$(A, \rightarrow, exit, 6)$	$(D, \rightarrow, exit, 6)$	$(B, \rightarrow, C, -3)$
$(D, \leftarrow, exit, 6)$			$(C, \leftarrow, B, -1)$
			$(B, \leftarrow, A, -1)$
			$(A, \leftarrow, exit, 6)$

each field in the table is an n-tuple (s, a, s', r)

A	B	C	D

$S = \{A, B, C, D\}$

$A = \{\rightarrow, \leftarrow\}$

$r(\{B, C\}, \leftarrow) = -1$, $r(\{A, D\}) = 6$, $r(\{B, C\}, \rightarrow) = -3$

$p(C|B, \rightarrow) = p(A|B, \leftarrow) = 2/2 =$
$p(D|C, \rightarrow) = p(B|C, \leftarrow) = 1$

Evaluate policy for $\gamma = 1$:

A: $\pi(B) = \leftarrow, \pi(C) = \leftarrow$

B: $\pi(B) = \leftarrow, \pi(C) = \rightarrow$

C: $\pi(B) = \rightarrow, \pi(C) = \leftarrow$

D: $\pi(B) = \rightarrow, \pi(C) = \rightarrow$

Example II, $\gamma = 1$

Episode 1	**Episode 2**	**Episode 3**	**Episode 4**
$(B, \rightarrow, C, -3)$ $(C, \rightarrow, D, -3)$ $(D, \leftarrow, exit, 6)$	$(B, \leftarrow, A, -1)$ $(A, \rightarrow, exit, 6)$	$(C, \rightarrow, D, -3)$ $(D, \rightarrow, exit, 6)$	$(C, \leftarrow, B, -1)$ $(B, \rightarrow, C, -3)$ $(C, \leftarrow, B, -1)$ $(B, \leftarrow, A, -1)$ $(A, \leftarrow, exit, 6)$

each field in the table is an n-tuple (s, a, s', r)

A	B	C	D

$S = \{A, B, C, D\}$
$A = \{\rightarrow, \leftarrow\}$
$r(\{B, C\}, \leftarrow) = -1$, $r(\{A, D\}) = 6$, $r(\{B, C\}, \rightarrow) = -3$
$p(C|B, \rightarrow) = p(A|B, \leftarrow) = 2/2 = p(D|C, \rightarrow) = p(B|C, \leftarrow) = 1$

Evaluate policy for $\gamma = 1$:

A: $\pi(B) = \leftarrow, \pi(C) = \leftarrow$

B: $\pi(B) = \leftarrow, \pi(C) = \rightarrow$

C: $\pi(B) = \rightarrow, \pi(C) = \leftarrow$

D: $\pi(B) = \rightarrow, \pi(C) = \rightarrow$

Example II

$$\gamma = ?$$

Example II, $\gamma = ?$

Episode 1	Episode 2	Episode 3	Episode 4
$(B, \rightarrow, C, -3)$	$(B, \leftarrow, A, -1)$	$(C, \rightarrow, D, -3)$	$(C, \leftarrow, B, -1)$
$(C, \rightarrow, D, -3)$	$(A, \rightarrow, exit, 6)$	$(D, \rightarrow, exit, 6)$	$(B, \rightarrow, C, -3)$
$(D, \leftarrow, exit, 6)$			$(C, \leftarrow, B, -1)$
			$(B, \leftarrow, A, -1)$
			$(A, \leftarrow, exit, 6)$

each field in the table is an n-tuple (s, a, s', r)

A	B	C	D

$S = \{A, B, C, D\}$
$A = \{\rightarrow, \leftarrow\}$
$r(\{B, C\}, \leftarrow) = -1$, $r(\{A, D\}) = 6$, $r(\{B, C\}, \rightarrow) = -3$
$p(C|B, \rightarrow) = p(A|B, \leftarrow) = 2/2 = p(D|C, \rightarrow) = p(B|C, \leftarrow) = 1$

- for $\gamma = 1$: $\pi(B) = \leftarrow, \pi(C) = \leftarrow$
- Task: determine γ which changes the policy computed for $\gamma = 1$

Can the policy in state B be changed?

A: Yes

B: No

Let's find out :-)

Example II, $\gamma =?$

Episode 1	Episode 2	Episode 3	Episode 4
$(B, \rightarrow, C, -3)$	$(B, \leftarrow, A, -1)$	$(C, \rightarrow, D, -3)$	$(C, \leftarrow, B, -1)$
$(C, \rightarrow, D, -3)$	$(A, \rightarrow, exit, 6)$	$(D, \rightarrow, exit, 6)$	$(B, \rightarrow, C, -3)$
$(D, \leftarrow, exit, 6)$			$(C, \leftarrow, B, -1)$
			$(B, \leftarrow, A, -1)$
			$(A, \leftarrow, exit, 6)$

each field in the table is an n-tuple (s, a, s', r)

A	B	C	D

$S = \{A, B, C, D\}$
$A = \{\rightarrow, \leftarrow\}$
$r(\{B, C\}, \leftarrow) = -1$, $r(\{A, D\}) = 6$, $r(\{B, C\}, \rightarrow) = -3$
$p(C|B, \rightarrow) = p(A|B, \leftarrow) = 2/2 = p(D|C, \rightarrow) = p(B|C, \leftarrow) = 1$

- for $\gamma = 1$: $\pi(B) = \leftarrow, \pi(C) = \leftarrow$
- Task: determine γ which changes the policy computed for $\gamma = 1$

Can the policy in state B be changed?

A: Yes

B: No

Let's find out :-)

Example II, $\gamma = ?$

Episode 1	Episode 2	Episode 3	Episode 4
$(B, \rightarrow, C, -3)$	$(B, \leftarrow, A, -1)$	$(C, \rightarrow, D, -3)$	$(C, \leftarrow, B, -1)$
$(C, \rightarrow, D, -3)$	$(A, \rightarrow, exit, 6)$	$(D, \rightarrow, exit, 6)$	$(B, \rightarrow, C, -3)$
$(D, \leftarrow, exit, 6)$			$(C, \leftarrow, B, -1)$
			$(B, \leftarrow, A, -1)$
			$(A, \leftarrow, exit, 6)$

each field in the table is an n-tuple (s, a, s', r)

A	B	C	D

$S = \{A, B, C, D\}$

$A = \{\rightarrow, \leftarrow\}$

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$p(C|B, \rightarrow) = p(A|B, \leftarrow) = 2/2 = p(D|C, \rightarrow) = p(B|C, \leftarrow) = 1$

- for $\gamma = 1$: $\pi(B) = \leftarrow, \pi(C) = \leftarrow$
- Task: determine γ which changes the policy computed for $\gamma = 1$

Can the policy in state B be changed?

$$
\begin{aligned}
V(B) &= \max_a (r(B, a) + \gamma \cdot V(s')), s' \in \{A, C\}) \\
&= \max \left\{ \begin{array}{ll} (\rightarrow) & r(B, \rightarrow) + \gamma \cdot V(C) \\ (\leftarrow) & r(B, \leftarrow) + \gamma \cdot V(A) \end{array} \right\} \\
&= r(B, \leftarrow) + \gamma \cdot V(A) \text{ since } V(A) > V(C) \;\&\; r(B, \leftarrow) > r(B, \rightarrow)
\end{aligned}
$$

$\Rightarrow \pi(B) = \leftarrow$

$V(B) = -1 + 6\gamma$

Example II, $\gamma = ?$

Episode 1	Episode 2	Episode 3	Episode 4
$(B, \rightarrow, C, -3)$	$(B, \leftarrow, A, -1)$	$(C, \rightarrow, D, -3)$	$(C, \leftarrow, B, -1)$
$(C, \rightarrow, D, -3)$	$(A, \rightarrow, exit, 6)$	$(D, \rightarrow, exit, 6)$	$(B, \rightarrow, C, -3)$
$(D, \leftarrow, exit, 6)$			$(C, \leftarrow, B, -1)$
			$(B, \leftarrow, A, -1)$
			$(A, \leftarrow, exit, 6)$

each field in the table is an n-tuple (s, a, s', r)

A	B	C	D

$S = \{A, B, C, D\}$
$A = \{\rightarrow, \leftarrow\}$
$r(\{B, C\}, \leftarrow) = -1, \; r(\{A, D\}) = 6,$
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$p(C|B, \rightarrow) = p(A|B, \leftarrow) = 2/2 =$
$p(D|C, \rightarrow) = p(B|C, \leftarrow) = 1$

- for $\gamma = 1$: $\pi(B) = \leftarrow, \pi(C) = \leftarrow$
- Task: determine γ which changes the policy computed for $\gamma = 1$

Can the policy in state B be changed?

$$
\begin{aligned}
V(B) &= \max_a(r(B, a) + \gamma \cdot V(s')), s' \in \{A, C\}) \\
&= \max \left\{ \begin{array}{ll} (\rightarrow) & r(B, \rightarrow) + \gamma \cdot V(C) \\ (\leftarrow) & r(B, \leftarrow) + \gamma \cdot V(A) \end{array} \right\} \\
&= r(B, \leftarrow) + \gamma \cdot V(A) \text{ since } V(A) > V(C) \;\&\; r(B, \leftarrow) > r(B, \rightarrow)
\end{aligned}
$$

$\Rightarrow \pi(B) = \leftarrow$

$V(B) = -1 + 6\gamma$

Example II, $\gamma = ?$

Episode 1	Episode 2	Episode 3	Episode 4
$(B, \rightarrow, C, -3)$	$(B, \leftarrow, A, -1)$	$(C, \rightarrow, D, -3)$	$(C, \leftarrow, B, -1)$
$(C, \rightarrow, D, -3)$	$(A, \rightarrow, exit, 6)$	$(D, \rightarrow, exit, 6)$	$(B, \rightarrow, C, -3)$
$(D, \leftarrow, exit, 6)$			$(C, \leftarrow, B, -1)$
			$(B, \leftarrow, A, -1)$
			$(A, \leftarrow, exit, 6)$

each field in the table is an n-tuple (s, a, s', r)

A	B	C	D

$S = \{A, B, C, D\}$

$A = \{\rightarrow, \leftarrow\}$

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- Task: determine γ which changes the policy computed for $\gamma = 1$

Can the policy in state B be changed?

$$
\begin{aligned}
V(B) &= \max_a(r(B, a) + \gamma \cdot V(s')), s' \in \{A, C\}) \\
&= \max \left\{ \begin{array}{ll} (\rightarrow) & r(B, \rightarrow) + \gamma \cdot V(C) \\ (\leftarrow) & r(B, \leftarrow) + \gamma \cdot V(A) \end{array} \right\} \\
&= r(B, \leftarrow) + \gamma \cdot V(A) \text{ since } V(A) > V(C) \;\&\; r(B, \leftarrow) > r(B, \rightarrow)
\end{aligned}
$$

$\Rightarrow \pi(B) = \leftarrow$

$V(B) = -1 + 6\gamma$

Example II, $\gamma = ?$

Episode 1	Episode 2	Episode 3	Episode 4
$(B, \rightarrow, C, -3)$	$(B, \leftarrow, A, -1)$	$(C, \rightarrow, D, -3)$	$(C, \leftarrow, B, -1)$
$(C, \rightarrow, D, -3)$	$(A, \rightarrow, exit, 6)$	$(D, \rightarrow, exit, 6)$	$(B, \rightarrow, C, -3)$
$(D, \leftarrow, exit, 6)$			$(C, \leftarrow, B, -1)$
			$(B, \leftarrow, A, -1)$
			$(A, \leftarrow, exit, 6)$

each field in the table is an n-tuple (s, a, s', r)

A	B	C	D

$S = \{A, B, C, D\}$

$A = \{\rightarrow, \leftarrow\}$

$r(\{B, C\}, \leftarrow) = -1,\ r(\{A, D\}) = 6,$
$r(\{B, C\}, \rightarrow) = -3$

$p(C|B, \rightarrow) = p(A|B, \leftarrow) = 2/2 =$
$p(D|C, \rightarrow) = p(B|C, \leftarrow) = 1$

- for $\gamma = 1$: $\pi(B) = \leftarrow, \pi(C) = \leftarrow$
- Task: determine γ which changes the policy computed for $\gamma = 1$

Can the policy in state B be changed?

$$
\begin{aligned}
V(B) &= \max_a(r(B, a) + \gamma \cdot V(s')), s' \in \{A, C\}) \\
&= \max \left\{ \begin{array}{ll} (\rightarrow) & r(B, \rightarrow) + \gamma \cdot V(C) \\ (\leftarrow) & r(B, \leftarrow) + \gamma \cdot V(A) \end{array} \right\} \\
&= r(B, \leftarrow) + \gamma \cdot V(A) \ \text{since}\ V(A) > V(C)\ \&\ r(B, \leftarrow) > r(B, \rightarrow)
\end{aligned}
$$

$\Rightarrow \pi(B) = \leftarrow$

$V(B) = -1 + 6\gamma$

Example II, $\gamma = ?$

Episode 1	Episode 2	Episode 3	Episode 4
$(B, \rightarrow, C, -3)$	$(B, \leftarrow, A, -1)$	$(C, \rightarrow, D, -3)$	$(C, \leftarrow, B, -1)$
$(C, \rightarrow, D, -3)$	$(A, \rightarrow, exit, 6)$	$(D, \rightarrow, exit, 6)$	$(B, \rightarrow, C, -3)$
$(D, \leftarrow, exit, 6)$			$(C, \leftarrow, B, -1)$
			$(B, \leftarrow, A, -1)$
			$(A, \leftarrow, exit, 6)$

each field in the table is an n-tuple (s, a, s', r)

A	B	C	D

$S = \{A, B, C, D\}$

$A = \{\rightarrow, \leftarrow\}$

$r(\{B, C\}, \leftarrow) = -1$, $r(\{A, D\}) = 6$, $r(\{B, C\}, \rightarrow) = -3$

$p(C|B, \rightarrow) = p(A|B, \leftarrow) = 2/2 = p(D|C, \rightarrow) = p(B|C, \leftarrow) = 1$

- for $\gamma = 1$: $\pi(B) = \leftarrow, \pi(C) = \leftarrow$
- Task: determine γ which changes the policy computed for $\gamma = 1$

Can the policy in state B be changed?

$$\begin{aligned} V(B) &= \max_a(r(B, a) + \gamma \cdot V(s')), s' \in \{A, C\}) \\ &= \max \begin{cases} (\rightarrow) & r(B, \rightarrow) + \gamma \cdot V(C) \\ (\leftarrow) & r(B, \leftarrow) + \gamma \cdot V(A) \end{cases} \\ &= r(B, \leftarrow) + \gamma \cdot V(A) \text{ since } V(A) > V(C) \ \& \ r(B, \leftarrow) > r(B, \rightarrow) \end{aligned}$$

$\Rightarrow \pi(B) = \leftarrow$

$V(B) = -1 + 6\gamma$

Example II, $\gamma = ?$

Episode 1	Episode 2	Episode 3	Episode 4
$(B, \rightarrow, C, -3)$	$(B, \leftarrow, A, -1)$	$(C, \rightarrow, D, -3)$	$(C, \leftarrow, B, -1)$
$(C, \rightarrow, D, -3)$	$(A, \rightarrow, exit, 6)$	$(D, \rightarrow, exit, 6)$	$(B, \rightarrow, C, -3)$
$(D, \leftarrow, exit, 6)$			$(C, \leftarrow, B, -1)$
			$(B, \leftarrow, A, -1)$
			$(A, \leftarrow, exit, 6)$

each field in the table is an n-tuple (s, a, s', r)

A	B	C	D

$S = \{A, B, C, D\}$
$A = \{\rightarrow, \leftarrow\}$
$r(\{B, C\}, \leftarrow) = -1,\ r(\{A, D\}) = 6,$
$r(\{B, C\}, \rightarrow) = -3$
$p(C|B, \rightarrow) = p(A|B, \leftarrow) = 2/2 =$
$p(D|C, \rightarrow) = p(B|C, \leftarrow) = 1$

- for $\gamma = 1$: $\pi(B) = \leftarrow, \pi(C) = \leftarrow$
- Task: determine γ which changes the policy computed for $\gamma = 1$

State B: $\pi(B) = \leftarrow, V(B) = -1 + 6\gamma$

$\Rightarrow$ Policy in state C has to be changed.

Compute:

A: $q(C, \rightarrow) = r(C, \rightarrow) + \gamma \cdot V(D)$

B: $q(C, \rightarrow) = r(C, \rightarrow) + \gamma \cdot V(B)$

C: $q(C, \rightarrow) = r(C, \leftarrow) + \gamma \cdot V(D)$

D: $q(C, \rightarrow) = r(C, \leftarrow) + V(B)$

Example II, $\gamma =?$

Episode 1	Episode 2	Episode 3	Episode 4
$(B, \rightarrow, C, -3)$	$(B, \leftarrow, A, -1)$	$(C, \rightarrow, D, -3)$	$(C, \leftarrow, B, -1)$
$(C, \rightarrow, D, -3)$	$(A, \rightarrow, exit, 6)$	$(D, \rightarrow, exit, 6)$	$(B, \rightarrow, C, -3)$
$(D, \leftarrow, exit, 6)$			$(C, \leftarrow, B, -1)$
			$(B, \leftarrow, A, -1)$
			$(A, \leftarrow, exit, 6)$

each field in the table is an n-tuple (s, a, s', r)

A	B	C	D

$S = \{A, B, C, D\}$
$A = \{\rightarrow, \leftarrow\}$
$r(\{B, C\}, \leftarrow) = -1, \; r(\{A, D\}) = 6,$
$r(\{B, C\}, \rightarrow) = -3$
$p(C|B, \rightarrow) = p(A|B, \leftarrow) = 2/2 =$
$p(D|C, \rightarrow) = p(B|C, \leftarrow) = 1$

- for $\gamma = 1$: $\pi(B) = \leftarrow, \pi(C) = \leftarrow$
- Task: determine γ which changes the policy computed for $\gamma = 1$

State B: $\pi(B) = \leftarrow, V(B) = -1 + 6\gamma$
$\Rightarrow$ Policy in state C has to be changed.

Compute:

A: $q(C, \rightarrow) = r(C, \rightarrow) + \gamma \cdot V(D)$

B: $q(C, \rightarrow) = r(C, \rightarrow) + \gamma \cdot V(B)$

C: $q(C, \rightarrow) = r(C, \leftarrow) + \gamma \cdot V(D)$

D: $q(C, \rightarrow) = r(C, \leftarrow) + V(B)$

Example II, $\gamma = ?$

Episode 1	Episode 2	Episode 3	Episode 4
$(B, \rightarrow, C, -3)$	$(B, \leftarrow, A, -1)$	$(C, \rightarrow, D, -3)$	$(C, \leftarrow, B, -1)$
$(C, \rightarrow, D, -3)$	$(A, \rightarrow, exit, 6)$	$(D, \rightarrow, exit, 6)$	$(B, \rightarrow, C, -3)$
$(D, \leftarrow, exit, 6)$			$(C, \leftarrow, B, -1)$
			$(B, \leftarrow, A, -1)$
			$(A, \leftarrow, exit, 6)$

each field in the table is an n-tuple (s, a, s', r)

A	B	C	D

$S = \{A, B, C, D\}$
$A = \{\rightarrow, \leftarrow\}$

$r(\{B, C\}, \leftarrow) = -1$, $r(\{A, D\}) = 6$,
$r(\{B, C\}, \rightarrow) = -3$

$p(C|B, \rightarrow) = p(A|B, \leftarrow) = 2/2 =$
$p(D|C, \rightarrow) = p(B|C, \leftarrow) = 1$

- for $\gamma = 1$: $\pi(B) = \leftarrow, \pi(C) = \leftarrow$
- Task: determine γ which changes the policy computed for $\gamma = 1$

State B: $\pi(B) = \leftarrow$, $V(B) = -1 + 6\gamma$
$\Rightarrow$ Policy in state C has to be changed.
Compute:

A: $q(C, \rightarrow) = r(C, \rightarrow) + \gamma \cdot V(D)$

B: $q(C, \rightarrow) = r(C, \rightarrow) + \gamma \cdot V(B)$

C: $q(C, \rightarrow) = r(C, \leftarrow) + \gamma \cdot V(D)$

D: $q(C, \rightarrow) = r(C, \leftarrow) + V(B)$

Example II, $\gamma =?$

Episode 1	Episode 2	Episode 3	Episode 4
$(B, \rightarrow, C, -3)$	$(B, \leftarrow, A, -1)$	$(C, \rightarrow, D, -3)$	$(C, \leftarrow, B, -1)$
$(C, \rightarrow, D, -3)$	$(A, \rightarrow, exit, 6)$	$(D, \rightarrow, exit, 6)$	$(B, \rightarrow, C, -3)$
$(D, \leftarrow, exit, 6)$			$(C, \leftarrow, B, -1)$
			$(B, \leftarrow, A, -1)$
			$(A, \leftarrow, exit, 6)$

each field in the table is an n-tuple (s, a, s', r)

A	B	C	D

$S = \{A, B, C, D\}$
$A = \{\rightarrow, \leftarrow\}$
$r(\{B, C\}, \leftarrow) = -1$, $r(\{A, D\}) = 6$, $r(\{B, C\}, \rightarrow) = -3$
$p(C|B, \rightarrow) = p(A|B, \leftarrow) = 2/2 = p(D|C, \rightarrow) = p(B|C, \leftarrow) = 1$

- for $\gamma = 1$: $\pi(B) = \leftarrow, \pi(C) = \leftarrow$
- Task: determine γ which changes the policy computed for $\gamma = 1$

State B: $\pi(B) = \leftarrow$, $V(B) = -1 + 6\gamma$
$\Rightarrow$ Policy in state C has to be changed.
Compute:

A: $q(C, \rightarrow) = r(C, \rightarrow) + \gamma \cdot V(D) = -3 + 6\gamma$

B: $q(C, \rightarrow) = r(C, \rightarrow) + \gamma \cdot V(B)$

C: $q(C, \rightarrow) = r(C, \leftarrow) + \gamma \cdot V(D)$

D: $q(C, \rightarrow) = r(C, \leftarrow) + V(B)$

Example II, $\gamma = ?$

Episode 1	Episode 2	Episode 3	Episode 4
$(B, \rightarrow, C, -3)$ $(C, \rightarrow, D, -3)$ $(D, \leftarrow, exit, 6)$	$(B, \leftarrow, A, -1)$ $(A, \rightarrow, exit, 6)$	$(C, \rightarrow, D, -3)$ $(D, \rightarrow, exit, 6)$	$(C, \leftarrow, B, -1)$ $(B, \rightarrow, C, -3)$ $(C, \leftarrow, B, -1)$ $(B, \leftarrow, A, -1)$ $(A, \leftarrow, exit, 6)$

each field in the table is an n-tuple (s, a, s', r)

A	B	C	D

$S = \{A, B, C, D\}$
$A = \{\rightarrow, \leftarrow\}$

$r(\{B, C\}, \leftarrow) = -1$, $r(\{A, D\}) = 6$,
$r(\{B, C\}, \rightarrow) = -3$

$p(C|B, \rightarrow) = p(A|B, \leftarrow) = 2/2 =$
$p(D|C, \rightarrow) = p(B|C, \leftarrow) = 1$

- for $\gamma = 1$: $\pi(B) = \leftarrow, \pi(C) = \leftarrow$
- Task: determine γ which changes the policy computed for $\gamma = 1$

State B: $\pi(B) = \leftarrow, V(B) = -1 + 6\gamma$
$\Rightarrow$ Policy in state C has to be changed.

- $q(C, \rightarrow) = -3 + 6\gamma$

Compute:

A: $q(C, \leftarrow) = r(C) + V(D)$

B: $q(C, \leftarrow) = r(C, \leftarrow) + \gamma \cdot V(B)$

C: $q(C, \leftarrow) = r(C \leftarrow) + \gamma \cdot V(D)$

D: $q(C, \leftarrow) = r(C, \rightarrow) + V(B)$

Example II, $\gamma =?$

Episode 1	Episode 2	Episode 3	Episode 4
$(B, \rightarrow, C, -3)$ $(C, \rightarrow, D, -3)$ $(D, \leftarrow, exit, 6)$	$(B, \leftarrow, A, -1)$ $(A, \rightarrow, exit, 6)$	$(C, \rightarrow, D, -3)$ $(D, \rightarrow, exit, 6)$	$(C, \leftarrow, B, -1)$ $(B, \rightarrow, C, -3)$ $(C, \leftarrow, B, -1)$ $(B, \leftarrow, A, -1)$ $(A, \leftarrow, exit, 6)$

each field in the table is an n-tuple (s, a, s', r)

A	B	C	D

$S = \{A, B, C, D\}$
$A = \{\rightarrow, \leftarrow\}$
$r(\{B, C\}, \leftarrow) = -1$, $r(\{A, D\}) = 6$, $r(\{B, C\}, \rightarrow) = -3$
$p(C|B, \rightarrow) = p(A|B, \leftarrow) = 2/2 = p(D|C, \rightarrow) = p(B|C, \leftarrow) = 1$

- for $\gamma = 1$: $\pi(B) = \leftarrow, \pi(C) = \leftarrow$
- Task: determine γ which changes the policy computed for $\gamma = 1$

State B: $\pi(B) = \leftarrow, V(B) = -1 + 6\gamma$
$\Rightarrow$ Policy in state C has to be changed.

- $q(C, \rightarrow) = -3 + 6\gamma$

Compute:

A: $q(C, \leftarrow) = r(C) + V(D)$

B: $q(C, \leftarrow) = r(C, \leftarrow) + \gamma \cdot V(B) = -1 + \gamma(-1 + 6\gamma)$

C: $q(C, \leftarrow) = r(C \leftarrow) + \gamma \cdot V(D)$

D: $q(C, \leftarrow) = r(C, \rightarrow) + V(B)$

Example II, $\gamma =?$

Episode 1	Episode 2	Episode 3	Episode 4
$(B, \rightarrow, C, -3)$	$(B, \leftarrow, A, -1)$	$(C, \rightarrow, D, -3)$	$(C, \leftarrow, B, -1)$
$(C, \rightarrow, D, -3)$	$(A, \rightarrow, exit, 6)$	$(D, \rightarrow, exit, 6)$	$(B, \rightarrow, C, -3)$
$(D, \leftarrow, exit, 6)$			$(C, \leftarrow, B, -1)$
			$(B, \leftarrow, A, -1)$
			$(A, \leftarrow, exit, 6)$

each field in the table is an n-tuple (s, a, s', r)

A	B	C	D

$S = \{A, B, C, D\}$
$A = \{\rightarrow, \leftarrow\}$
$r(\{B, C\}, \leftarrow) = -1$, $r(\{A, D\}) = 6$, $r(\{B, C\}, \rightarrow) = -3$
$p(C|B, \rightarrow) = p(A|B, \leftarrow) = 2/2 = p(D|C, \rightarrow) = p(B|C, \leftarrow) = 1$

- for $\gamma = 1$: $\pi(B) = \leftarrow, \pi(C) = \leftarrow$
- Task: determine γ which changes the policy computed for $\gamma = 1$

State B: $\pi(B) = \leftarrow$, $V(B) = -1 + 6\gamma$
$\Rightarrow$ Policy in state C has to be changed.

- $q(C, \rightarrow) = -3 + 6\gamma$
- $q(C, \leftarrow) = -1 + \gamma(-1 + 6\gamma)$

To change the policy, we need:
$q(C, \rightarrow) > q(C, \leftarrow)$

Let's evaluate for boundary equality:
$q(C, \rightarrow) = q(C, \leftarrow)$

Example II, $\gamma =?$

Episode 1	Episode 2	Episode 3	Episode 4
$(B, \rightarrow, C, -3)$	$(B, \leftarrow, A, -1)$	$(C, \rightarrow, D, -3)$	$(C, \leftarrow, B, -1)$
$(C, \rightarrow, D, -3)$	$(A, \rightarrow, exit, 6)$	$(D, \rightarrow, exit, 6)$	$(B, \rightarrow, C, -3)$
$(D, \leftarrow, exit, 6)$			$(C, \leftarrow, B, -1)$
			$(B, \leftarrow, A, -1)$
			$(A, \leftarrow, exit, 6)$

each field in the table is an n-tuple (s, a, s', r)

A	B	C	D

$S = \{A, B, C, D\}$
$A = \{\rightarrow, \leftarrow\}$
$r(\{B, C\}, \leftarrow) = -1, \; r(\{A, D\}) = 6,$
$r(\{B, C\}, \rightarrow) = -3$
$p(C|B, \rightarrow) = p(A|B, \leftarrow) = 2/2 =$
$p(D|C, \rightarrow) = p(B|C, \leftarrow) = 1$

- for $\gamma = 1$: $\pi(B) = \leftarrow, \pi(C) = \leftarrow$
- Task: determine γ which changes the policy computed for $\gamma = 1$

State B: $\pi(B) = \leftarrow, V(B) = -1 + 6\gamma$
$\Rightarrow$ Policy in state C has to be changed.

- $q(C, \rightarrow) = -3 + 6\gamma$
- $q(C, \leftarrow) = -1 + \gamma(-1 + 6\gamma)$

To change the policy, we need:
$q(C, \rightarrow) > q(C, \leftarrow)$
Let's evaluate for boundary equality:
$q(C, \rightarrow) = q(C, \leftarrow)$

Example II, $\gamma = ?$

Episode 1	Episode 2	Episode 3	Episode 4
$(B, \rightarrow, C, -3)$	$(B, \leftarrow, A, -1)$	$(C, \rightarrow, D, -3)$	$(C, \leftarrow, B, -1)$
$(C, \rightarrow, D, -3)$	$(A, \rightarrow, exit, 6)$	$(D, \rightarrow, exit, 6)$	$(B, \rightarrow, C, -3)$
$(D, \leftarrow, exit, 6)$			$(C, \leftarrow, B, -1)$
			$(B, \leftarrow, A, -1)$
			$(A, \leftarrow, exit, 6)$

each field in the table is an n-tuple (s, a, s', r)

A	B	C	D

$S = \{A, B, C, D\}$
$A = \{\rightarrow, \leftarrow\}$
$r(\{B, C\}, \leftarrow) = -1, \ r(\{A, D\}) = 6,$
$r(\{B, C\}, \rightarrow) = -3$
$p(C|B, \rightarrow) = p(A|B, \leftarrow) = 2/2 =$
$p(D|C, \rightarrow) = p(B|C, \leftarrow) = 1$

- for $\gamma = 1$: $\pi(B) = \leftarrow, \pi(C) = \leftarrow$
- Task: determine γ which changes the policy computed for $\gamma = 1$

$$
\begin{aligned}
q(C, \rightarrow) &= q(C, \leftarrow) \\
-3 + 6\gamma &= -1 + \gamma(-1 + 6\gamma) \\
-3 + 6\gamma &= -1 - \gamma + 6\gamma^2 \\
6\gamma^2 - 7\gamma + 2 &= 0
\end{aligned}
$$

$\Rightarrow \gamma_1 = 2/3, \gamma_2 = 1/2$

$\Rightarrow \pi(B) = \leftarrow, \pi(C) = \leftarrow$; for $\gamma \in]0, 1/2[\cup]2/3, 1[$

$\pi(B) = \leftarrow, \pi(C) = \rightarrow$; for $\gamma \in]1/2, 2/3[$

Example II, $\gamma = ?$

Episode 1	Episode 2	Episode 3	Episode 4
$(B, \rightarrow, C, -3)$	$(B, \leftarrow, A, -1)$	$(C, \rightarrow, D, -3)$	$(C, \leftarrow, B, -1)$
$(C, \rightarrow, D, -3)$	$(A, \rightarrow, exit, 6)$	$(D, \rightarrow, exit, 6)$	$(B, \rightarrow, C, -3)$
$(D, \leftarrow, exit, 6)$			$(C, \leftarrow, B, -1)$
			$(B, \leftarrow, A, -1)$
			$(A, \leftarrow, exit, 6)$

each field in the table is an n-tuple (s, a, s', r)

A	B	C	D

$S = \{A, B, C, D\}$
$A = \{\rightarrow, \leftarrow\}$
$r(\{B, C\}, \leftarrow) = -1, \; r(\{A, D\}) = 6,$
$r(\{B, C\}, \rightarrow) = -3$
$p(C|B, \rightarrow) = p(A|B, \leftarrow) = 2/2 =$
$p(D|C, \rightarrow) = p(B|C, \leftarrow) = 1$

- for $\gamma = 1$: $\pi(B) = \leftarrow, \pi(C) = \leftarrow$
- Task: determine γ which changes the policy computed for $\gamma = 1$

$$
\begin{aligned}
q(C, \rightarrow) &= q(C, \leftarrow) \\
-3 + 6\gamma &= -1 + \gamma(-1 + 6\gamma) \\
-3 + 6\gamma &= -1 - \gamma + 6\gamma^2 \\
6\gamma^2 - 7\gamma + 2 &= 0 \\
\Rightarrow \gamma_1 = 2/3, \gamma_2 = 1/2
\end{aligned}
$$

$\Rightarrow \quad \pi(B) = \leftarrow, \pi(C) = \leftarrow$; for $\gamma \in]0, 1/2[\cup]2/3, 1[$

$\pi(B) = \leftarrow, \pi(C) = \rightarrow$; for $\gamma \in]1/2, 2/3[$

Example II, $\gamma = ?$

Episode 1	Episode 2	Episode 3	Episode 4
$(B, \rightarrow, C, -3)$	$(B, \leftarrow, A, -1)$	$(C, \rightarrow, D, -3)$	$(C, \leftarrow, B, -1)$
$(C, \rightarrow, D, -3)$	$(A, \rightarrow, exit, 6)$	$(D, \rightarrow, exit, 6)$	$(B, \rightarrow, C, -3)$
$(D, \leftarrow, exit, 6)$			$(C, \leftarrow, B, -1)$
			$(B, \leftarrow, A, -1)$
			$(A, \leftarrow, exit, 6)$

each field in the table is an n-tuple (s, a, s', r)

A	B	C	D

$S = \{A, B, C, D\}$
$A = \{\rightarrow, \leftarrow\}$
$r(\{B, C\}, \leftarrow) = -1, \; r(\{A, D\}) = 6, \; r(\{B, C\}, \rightarrow) = -3$
$p(C|B, \rightarrow) = p(A|B, \leftarrow) = 2/2 = p(D|C, \rightarrow) = p(B|C, \leftarrow) = 1$

- for $\gamma = 1$: $\pi(B) = \leftarrow, \pi(C) = \leftarrow$
- Task: determine γ which changes the policy computed for $\gamma = 1$

$$
\begin{aligned}
q(C, \rightarrow) &= q(C, \leftarrow) \\
-3 + 6\gamma &= -1 + \gamma(-1 + 6\gamma) \\
-3 + 6\gamma &= -1 - \gamma + 6\gamma^2 \\
6\gamma^2 - 7\gamma + 2 &= 0
\end{aligned}
$$

$\Rightarrow \gamma_1 = 2/3, \gamma_2 = 1/2$

$\Rightarrow \quad \pi(B) = \leftarrow, \pi(C) = \leftarrow$; for $\gamma \in]0, 1/2[\cup]2/3, 1[$

$\pi(B) = \leftarrow, \pi(C) = \rightarrow$; for $\gamma \in]1/2, 2/3[$

Example II, $\gamma = ?$

Episode 1	Episode 2	Episode 3	Episode 4
$(B, \rightarrow, C, -3)$	$(B, \leftarrow, A, -1)$	$(C, \rightarrow, D, -3)$	$(C, \leftarrow, B, -1)$
$(C, \rightarrow, D, -3)$	$(A, \rightarrow, exit, 6)$	$(D, \rightarrow, exit, 6)$	$(B, \rightarrow, C, -3)$
$(D, \leftarrow, exit, 6)$			$(C, \leftarrow, B, -1)$
			$(B, \leftarrow, A, -1)$
			$(A, \leftarrow, exit, 6)$

each field in the table is an n-tuple (s, a, s', r)

A	B	C	D

$S = \{A, B, C, D\}$

$A = \{\rightarrow, \leftarrow\}$

$r(\{B, C\}, \leftarrow) = -1, \; r(\{A, D\}) = 6, \; r(\{B, C\}, \rightarrow) = -3$

$p(C|B, \rightarrow) = p(A|B, \leftarrow) = 2/2 = p(D|C, \rightarrow) = p(B|C, \leftarrow) = 1$

- for $\gamma = 1$: $\pi(B) = \leftarrow, \pi(C) = \leftarrow$
- Task: determine γ which changes the policy computed for $\gamma = 1$

$$
\begin{aligned}
q(C, \rightarrow) &= q(C, \leftarrow) \\
-3 + 6\gamma &= -1 + \gamma(-1 + 6\gamma) \\
-3 + 6\gamma &= -1 - \gamma + 6\gamma^2 \\
6\gamma^2 - 7\gamma + 2 &= 0
\end{aligned}
$$

$\Rightarrow \gamma_1 = 2/3, \gamma_2 = 1/2$

$\Rightarrow \; \pi(B) = \leftarrow, \pi(C) = \leftarrow$; for $\gamma \in]0, 1/2[\cup]2/3, 1[$

$\pi(B) = \leftarrow, \pi(C) = \rightarrow$; for $\gamma \in]1/2, 2/3[$

Example II, $\gamma = ?$

Episode 1	Episode 2	Episode 3	Episode 4
$(B, \rightarrow, C, -3)$ $(C, \rightarrow, D, -3)$ $(D, \leftarrow, exit, 6)$	$(B, \leftarrow, A, -1)$ $(A, \rightarrow, exit, 6)$	$(C, \rightarrow, D, -3)$ $(D, \rightarrow, exit, 6)$	$(C, \leftarrow, B, -1)$ $(B, \rightarrow, C, -3)$ $(C, \leftarrow, B, -1)$ $(B, \leftarrow, A, -1)$ $(A, \leftarrow, exit, 6)$

each field in the table is an n-tuple (s, a, s', r)

A	B	C	D

$S = \{A, B, C, D\}$
$A = \{\rightarrow, \leftarrow\}$

$r(\{B, C\}, \leftarrow) = -1$, $r(\{A, D\}) = 6$, $r(\{B, C\}, \rightarrow) = -3$

$p(C|B, \rightarrow) = p(A|B, \leftarrow) = 2/2 = p(D|C, \rightarrow) = p(B|C, \leftarrow) = 1$

- for $\gamma = 1$: $\pi(B) = \leftarrow, \pi(C) = \leftarrow$
- Task: determine γ which changes the policy computed for $\gamma = 1$

$$\begin{aligned} q(C, \rightarrow) &= q(C, \leftarrow) \\ -3 + 6\gamma &= -1 + \gamma(-1 + 6\gamma) \\ -3 + 6\gamma &= -1 - \gamma + 6\gamma^2 \\ 6\gamma^2 - 7\gamma + 2 &= 0 \end{aligned}$$

$\Rightarrow \gamma_1 = 2/3, \gamma_2 = 1/2$

$\Rightarrow$ $\pi(B) = \leftarrow, \pi(C) = \leftarrow$; for $\gamma \in]0, 1/2[\cup]2/3, 1[$

$\pi(B) = \leftarrow, \pi(C) = \rightarrow$; for $\gamma \in]1/2, 2/3[$

Example II, $\gamma = ?$

Episode 1	Episode 2	Episode 3	Episode 4
$(B, \rightarrow, C, -3)$	$(B, \leftarrow, A, -1)$	$(C, \rightarrow, D, -3)$	$(C, \leftarrow, B, -1)$
$(C, \rightarrow, D, -3)$	$(A, \rightarrow, exit, 6)$	$(D, \rightarrow, exit, 6)$	$(B, \rightarrow, C, -3)$
$(D, \leftarrow, exit, 6)$			$(C, \leftarrow, B, -1)$
			$(B, \leftarrow, A, -1)$
			$(A, \leftarrow, exit, 6)$

each field in the table is an n-tuple (s, a, s', r)

A	B	C	D

$S = \{A, B, C, D\}$
$A = \{\rightarrow, \leftarrow\}$
$r(\{B, C\}, \leftarrow) = -1,\ r(\{A, D\}) = 6,$
$r(\{B, C\}, \rightarrow) = -3$
$p(C|B, \rightarrow) = p(A|B, \leftarrow) = 2/2 =$
$p(D|C, \rightarrow) = p(B|C, \leftarrow) = 1$

- for $\gamma = 1$: $\pi(B) = \leftarrow, \pi(C) = \leftarrow$
- Task: determine γ which changes the policy computed for $\gamma = 1$

$$
\begin{aligned}
q(C, \rightarrow) &= q(C, \leftarrow) \\
-3 + 6\gamma &= -1 + \gamma(-1 + 6\gamma) \\
-3 + 6\gamma &= -1 - \gamma + 6\gamma^2 \\
6\gamma^2 - 7\gamma + 2 &= 0
\end{aligned}
$$

$\Rightarrow \gamma_1 = 2/3, \gamma_2 = 1/2$

$\Rightarrow$ $\pi(B) = \leftarrow, \pi(C) = \leftarrow$; for $\gamma \in]0, 1/2[\cup]2/3, 1[$

$\pi(B) = \leftarrow, \pi(C) = \rightarrow$; for $\gamma \in]1/2, 2/3[$

Example II

$$\gamma = 0$$

Example II, $\gamma = 0$

Episode 1	Episode 2	Episode 3	Episode 4
$(B, \rightarrow, C, -3)$	$(B, \leftarrow, A, -1)$	$(C, \rightarrow, D, -3)$	$(C, \leftarrow, B, -1)$
$(C, \rightarrow, D, -3)$	$(A, \rightarrow, exit, 6)$	$(D, \rightarrow, exit, 6)$	$(B, \rightarrow, C, -3)$
$(D, \leftarrow, exit, 6)$			$(C, \leftarrow, B, -1)$
			$(B, \leftarrow, A, -1)$
			$(A, \leftarrow, exit, 6)$

each field in the table is an n-tuple (s, a, s', r)

A	B	C	D

$S = \{A, B, C, D\}$

$A = \{\rightarrow, \leftarrow\}$

$r(\{B, C\}, \leftarrow) = -1$, $r(\{A, D\}) = 6$, $r(\{B, C\}, \rightarrow) = -3$

$p(C|B, \rightarrow) = p(A|B, \leftarrow) = 2/2 = p(D|C, \rightarrow) = p(B|C, \leftarrow) = 1$

For $\gamma = 0$:

Compute:

A: $q(B, \leftarrow) = 6$

B: $q(B, \leftarrow) = 5$

C: $q(B, \leftarrow) = -1$

D: $q(B, \leftarrow) = 0$

Example II, $\gamma = 0$

Episode 1	Episode 2	Episode 3	Episode 4
$(B, \rightarrow, C, -3)$	$(B, \leftarrow, A, -1)$	$(C, \rightarrow, D, -3)$	$(C, \leftarrow, B, -1)$
$(C, \rightarrow, D, -3)$	$(A, \rightarrow, exit, 6)$	$(D, \rightarrow, exit, 6)$	$(B, \rightarrow, C, -3)$
$(D, \leftarrow, exit, 6)$			$(C, \leftarrow, B, -1)$
			$(B, \leftarrow, A, -1)$
			$(A, \leftarrow, exit, 6)$

each field in the table is an n-tuple (s, a, s', r)

A	B	C	D

$S = \{A, B, C, D\}$
$A = \{\rightarrow, \leftarrow\}$
$r(\{B, C\}, \leftarrow) = -1, \; r(\{A, D\}) = 6,$
$r(\{B, C\}, \rightarrow) = -3$
$p(C|B, \rightarrow) = p(A|B, \leftarrow) = 2/2 =$
$p(D|C, \rightarrow) = p(B|C, \leftarrow) = 1$

For $\gamma = 0$:
Compute:

A: $q(B, \leftarrow) = 6$

B: $q(B, \leftarrow) = 5$

C: $q(B, \leftarrow) = r(B, \leftarrow) + 0 \cdot V(A) = -1$

D: $q(B, \leftarrow) = 0$

Example II, $\gamma = 0$

Episode 1	Episode 2	Episode 3	Episode 4
$(B, \rightarrow, C, -3)$	$(B, \leftarrow, A, -1)$	$(C, \rightarrow, D, -3)$	$(C, \leftarrow, B, -1)$
$(C, \rightarrow, D, -3)$	$(A, \rightarrow, exit, 6)$	$(D, \rightarrow, exit, 6)$	$(B, \rightarrow, C, -3)$
$(D, \leftarrow, exit, 6)$			$(C, \leftarrow, B, -1)$
			$(B, \leftarrow, A, -1)$
			$(A, \leftarrow, exit, 6)$

each field in the table is an n-tuple (s, a, s', r)

A	B	C	D

$S = \{A, B, C, D\}$

$A = \{\rightarrow, \leftarrow\}$

$r(\{B, C\}, \leftarrow) = -1$, $r(\{A, D\}) = 6$, $r(\{B, C\}, \rightarrow) = -3$

$p(C|B, \rightarrow) = p(A|B, \leftarrow) = 2/2 = p(D|C, \rightarrow) = p(B|C, \leftarrow) = 1$

For $\gamma = 0$:

- $q(B, \leftarrow) = -1$

Compute:

A: $q(B, \rightarrow) = 6$

B: $q(B, \rightarrow) = -3$

C: $q(B, \rightarrow) = 3$

D: $q(B, \rightarrow) = 0$

Example II, $\gamma = 0$

Episode 1	Episode 2	Episode 3	Episode 4
$(B, \rightarrow, C, -3)$	$(B, \leftarrow, A, -1)$	$(C, \rightarrow, D, -3)$	$(C, \leftarrow, B, -1)$
$(C, \rightarrow, D, -3)$	$(A, \rightarrow, exit, 6)$	$(D, \rightarrow, exit, 6)$	$(B, \rightarrow, C, -3)$
$(D, \leftarrow, exit, 6)$			$(C, \leftarrow, B, -1)$
			$(B, \leftarrow, A, -1)$
			$(A, \leftarrow, exit, 6)$

each field in the table is an n-tuple (s, a, s', r)

A	B	C	D

$S = \{A, B, C, D\}$
$A = \{\rightarrow, \leftarrow\}$
$r(\{B, C\}, \leftarrow) = -1$, $r(\{A, D\}) = 6$, $r(\{B, C\}, \rightarrow) = -3$
$p(C|B, \rightarrow) = p(A|B, \leftarrow) = 2/2 = p(D|C, \rightarrow) = p(B|C, \leftarrow) = 1$

For $\gamma = 0$:

- $q(B, \leftarrow) = -1$

Compute:

A: $q(B, \rightarrow) = 6$

B: $q(B, \rightarrow) = r(B, \rightarrow) + 0 \cdot V(C) = -3$

C: $q(B, \rightarrow) = 3$

D: $q(B, \rightarrow) = 0$

Example II, $\gamma = 0$

Episode 1	Episode 2	Episode 3	Episode 4
$(B, \rightarrow, C, -3)$	$(B, \leftarrow, A, -1)$	$(C, \rightarrow, D, -3)$	$(C, \leftarrow, B, -1)$
$(C, \rightarrow, D, -3)$	$(A, \rightarrow, exit, 6)$	$(D, \rightarrow, exit, 6)$	$(B, \rightarrow, C, -3)$
$(D, \leftarrow, exit, 6)$			$(C, \leftarrow, B, -1)$
			$(B, \leftarrow, A, -1)$
			$(A, \leftarrow, exit, 6)$

each field in the table is an n-tuple (s, a, s', r)

A	B	C	D

$S = \{A, B, C, D\}$

$A = \{\rightarrow, \leftarrow\}$

$r(\{B, C\}, \leftarrow) = -1$, $r(\{A, D\}) = 6$, $r(\{B, C\}, \rightarrow) = -3$

$p(C|B, \rightarrow) = p(A|B, \leftarrow) = 2/2 = p(D|C, \rightarrow) = p(B|C, \leftarrow) = 1$

For $\gamma = 0$:

- $q(B, \leftarrow) = -1$
- $q(B, \rightarrow) = -3$

$\Rightarrow \pi(B) = \leftarrow$

Example II, $\gamma = 0$

Episode 1	Episode 2	Episode 3	Episode 4
$(B, \rightarrow, C, -3)$	$(B, \leftarrow, A, -1)$	$(C, \rightarrow, D, -3)$	$(C, \leftarrow, B, -1)$
$(C, \rightarrow, D, -3)$	$(A, \rightarrow, exit, 6)$	$(D, \rightarrow, exit, 6)$	$(B, \rightarrow, C, -3)$
$(D, \leftarrow, exit, 6)$			$(C, \leftarrow, B, -1)$
			$(B, \leftarrow, A, -1)$
			$(A, \leftarrow, exit, 6)$

each field in the table is an n-tuple (s, a, s', r)

A	B	C	D

$S = \{A, B, C, D\}$

$A = \{\rightarrow, \leftarrow\}$

$r(\{B, C\}, \leftarrow) = -1,\ r(\{A, D\}) = 6,$
$r(\{B, C\}, \rightarrow) = -3$

$p(C|B, \rightarrow) = p(A|B, \leftarrow) = 2/2 =$
$p(D|C, \rightarrow) = p(B|C, \leftarrow) = 1$

For $\gamma = 0$:

- $q(B, \leftarrow) = -1$
- $q(B, \rightarrow) = -3$

$\Rightarrow \pi(B) = \leftarrow$

Example II, $\gamma = 0$

Episode 1	Episode 2	Episode 3	Episode 4
$(B, \rightarrow, C, -3)$	$(B, \leftarrow, A, -1)$	$(C, \rightarrow, D, -3)$	$(C, \leftarrow, B, -1)$
$(C, \rightarrow, D, -3)$	$(A, \rightarrow, exit, 6)$	$(D, \rightarrow, exit, 6)$	$(B, \rightarrow, C, -3)$
$(D, \leftarrow, exit, 6)$			$(C, \leftarrow, B, -1)$
			$(B, \leftarrow, A, -1)$
			$(A, \leftarrow, exit, 6)$

each field in the table is an n-tuple (s, a, s', r)

A	B	C	D

$S = \{A, B, C, D\}$
$A = \{\rightarrow, \leftarrow\}$
$r(\{B, C\}, \leftarrow) = -1$, $r(\{A, D\}) = 6$, $r(\{B, C\}, \rightarrow) = -3$
$p(C|B, \rightarrow) = p(A|B, \leftarrow) = 2/2 = p(D|C, \rightarrow) = p(B|C, \leftarrow) = 1$

For $\gamma = 0$:

- $\pi(B) = \leftarrow$

Compute:

A: $q(C, \leftarrow) = -3$

B: $q(C, \leftarrow) = -1$

C: $q(C, \leftarrow) = 6$

D: $q(C, \leftarrow) = 3$

Example II, $\gamma = 0$

Episode 1	Episode 2	Episode 3	Episode 4
$(B, \rightarrow, C, -3)$	$(B, \leftarrow, A, -1)$	$(C, \rightarrow, D, -3)$	$(C, \leftarrow, B, -1)$
$(C, \rightarrow, D, -3)$	$(A, \rightarrow, exit, 6)$	$(D, \rightarrow, exit, 6)$	$(B, \rightarrow, C, -3)$
$(D, \leftarrow, exit, 6)$			$(C, \leftarrow, B, -1)$
			$(B, \leftarrow, A, -1)$
			$(A, \leftarrow, exit, 6)$

each field in the table is an n-tuple (s, a, s', r)

A	B	C	D

$S = \{A, B, C, D\}$

$A = \{\rightarrow, \leftarrow\}$

$r(\{B, C\}, \leftarrow) = -1$, $r(\{A, D\}) = 6$, $r(\{B, C\}, \rightarrow) = -3$

$p(C|B, \rightarrow) = p(A|B, \leftarrow) = 2/2 = p(D|C, \rightarrow) = p(B|C, \leftarrow) = 1$

For $\gamma = 0$:

- $\pi(B) = \leftarrow$

Compute:

A: $q(C, \leftarrow) = -3$

B: $q(C, \leftarrow) = -1$

C: $q(C, \leftarrow) = 6$

D: $q(C, \leftarrow) = 3$

Example II, $\gamma = 0$

Episode 1	Episode 2	Episode 3	Episode 4
$(B, \rightarrow, C, -3)$	$(B, \leftarrow, A, -1)$	$(C, \rightarrow, D, -3)$	$(C, \leftarrow, B, -1)$
$(C, \rightarrow, D, -3)$	$(A, \rightarrow, exit, 6)$	$(D, \rightarrow, exit, 6)$	$(B, \rightarrow, C, -3)$
$(D, \leftarrow, exit, 6)$			$(C, \leftarrow, B, -1)$
			$(B, \leftarrow, A, -1)$
			$(A, \leftarrow, exit, 6)$

each field in the table is an n-tuple (s, a, s', r)

A	B	C	D

$S = \{A, B, C, D\}$

$A = \{\rightarrow, \leftarrow\}$

$r(\{B, C\}, \leftarrow) = -1$, $r(\{A, D\}) = 6$, $r(\{B, C\}, \rightarrow) = -3$

$p(C|B, \rightarrow) = p(A|B, \leftarrow) = 2/2 = p(D|C, \rightarrow) = p(B|C, \leftarrow) = 1$

For $\gamma = 0$:

- $\pi(B) = \leftarrow$

Compute:

A: $q(C, \leftarrow) = -3$

B: $q(C, \leftarrow) = r(C, \leftarrow) + 0.V(B) = -1$

C: $q(C, \leftarrow) = 6$

D: $q(C, \leftarrow) = 3$

Example II, $\gamma = 0$

Episode 1	Episode 2	Episode 3	Episode 4
$(B, \rightarrow, C, -3)$	$(B, \leftarrow, A, -1)$	$(C, \rightarrow, D, -3)$	$(C, \leftarrow, B, -1)$
$(C, \rightarrow, D, -3)$	$(A, \rightarrow, exit, 6)$	$(D, \rightarrow, exit, 6)$	$(B, \rightarrow, C, -3)$
$(D, \leftarrow, exit, 6)$			$(C, \leftarrow, B, -1)$
			$(B, \leftarrow, A, -1)$
			$(A, \leftarrow, exit, 6)$

each field in the table is an n-tuple (s, a, s', r)

For $\gamma = 0$:

- $\pi(B) = \leftarrow$
  - $q(C, \leftarrow) = -1$

Compute:

A: $q(C, \rightarrow) = -3$

B: $q(C, \rightarrow) = -1$

C: $q(C, \rightarrow) = 6$

D: $q(C, \rightarrow) = 3$

A	B	C	D

$S = \{A, B, C, D\}$
$A = \{\rightarrow, \leftarrow\}$

$r(\{B, C\}, \leftarrow) = -1, \; r(\{A, D\}) = 6, \; r(\{B, C\}, \rightarrow) = -3$

$p(C|B, \rightarrow) = p(A|B, \leftarrow) = 2/2 = p(D|C, \rightarrow) = p(B|C, \leftarrow) = 1$

Example II, $\gamma = 0$

Episode 1	Episode 2	Episode 3	Episode 4
$(B, \rightarrow, C, -3)$ $(C, \rightarrow, D, -3)$ $(D, \leftarrow, exit, 6)$	$(B, \leftarrow, A, -1)$ $(A, \rightarrow, exit, 6)$	$(C, \rightarrow, D, -3)$ $(D, \rightarrow, exit, 6)$	$(C, \leftarrow, B, -1)$ $(B, \rightarrow, C, -3)$ $(C, \leftarrow, B, -1)$ $(B, \leftarrow, A, -1)$ $(A, \leftarrow, exit, 6)$

each field in the table is an n-tuple (s, a, s', r)

A	B	C	D

$S = \{A, B, C, D\}$
$A = \{\rightarrow, \leftarrow\}$

$r(\{B, C\}, \leftarrow) = -1$, $r(\{A, D\}) = 6$, $r(\{B, C\}, \rightarrow) = -3$

$p(C|B, \rightarrow) = p(A|B, \leftarrow) = 2/2 =$
$p(D|C, \rightarrow) = p(B|C, \leftarrow) = 1$

For $\gamma = 0$:

- $\pi(B) = \leftarrow$
  - $q(C, \leftarrow) = -1$

Compute:

A: $q(C, \rightarrow) = r(C, \rightarrow) + 0 \cdot V(D) = -3$

B: $q(C, \rightarrow) = -1$

C: $q(C, \rightarrow) = 6$

D: $q(C, \rightarrow) = 3$

Example II, $\gamma = 0$

Episode 1	Episode 2	Episode 3	Episode 4
$(B, \rightarrow, C, -3)$	$(B, \leftarrow, A, -1)$	$(C, \rightarrow, D, -3)$	$(C, \leftarrow, B, -1)$
$(C, \rightarrow, D, -3)$	$(A, \rightarrow, exit, 6)$	$(D, \rightarrow, exit, 6)$	$(B, \rightarrow, C, -3)$
$(D, \leftarrow, exit, 6)$			$(C, \leftarrow, B, -1)$
			$(B, \leftarrow, A, -1)$
			$(A, \leftarrow, exit, 6)$

each field in the table is an n-tuple (s, a, s', r)

A	B	C	D

$S = \{A, B, C, D\}$
$A = \{\rightarrow, \leftarrow\}$
$r(\{B, C\}, \leftarrow) = -1, \; r(\{A, D\}) = 6,$
$r(\{B, C\}, \rightarrow) = -3$
$p(C|B, \rightarrow) = p(A|B, \leftarrow) = 2/2 =$
$p(D|C, \rightarrow) = p(B|C, \leftarrow) = 1$

For $\gamma = 0$:

- $\pi(B) = \leftarrow$
  - $q(C, \leftarrow) = -1$
  - $q(C, \rightarrow) = -3$

$\Rightarrow \pi(C) = \leftarrow$

Example II, $\gamma = 0$

Episode 1	Episode 2	Episode 3	Episode 4
$(B, \rightarrow, C, -3)$	$(B, \leftarrow, A, -1)$	$(C, \rightarrow, D, -3)$	$(C, \leftarrow, B, -1)$
$(C, \rightarrow, D, -3)$	$(A, \rightarrow, exit, 6)$	$(D, \rightarrow, exit, 6)$	$(B, \rightarrow, C, -3)$
$(D, \leftarrow, exit, 6)$			$(C, \leftarrow, B, -1)$
			$(B, \leftarrow, A, -1)$
			$(A, \leftarrow, exit, 6)$

each field in the table is an n-tuple (s, a, s', r)

A	B	C	D

$S = \{A, B, C, D\}$

$A = \{\rightarrow, \leftarrow\}$

$r(\{B, C\}, \leftarrow) = -1$, $r(\{A, D\}) = 6$, $r(\{B, C\}, \rightarrow) = -3$

$p(C|B, \rightarrow) = p(A|B, \leftarrow) = 2/2 =$
$p(D|C, \rightarrow) = p(B|C, \leftarrow) = 1$

For $\gamma = 0$:

- $\pi(B) = \leftarrow$
  - $q(C, \leftarrow) = -1$
  - $q(C, \rightarrow) = -3$

$\Rightarrow \pi(C) = \leftarrow$

Example II

summary

Example II, summary

Episode 1	Episode 2	Episode 3	Episode 4
$(B, \rightarrow, C, -3)$ $(C, \rightarrow, D, -3)$ $(D, \leftarrow, exit, 6)$	$(B, \leftarrow, A, -1)$ $(A, \rightarrow, exit, 6)$	$(C, \rightarrow, D, -3)$ $(D, \rightarrow, exit, 6)$	$(C, \leftarrow, B, -1)$ $(B, \rightarrow, C, -3)$ $(C, \leftarrow, B, -1)$ $(B, \leftarrow, A, -1)$ $(A, \leftarrow, exit, 6)$

each field in the table is an n-tuple (s, a, s', r)

A	B	C	D

$S = \{A, B, C, D\}$

$A = \{\rightarrow, \leftarrow\}$

$r(\{B, C\}, \leftarrow) = -1$, $r(\{A, D\}) = 6$, $r(\{B, C\}, \rightarrow) = -3$

$p(C|B, \rightarrow) = p(A|B, \leftarrow) = 2/2 =$
$p(D|C, \rightarrow) = p(B|C, \leftarrow) = 1$

For $\gamma = 1$: $\pi(B) = \leftarrow$
$\pi(C) = \leftarrow$

For $\gamma \in]2/3, 1]$: $\pi(B) = \leftarrow$
$\pi(C) = \leftarrow$

For $\gamma \in]1/2, 2/3[$: $\pi(B) = \leftarrow$
$\pi(C) = \rightarrow$

For $\gamma \in [0, 1/2[$: $\pi(B) = \leftarrow$
$\pi(C) = \leftarrow$

For $\gamma = 0$: $\pi(B) = \leftarrow$
$\pi(C) = \leftarrow$