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Worked on Problem 1 with Blake Johnson

Problem 1.

1. State Space = {(Rock, Rock), (Rock, Paper), (Rock, Scissors), (Paper, Rock), (Paper, Paper), (Paper, Scissors), (Scissors, Rock), (Scissors, Paper), (Scissors, Scissors)}

Action Space = {Rock, Paper, Scissors}

State Transition Model

T(S,A,S’) –> P(S’| A,S) = P (S’,A,S) / P(A,S)

P(A,S) = µ(A|S) P(S)

P(S’|A,S) = P(S’,A,S) /( µ(A|S) \* P(S) )

Entry = (P(S’|A=Rock,S), P(S’|A=Paper,S), P(S’|A=Scissors,S) )

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| S/  S’ | **Rock,Rock** | **Rock,Paper** | **Rock,Scissors** | **Paper,Rock** | **Paper,Paper** | **Paper,Scissors** | **Scissors,Rock** | **Scissors,Paper** | **Scissors,Scissors** |
| **Rock,Rock** | (1,0,0) | (0,0,0) | (0,0,0) | (1,0,0) | (0,0,0) | (0,0,0) | (1,0,0) | (0,0,0) | (0,0,0) |
| **Rock,Paper** | (0,0,0) | (1,0,0) | (0,0,0) | (0,0,0) | (1,0,0) | (0,0,0) | (0,0,0) | (1,0,0) | (0,0,0) |
| **Rock,Scissors** | (0,0,0) | (0,0,0) | (1,0,0) | (0,0,0) | (0,0,0) | (1,0,0) | (0,0,0) | (0,0,0) | (1,0,0) |
| **Paper,Rock** | (0,1,0) | (0,0,0) | (0,0,0) | (0,1,0) | (0,0,0) | (0,0,0) | (0,1,0) | (0,0,0) | (0,0,0) |
| **Paper,Paper** | (0,0,0) | (0,1,0) | (0,0,0) | (0,0,0) | (0,1,0) | (0,0,0) | (0,0,0) | (0,1,0) | (0,0,0) |
| **Paper,Scissors** | (0,0,0) | (0,0,0) | (0,1,0) | (0,0,0) | (0,0,0) | (0,1,0) | (0,0,0) | (0,0,0) | (0,1,0) |
| **Scissors,Rock** | (0,0,1) | (0,0,0) | (0,0,0) | (0,0,1) | (0,0,0) | (0,0,0) | (0,0,1) | (0,0,0) | (0,0,0) |
| **Scissors,Paper** | (0,0,0) | (0,0,1) | (0,0,0) | (0,0,0) | (0,0,1) | (0,0,0) | (0,0,0) | (0,0,1) | (0,0,0) |
| **Scissors,Scissors** | (0,0,0) | (0,0,0) | (0,0,1) | (0,0,0) | (0,0,0) | (0,0,1) | (0,0,0) | (0,0,0) | (0,0,1) |

P(R= 1|S=s,A=a) => P(R=1,S=s,A=a)/ ( µ(A=a|S=s) \* P(S=s))

P(R= 0|S=s,A=a) => P(R=0,S=s,A=a)/ ( µ(A=a|S=s) \* P(S=s))

P(R=-1|S=s,A=a) => P(R=-1,S=s,A=a)/ ( µ(A=a|S=s) \* P(S=s))

Reward Distribution

Entry = ( P(R= 1|S=s,A=a), P(R= 0|S=s,A=a), P(R=-1|S=s,A=a) )

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| State/  Action | **Rock,Rock** | **Rock,Paper** | **Rock,Scissors** | **Paper,Rock** | **Paper,Paper** | **Paper,Scissors** | **Scissors,Rock** | **Scissors,Paper** | **Scissors,Scissors** |
| **Rock** | (0,1 ,0) | (0,0,1) | (1,0,0) | (0,1 ,0) | (0,0,1) | (1,0,0) | (0,1 ,0) | (0,0,1) | (1,0,0) |
| **Paper** | (1,0,0) | (0,1,0) | (0,0,1) | (1,0,0) | (0,1,0) | (0,0,1) | (1,0,0) | (0,1,0) | (0,0,1) |
| **Scissors** | (0,0,1) | (1,0,0) | (0,1,0) | (0,0,1) | (1,0,0) | (0,1,0) | (0,0,1) | (1,0,0) | (0,1,0) |

1. Vπ\*(s) = max {R(S,A) + γ ∑s’ [P(S’,A,S) /( π(A|S) \* P(S) ) \* Vπ\*(s’)]}
2. ?

Problem 2

1. Vπ (s) =

Problem 3

1. A person who is Radical (R) is Electable (E) if he/she is Conservative (C) otherwise is not electable.

From the statement we know that R implies E. Because if the person is radical then the person is also electable.

We also know that C implies E because if the person is electable if the person is conservative.

Finally we know that E implies C because if the person is not conservative then we know that the person was electable.

Conclusion : R -> (E<->C)

Problem 4

[(F **->** P ) ∪ (D **->** P)] -> [(F ∩ D) **->** P] //simplify **->**

[(¬F ∪ P ) ∪ (¬D ∪ P)] **->** [¬ (F ∩ D) ∪ P] //simplify **->**

**¬** [(¬F ∪ P ) ∪ (¬D ∪ P)] ∪ [**¬** (F ∩ D) ∪ P] //factor **¬**

[**¬** (¬F ∪ P ) ∩ **¬** (¬D ∪ P)] ∪ [¬F ∪ ¬D ∪ P] //factor **¬**

[F ∩ ¬P ∩ D ∩ ¬P] ∪ ¬F ∪ ¬D ∪ P //remove ¬P

[F ∩ ¬P ∩ D ] ∪ ¬F ∪ ¬D ∪ P //distribute ¬F

[(F ∪ ¬F ) ∩ (¬P ∪ ¬F ) ∩ ( D ∪ ¬F)] ∪ ¬D ∪ P //simplify

[(¬P ∪ ¬F) ∩ ( D ∪ ¬F)] ∪ ¬D ∪ P //distribute ¬D

¬P ∪ ¬F ∪ ¬D ∪ P //simplify

True

This statement is valid because (P ∪ ¬P) is always true and (true ∪ anything) is always true