Assignment 3 Part 1

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Values used

Rollnumber : 2020121001
x = 0.88
y = 2

Actions = Left, Right
P(Success of action) = x = 0.88
P(Failure of action) = 1-x = 0.12

The follwing is the table used.

P(Observation/State)	O=Red	O=Green
State=Red	0.9	0.1
State=Green	0.15	0.85

Figure 1: State Space

Belief states = [1/3, 0, 1/3, 0, 0, 1/3]
As initially it is said to be on red.

Action 1

Belief states B = [1/3, 0, 1/3, 0, 0, 1/3]
Agent took the action Right and observed Green.

Ub'[S1]=0.1[(0.12 * 0.3333) + (0.12 * 0) + (0 * 0.3333) + (0 * 0) + (0 * 0) + (0 * 0.3333)]=0.0039996

Ub'[S2]=0.85[(0.88 * 0.3333) + (0 * 0) + (0.12 * 0.3333) + (0 * 0) + (0 * 0) + (0 * 0.3333)]=0.283305

Ub'[S3]=0.1[(0 * 0.3333) + (0.88 * 0) + (0 * 0.3333) + (0.12 * 0) + (0 * 0) + (0 * 0.3333)]=0.0

Ub'[S4]=0.85[(0 * 0.3333) + (0 * 0) + (0.88 * 0.3333) + (0 * 0) + (0.12 * 0) + (0 * 0.3333)]=0.2493084

Ub'[S5]=0.85[(0 * 0.3333) + (0 * 0) + (0 * 0.3333) + (0.88 * 0) + (0 * 0) + (0.12 * 0.3333)]=0.033996599999999995

Ub'[S6]=0.1[(0 * 0.3333) + (0 * 0) + (0 * 0.3333) + (0 * 0) + (0.88 * 0) + (0.88 * 0.3333)]=0.029330400000000003

sum = sum(Ub') = 0.59994
new B = [Ub'[Si]/sum for i in 1 to 6]

B = [0.006666666666666666, 0.47222222222222215, 0.0, 0.41555555555555557, 0.05666666666666666, 0.04888888888888889]

Action 2

B = [0.006666666666666666, 0.47222222222222215, 0.0, 0.41555555555555557, 0.05666666666666666, 0.04888888888888889]
Agent took the action Left and observed Red.

Ub'[S1]=0.9[(0.88 * 0.00666667) + (0.88 * 0.47222222) + (0 * 0.0) + (0 * 0.41555556) + (0 * 0.05666667) + (0 * 0.04888889)]=0.37928000088

Ub'[S2]=0.15[(0.12 * 0.00666667) + (0 * 0.47222222) + (0.88 * 0.0) + (0 * 0.41555556) + (0 * 0.05666667) + (0 * 0.04888889)]=0.00012000006000000001

Ub'[S3]=0.9[(0 * 0.00666667) + (0.12 * 0.47222222) + (0 * 0.0) + (0.88 * 0.41555556) + (0 * 0.05666667) + (0 * 0.04888889)]=0.38012000328

Ub'[S4]=0.15[(0 * 0.00666667) + (0 * 0.47222222) + (0.12 * 0.0) + (0 * 0.41555556) + (0.88 * 0.05666667) + (0 * 0.04888889)]=0.0074800004400000005

Ub'[S5]=0.15[(0 * 0.00666667) + (0 * 0.47222222) + (0 * 0.0) + (0.12 * 0.41555556) + (0 * 0.05666667) + (0.88 * 0.04888889)]=0.01393333356

Ub'[S6]=0.9[(0 * 0.00666667) + (0 * 0.47222222) + (0 * 0.0) + (0 * 0.41555556) + (0.12 * 0.05666667) + (0.12 * 0.04888889)]=0.011400000479999998

sum = sum(Ub') = 0.7923333387000001
new B = [Ub'[Si]/sum for i in 1 to 6]

B = [0.4786874189874348, 0.00015145148403939045, 0.4797475818746587, 0.009440471673541609, 0.017585191584719568, 0.014387884395605828]

Action 3

B = [0.4786874189874348, 0.00015145148403939045, 0.4797475818746587, 0.009440471673541609, 0.017585191584719568, 0.014387884395605828]
Agent took the action Left and observed Green.

Ub'[S1]=0.1[(0.88 * 0.47868742) + (0.88 * 0.00015145) + (0 * 0.47974758) + (0 * 0.00944047) + (0 * 0.01758519) + (0 * 0.01438788)]=0.042137820560000004

Ub'[S2]=0.85[(0.12 * 0.47868742) + (0 * 0.00015145) + (0.88 * 0.47974758) + (0 * 0.00944047) + (0 * 0.01758519) + (0 * 0.01438788)]=0.40767730667999996

Ub'[S3]=0.1[(0 * 0.47868742) + (0.12 * 0.00015145) + (0 * 0.47974758) + (0.88 * 0.00944047) + (0 * 0.01758519) + (0 * 0.01438788)]=0.0008325787599999999

Ub'[S4]=0.85[(0 * 0.47868742) + (0 * 0.00015145) + (0.12 * 0.47974758) + (0 * 0.00944047) + (0.88 * 0.01758519) + (0 * 0.01438788)]=0.06208797528

Ub'[S5]=0.85[(0 * 0.47868742) + (0 * 0.00015145) + (0 * 0.47974758) + (0.12 * 0.00944047) + (0 * 0.01758519) + (0.88 * 0.01438788)]=0.011725062179999999

Ub'[S6]=0.1[(0 * 0.47868742) + (0 * 0.00015145) + (0 * 0.47974758) + (0 * 0.00944047) + (0.12 * 0.01758519) + (0.12 * 0.01438788)]=0.00038367684

sum = sum(Ub') = 0.5248444202999999
new B = [Ub'[Si]/sum for i in 1 to 6]

B = [0.08028630758028088, 0.776758389556609, 0.0015863344027247156, 0.11829786671736102, 0.02234007207945162, 0.0007310296635728568]

Final Results

Now we have the beliefs at the end of each action (Displayed upto only 4 digits for convinience)

- **Initial**
  B = [0.3333, 0, 0.3333, 0, 0, 0.3333]
- **Action 1**
  B = [0.0066, 0.4722, 0.0, 0.4155, 0.0566, 0.0488]
- **Action 2**
  B = [0.4786, 0.0001, 0.4797, 0.0094, 0.0175, 0.0143]
- **Action 3 (Final Beliefs)**
  B = [0.0802, 0.7767, 0.0015, 0.1182, 0.0223, 0.0007]