

```
In [1]: 1 using Pkg
        2 Pkg.add(["POMDPs", "POMDPTools", "POMDPMODELS", "Random", "Distributions", "POMDPSimulators", "BasicPOMCP", "POMDPPolicies"])
```

```
Updating registry at `C:\Users\delete\.julia\registries\General`
Updating git-repo `https://github.com/JuliaRegistries/General.git`
Updating registry at `C:\Users\delete\.julia\registries\JuliaPOMDP`
Updating git-repo `https://github.com/JuliaPOMDP/Registry`
Resolving package versions...
No Changes to `C:\Users\delete\.julia\environments\v1.8\Project.toml`
No Changes to `C:\Users\delete\.julia\environments\v1.8\Manifest.toml`
```

```
In [2]: 1 using POMDPs, POMDPTools, POMDPMODELS, Random, Distributions, POMDPSimulators, BasicPOMCP, POMDPPolicies
```

```
In [3]: 1 Pkg.activate(; temp=true)
        2 Pkg.add("ARDESPOT")
        3 using ARDESPOT
        4
```

```
Activating new project at `C:\Users\delete\AppData\Local\Temp\jl_4GDhhS`
Resolving package versions...
Updating `C:\Users\delete\AppData\Local\Temp\jl_4GDhhS\Project.toml`
[d96c9ae4] + ARDESPOT v0.3.5
Updating `C:\Users\delete\AppData\Local\Temp\jl_4GDhhS\Manifest.toml`
[d96c9ae4] + ARDESPOT v0.3.5
[1520ce14] + AbstractTrees v0.4.4
[79e6a3ab] + Adapt v3.6.1
[ec485272] + ArnoldiMethod v0.2.0
[d721219e] + BasicPOMCP v0.3.9
[8bb6e9a1] + BeliefUpdaters v0.2.3
[d1d4a3ce] + BitFlags v0.1.7
[fa961155] + CEnum v0.4.2
[a9c8d775] + CPUtime v1.0.0
[49dc2e85] + Calculus v0.5.1
[d360d2e6] + ChainRulesCore v1.15.7
[9e997f8a] + ChangesOfVariables v0.1.6
[944b1d66] + CodecZlib v0.7.1
[3da002f7] + ColorTypes v0.11.4
[5331d141] + ColorVectorSpace v0.10.10
```

```
In [4]: ▶ 1 mutable struct PipeCS <: POMDPs.POMDP{Float64,Int,Int}
          2     discount_factor::Float64
          3 end
          4 PipeCS() = PipeCS(0.90)
          5 POMDPs.discount(p::PipeCS) = p.discount_factor
          6 isterminal(::PipeCS, sp::Float64) = sp == 0.95
```

Out[4]: isterminal (generic function with 1 method)

```
In [5]: ▶ 1 POMDPs.states(::PipeCS) = range(0.00, stop = 0.95)
```



In [6]: ▶

```
1
2 function gen(m::PipeCS, s::Float64, a::Int, rng::AbstractRNG)
3     # generate next state
4     if s > 0.00 && s <= 0.15
5         if a == 2
6             sp = rand(rng, 0.1:0.25)
7         elseif a == 4
8             sp = rand(rng, 0.0:0.10)
9         else
10            sp = rand(rng, s:0.60)
11        end
12    elseif s > 0.15 && s <= 0.35
13        if a == 2
14            sp = rand(rng, 0.15:0.25)
15        elseif a == 4
16            sp = rand(rng, 0.0:0.10)
17        else
18            sp = rand(rng, s:0.85)
19        end
20    elseif s > 0.35 && s <= 0.60
21        if a == 2
22            sp = rand(rng, 0.20:0.40)
23        elseif a == 3
24            sp = rand(rng, 0.15:0.35)
25        elseif a == 4
26            sp = rand(rng, 0.0:0.10)
27        else
28            sp = rand(rng, s:0.95)
29        end
30    elseif s > 0.60 && s <= 0.85
31        if a == 3
32            sp = rand(rng, 0.5:0.90)
33        elseif a == 4
34            sp = rand(rng, 0.0:0.10)
35        else
36            sp = rand(rng, s:0.95)
37        end
38    else s >= 0.85
39        sp = 0.95
40    end
41
42
43
```

```
44 # generate observation
45 n = 15
46 distort = rand(rng, -n:n)
47 if sp + (distort/100) <= 0
48     o = 0
49 elseif sp + (distort/100) >= 0.95
50     o = 95
51 else
52     o = round(Int, (sp*100)) + distort
53 end
54
55
56 # generate reward
57 if s > 0.00 && s <= 0.15
58     if a == 1
59         r = -200
60     elseif a == 2
61         r = -400
62     elseif a == 3
63         r = -5700
64     else
65         r = -5700
66     end
67 elseif s > 0.15 && s <= 0.35
68     if a == 1
69         r = -2600
70     elseif a == 2
71         r = -2550
72     elseif a == 3
73         r = -7700
74     else
75         r = -7700
76     end
77 elseif s > 0.35 && s <= 0.60
78     if a == 1
79         r = -4200
80     elseif a == 2
81         r = -9200
82     elseif a == 3
83         r = -4100
84     else
85         r = -8200
86     end
```

```
87     elseif s > 0.60 && s <= 0.85
88         if a == 1
89             r = -6700
90         elseif a == 2
91             r = -11600
92         elseif a == 3
93             r = -6550
94         else
95             r = -8100
96         end
97     else
98         if a == 1
99             r = -7930
100        elseif a == 2
101            r = -12730
102        elseif a == 3
103            r = -7730
104        else
105            r = -7980
106        end
107    end
108
109
110    return (sp=sp, o=o, r=r)
111
112 end;
```

```
In [7]: ▶ 1 POMDPs.actions(:PipeCS) = [1, 2, 3, 4]
2
3 POMDPs.initialstate(m::PipeCS) = Normal(0.05, 0.03);
4
5
```

```
In [8]: ▶ 1 T = zeros(Float64, 5,5,4) #zeros(5,5,4) # |S|x|S'|x|A|
2 T[:, :, 1] = XLSX.readdata("data1.xlsx", "C_State", "B17:F21")
3 T[:, :, 2] = XLSX.readdata("data1.xlsx", "C_State", "B26:F30")
4 T[:, :, 3] = XLSX.readdata("data1.xlsx", "C_State", "B35:F39")
5 T[:, :, 4] = XLSX.readdata("data1.xlsx", "C_State", "B44:F48")
6
```

```
Out[8]: 5x5 Matrix{Any}:
0.0666667  0.05  0.04  0.04  0.1
0          0    0    0    0
0          0    0    0    0
0          0    0    0    0
0          0    0    0    0
```





```
In [9]: 1 function POMDPs.transition(pomdp::PipeCS, s::Float64, a::Int, sp::Float64)
2     if a == 1
3         if s > 0.00 && s <= 0.15
4             if sp > 0.00 && sp <= 0.15
5                 return T[1,1,1]
6             elseif sp > 0.15 && sp <= 0.35
7                 return T[1,2,1]
8             elseif sp > 0.35 && sp <= 0.60
9                 return T[1,3,1]
10            elseif sp > 0.60 && sp <= 0.85
11                return T[1,4,1]
12            elseif sp > 0.85 && sp <= 0.95
13                return T[1,5,1]
14            else
15                return 0.0
16            end
17        elseif s > 0.15 && s <= 0.35
18            if sp > 0.00 && sp <= 0.15
19                return T[2,1,1]
20            elseif sp > 0.15 && sp <= 0.35
21                return T[2,2,1]
22            elseif sp > 0.35 && sp <= 0.60
23                return T[2,3,1]
24            elseif sp > 0.60 && sp <= 0.85
25                return T[2,4,1]
26            elseif sp > 0.85 && sp <= 0.95
27                return T[2,5,1]
28            else
29                return 0.0
30            end
31        elseif s > 0.35 && s <= 0.60
32            if sp > 0.00 && sp <= 0.15
33                return T[3,1,1]
34            elseif sp > 0.15 && sp <= 0.35
35                return T[3,2,1]
36            elseif sp > 0.35 && sp <= 0.60
37                return T[3,3,1]
38            elseif sp > 0.60 && sp <= 0.85
39                return T[3,4,1]
40            elseif sp > 0.85 && sp <= 0.95
41                return T[3,5,1]
42            else
43                return 0.0
```

```
44     end
45     elseif s > 0.60 && s <= 0.85
46         if sp > 0.00 && sp <= 0.15
47             return T[4,1,1]
48         elseif sp > 0.15 && sp <= 0.35
49             return T[4,2,1]
50         elseif sp > 0.35 && sp <= 0.60
51             return T[4,3,1]
52         elseif sp > 0.60 && sp <= 0.85
53             return T[4,4,1]
54         elseif sp > 0.85 && sp <= 0.95
55             return T[4,5,1]
56     else
57         return 0.0
58     end
59     elseif s > 0.85 && s <= 0.95
60         if sp > 0.00 && sp <= 0.15
61             return T[5,1,1]
62         elseif sp > 0.15 && sp <= 0.35
63             return T[5,2,1]
64         elseif sp > 0.35 && sp <= 0.60
65             return T[5,3,1]
66         elseif sp > 0.60 && sp <= 0.85
67             return T[5,4,1]
68         elseif sp > 0.85 && sp <= 0.95
69             return T[5,5,1]
70     else
71         return 0.0
72     end
73     else
74         return 0.0
75     end
76     elseif a == 2
77         if s > 0.00 && s <= 0.15
78             if sp > 0.00 && sp <= 0.15
79                 return T[1,1,2]
80             elseif sp > 0.15 && sp <= 0.35
81                 return T[1,2,2]
82             elseif sp > 0.35 && sp <= 0.60
83                 return T[1,3,2]
84             elseif sp > 0.60 && sp <= 0.85
85                 return T[1,4,2]
86             elseif sp > 0.85 && sp <= 0.95
```

```
87         return T[1,5,2]
88     else
89         return 0.0
90     end
91 elseif s > 0.15 && s <= 0.35
92     if sp > 0.00 && sp <= 0.15
93         return T[2,1,2]
94     elseif sp > 0.15 && sp <= 0.35
95         return T[2,2,2]
96     elseif sp > 0.35 && sp <= 0.60
97         return T[2,3,2]
98     elseif sp > 0.60 && sp <= 0.85
99         return T[2,4,2]
100    elseif sp > 0.85 && sp <= 0.95
101        return T[2,5,2]
102    else
103        return 0.0
104    end
105 elseif s > 0.35 && s <= 0.60
106     if sp > 0.00 && sp <= 0.15
107         return T[3,1,2]
108     elseif sp > 0.15 && sp <= 0.35
109         return T[3,2,2]
110     elseif sp > 0.35 && sp <= 0.60
111         return T[3,3,2]
112     elseif sp > 0.60 && sp <= 0.85
113         return T[3,4,2]
114     elseif sp > 0.85 && sp <= 0.95
115         return T[3,5,2]
116     else
117         return 0.0
118     end
119 elseif s > 0.60 && s <= 0.85
120     if sp > 0.00 && sp <= 0.15
121         return T[4,1,2]
122     elseif sp > 0.15 && sp <= 0.35
123         return T[4,2,2]
124     elseif sp > 0.35 && sp <= 0.60
125         return T[4,3,2]
126     elseif sp > 0.60 && sp <= 0.85
127         return T[4,4,2]
128     elseif sp > 0.85 && sp <= 0.95
129         return T[4,5,2]
```

```
130         else
131             return 0.0
132         end
133     elseif s > 0.85 && s <= 0.95
134         if sp > 0.00 && sp <= 0.15
135             return T[5,1,2]
136         elseif sp > 0.15 && sp <= 0.35
137             return T[5,2,2]
138         elseif sp > 0.35 && sp <= 0.60
139             return T[5,3,2]
140         elseif sp > 0.60 && sp <= 0.85
141             return T[5,4,2]
142         elseif sp > 0.85 && sp <= 0.95
143             return T[5,5,2]
144         else
145             return 0.0
146         end
147     else
148         return 0.0
149     end
150 elseif a == 3
151     if s > 0.00 && s <= 0.15
152         if sp > 0.00 && sp <= 0.15
153             return T[1,1,3]
154         elseif sp > 0.15 && sp <= 0.35
155             return T[1,2,3]
156         elseif sp > 0.35 && sp <= 0.60
157             return T[1,3,3]
158         elseif sp > 0.60 && sp <= 0.85
159             return T[1,4,3]
160         elseif sp > 0.85 && sp <= 0.95
161             return T[1,5,3]
162         else
163             return 0.0
164         end
165     elseif s > 0.15 && s <= 0.35
166         if sp > 0.00 && sp <= 0.15
167             return T[2,1,3]
168         elseif sp > 0.15 && sp <= 0.35
169             return T[2,2,3]
170         elseif sp > 0.35 && sp <= 0.60
171             return T[2,3,3]
172         elseif sp > 0.60 && sp <= 0.85
```

```
173         return T[2,4,3]
174     elseif sp > 0.85 && sp <= 0.95
175         return T[2,5,3]
176     else
177         return 0.0
178     end
179 elseif s > 0.35 && s <= 0.60
180     if sp > 0.00 && sp <= 0.15
181         return T[3,1,3]
182     elseif sp > 0.15 && sp <= 0.35
183         return T[3,2,3]
184     elseif sp > 0.35 && sp <= 0.60
185         return T[3,3,3]
186     elseif sp > 0.60 && sp <= 0.85
187         return T[3,4,3]
188     elseif sp > 0.85 && sp <= 0.95
189         return T[3,5,3]
190     else
191         return 0.0
192     end
193 elseif s > 0.60 && s <= 0.85
194     if sp > 0.00 && sp <= 0.15
195         return T[4,1,3]
196     elseif sp > 0.15 && sp <= 0.35
197         return T[4,2,3]
198     elseif sp > 0.35 && sp <= 0.60
199         return T[4,3,3]
200     elseif sp > 0.60 && sp <= 0.85
201         return T[4,4,3]
202     elseif sp > 0.85 && sp <= 0.95
203         return T[4,5,3]
204     else
205         return 0.0
206     end
207 elseif s > 0.85 && s <= 0.95
208     if sp > 0.00 && sp <= 0.15
209         return T[5,1,3]
210     elseif sp > 0.15 && sp <= 0.35
211         return T[5,2,3]
212     elseif sp > 0.35 && sp <= 0.60
213         return T[5,3,3]
214     elseif sp > 0.60 && sp <= 0.85
215         return T[5,4,3]
```

```
216         elseif sp > 0.85 && sp <= 0.95
217             return T[5,5,3]
218         else
219             return 0.0
220         end
221     else
222         return 0.0
223     end
224 else
225     if s > 0.00 && s <= 0.15
226         if sp > 0.00 && sp <= 0.15
227             return T[1,1,4]
228         elseif sp > 0.15 && sp <= 0.35
229             return T[1,2,4]
230         elseif sp > 0.35 && sp <= 0.60
231             return T[1,3,4]
232         elseif sp > 0.60 && sp <= 0.85
233             return T[1,4,4]
234         elseif sp > 0.85 && sp <= 0.95
235             return T[1,5,4]
236         else
237             return 0.0
238         end
239     elseif s > 0.15 && s <= 0.35
240         if sp > 0.00 && sp <= 0.15
241             return T[2,1,4]
242         elseif sp > 0.15 && sp <= 0.35
243             return T[2,2,4]
244         elseif sp > 0.35 && sp <= 0.60
245             return T[2,3,4]
246         elseif sp > 0.60 && sp <= 0.85
247             return T[2,4,4]
248         elseif sp > 0.85 && sp <= 0.95
249             return T[2,5,4]
250         else
251             return 0.0
252         end
253     elseif s > 0.35 && s <= 0.60
254         if sp > 0.00 && sp <= 0.15
255             return T[3,1,4]
256         elseif sp > 0.15 && sp <= 0.35
257             return T[3,2,4]
258         elseif sp > 0.35 && sp <= 0.60
```

```
259         return T[3,3,4]
260     elseif sp > 0.60 && sp <= 0.85
261         return T[3,4,4]
262     elseif sp > 0.85 && sp <= 0.95
263         return T[3,5,4]
264     else
265         return 0.0
266     end
267 elseif s > 0.60 && s <= 0.85
268     if sp > 0.00 && sp <= 0.15
269         return T[4,1,4]
270     elseif sp > 0.15 && sp <= 0.35
271         return T[4,2,4]
272     elseif sp > 0.35 && sp <= 0.60
273         return T[4,3,4]
274     elseif sp > 0.60 && sp <= 0.85
275         return T[4,4,4]
276     elseif sp > 0.85 && sp <= 0.95
277         return T[4,5,4]
278     else
279         return 0.0
280     end
281 elseif s > 0.85 && s <= 0.95
282     if sp > 0.00 && sp <= 0.15
283         return T[5,1,4]
284     elseif sp > 0.15 && sp <= 0.35
285         return T[5,2,4]
286     elseif sp > 0.35 && sp <= 0.60
287         return T[5,3,4]
288     elseif sp > 0.60 && sp <= 0.85
289         return T[5,4,4]
290     elseif sp > 0.85 && sp <= 0.95
291         return T[5,5,4]
292     else
293         return 0.0
294     end
295 else
296     return 0.0
297 end
298 end
299 end
```





In [10]: ▶

```
1 pomdp = PipeCS()  
2  
3 solver = DESPOTSolver(bounds=(0.0, 0.95))  
4 planner = solve(solver, pomdp)  
5
```

```

Out[10]: DESPOTPlanner{PipeCS, Tuple{Float64, Float64}, MemorizingSource{MersenneTwister}, MersenneTwister}(DESPO
TSolver
  epsilon_0: Float64 0.0
  xi: Float64 0.95
  K: Int64 500
  D: Int64 90
  lambda: Float64 0.01
  T_max: Float64 1.0
  max_trials: Int64 9223372036854775807
  bounds: Tuple{Float64, Float64}
  default_action: ExceptionRethrow ExceptionRethrow()
  rng: MersenneTwister
  random_source: MemorizingSource{MersenneTwister}
  bounds_warnings: Bool true
  tree_in_info: Bool false
, PipeCS(0.9), (0.0, 0.95), MemorizingSource{MersenneTwister}(MersenneTwister(4144756846), Float64[], Me
morizingRNG{MemorizingSource{MersenneTwister}}[MemorizingRNG{MemorizingSource{MersenneTwister}}(Float64
[], 1, 0, 0, MemorizingSource{MersenneTwister}(#= circular reference @-2 =#)) MemorizingRNG{MemorizingSo
urce{MersenneTwister}}(Float64[], 1, 0, 0, MemorizingSource{MersenneTwister}(#= circular reference @-2 =
#)) ... MemorizingRNG{MemorizingSource{MersenneTwister}}(Float64[], 1, 0, 0, MemorizingSource{MersenneTwis
ter}(#= circular reference @-2 =#)) MemorizingRNG{MemorizingSource{MersenneTwister}}(Float64[], 1, 0, 0,
MemorizingSource{MersenneTwister}(#= circular reference @-2 =#)); MemorizingRNG{MemorizingSource{Mersenn
eTwister}}(Float64[], 1, 0, 0, MemorizingSource{MersenneTwister}(#= circular reference @-2 =#)) Memorizi
ngRNG{MemorizingSource{MersenneTwister}}(Float64[], 1, 0, 0, MemorizingSource{MersenneTwister}(#= circul
ar reference @-2 =#)) ... MemorizingRNG{MemorizingSource{MersenneTwister}}(Float64[], 1, 0, 0, MemorizingS
ource{MersenneTwister}(#= circular reference @-2 =#)) MemorizingRNG{MemorizingSource{MersenneTwister}}(F
loat64[], 1, 0, 0, MemorizingSource{MersenneTwister}(#= circular reference @-2 =#)); ... ; MemorizingRNG{M
emorizingSource{MersenneTwister}}(Float64[], 1, 0, 0, MemorizingSource{MersenneTwister}(#= circular refe
rence @-2 =#)) MemorizingRNG{MemorizingSource{MersenneTwister}}(Float64[], 1, 0, 0, MemorizingSource{Mer
senneTwister}(#= circular reference @-2 =#)) ... MemorizingRNG{MemorizingSource{MersenneTwister}}(Float64
[], 1, 0, 0, MemorizingSource{MersenneTwister}(#= circular reference @-2 =#)) MemorizingRNG{MemorizingSo
urce{MersenneTwister}}(Float64[], 1, 0, 0, MemorizingSource{MersenneTwister}(#= circular reference @-2 =
#)); MemorizingRNG{MemorizingSource{MersenneTwister}}(Float64[], 1, 0, 0, MemorizingSource{MersenneTwist
er}(#= circular reference @-2 =#)) MemorizingRNG{MemorizingSource{MersenneTwister}}(Float64[], 1, 0, 0,
MemorizingSource{MersenneTwister}(#= circular reference @-2 =#)) ... MemorizingRNG{MemorizingSource{Mersen
eTwister}}(Float64[], 1, 0, 0, MemorizingSource{MersenneTwister}(#= circular reference @-2 =#)) Memoriz
ingRNG{MemorizingSource{MersenneTwister}}(Float64[], 1, 0, 0, MemorizingSource{MersenneTwister}(#= circu
lar reference @-2 =#))), 0, 0, true, 0, true), MersenneTwister(982279912, (0, 1002, 0, 1)))

```

```
In [11]: ▶ 1 for (s,a,r,sp,o) in stepthrough(pomdp, planner, "s,a,r,sp,o", max_steps=50)
           2     @show (s,a,r,sp,o)
           3
           4 end
```

```

MethodError: no method matching transition(::PipeCS, ::Float64, ::Int64)
Closest candidates are:
  transition(::PipeCS, ::Float64, ::Int64, ::Float64) at In[9]:1
  transition(::FullyObservablePOMDP, ::Any, ::Any) at C:\Users\delete\.julia\packages\POMDPTools\Dhp8w\src\ModelTools\fully_observable_pomdp.jl:34
  transition(::UnderlyingMDP{P, S, A}, ::S, ::A) where {P, S, A} at C:\Users\delete\.julia\packages\POMDPTools\Dhp8w\src\ModelTools\underlying_mdp.jl:21
  ...

```

Stacktrace:

```

[1] macro expansion
  @ C:\Users\delete\.julia\packages\POMDPs\XBTe5\src\gen_impl.jl:39 [inlined]
[2] genout(v::DDNOut{(:sp, :o, :r)}, m::PipeCS, s::Float64, a::Int64, rng::MemorizingRNG{MemorizingSource{MersenneTwister}})
  @ POMDPs C:\Users\delete\.julia\packages\POMDPs\XBTe5\src\gen_impl.jl:19
[3] (::ARDESPOT.var"#157#f#30")(m::PipeCS, s::Float64, a::Int64, rng::MemorizingRNG{MemorizingSource{MersenneTwister}})
  @ ARDESPOT C:\Users\delete\.julia\packages\POMDPs\XBTe5\src\generative.jl:65
[4] expand!(D::ARDESPOT.DESPOT{Float64, Int64, Int64}, b::Int64, p::DESPOTPlanner{PipeCS, Tuple{Float64, Float64}, MemorizingSource{MersenneTwister}, MersenneTwister})
  @ ARDESPOT C:\Users\delete\.julia\packages\ARDESPOT\l9sbg\src\tree.jl:70
[5] explore!(D::ARDESPOT.DESPOT{Float64, Int64, Int64}, b::Int64, p::DESPOTPlanner{PipeCS, Tuple{Float64, Float64}, MemorizingSource{MersenneTwister}, MersenneTwister})
  @ ARDESPOT C:\Users\delete\.julia\packages\ARDESPOT\l9sbg\src\planner.jl:24
[6] build_despot(p::DESPOTPlanner{PipeCS, Tuple{Float64, Float64}, MemorizingSource{MersenneTwister}, MersenneTwister}, b_0::ParticleFilters.ParticleCollection{Float64})
  @ ARDESPOT C:\Users\delete\.julia\packages\ARDESPOT\l9sbg\src\planner.jl:10
[7] action_info(p::DESPOTPlanner{PipeCS, Tuple{Float64, Float64}, MemorizingSource{MersenneTwister}, MersenneTwister}, b::ParticleFilters.ParticleCollection{Float64})
  @ ARDESPOT C:\Users\delete\.julia\packages\ARDESPOT\l9sbg\src\pomdps_glue.jl:8
[8] iterate
  @ C:\Users\delete\.julia\packages\POMDPTools\Dhp8w\src\Simulators\stepthrough.jl:91 [inlined]
[9] iterate(it::POMDPTools.Simulators.POMDPSimIterator{(:s, :a, :r, :sp, :o), PipeCS, DESPOTPlanner{PipeCS, Tuple{Float64, Float64}, MemorizingSource{MersenneTwister}, MersenneTwister}, ParticleFilters.BasicParticleFilter{PipeCS, PipeCS, ParticleFilters.LowVarianceResampler, MersenneTwister, Vector{Float64}}, Random.GLOBAL_RNG, ParticleFilters.ParticleCollection{Float64}, Float64})
  @ POMDPTools.Simulators C:\Users\delete\.julia\packages\POMDPTools\Dhp8w\src\Simulators\stepthrough.jl:85
[10] top-level scope
  @ .\In[11]:1

```

