[1]:
```
using Markdown
```

[2]:
```
using Plots, LaTeXStrings, DifferentialEquations,␣
↪Distributions
```

# 1 Chapter 1 Figures. Statistics

[3]:
```
random_count() = floor(Int, n_min + rand() * n_max)
```

[3]:
```
random_count (generic function with 1 method)
```

[4]:
```
begin
        affect1!(integrator) = integrator.u += 1
        affect2!(integrator) = integrator.u -= 1
        prod1Jump(A) = ConstantRateJump((u, p, t) -> A,␣
↪affect1!)
        deg1Jump = ConstantRateJump((u, p, t) -> u, affect2!)
        u01 = 0
        t1 = (0.0, 15.0)
        dprob1 = DiscreteProblem(u01, t1)
        jprob1 = JumpProblem(dprob1, Direct(),␣
↪prod1Jump(100), deg1Jump)
        continous(A) = t -> -A* ^(-t) + A
end
```

[4]:
```
continous (generic function with 1 method)
```

[5]:
```
sol1 = solve(jprob1, SSAStepper())
```

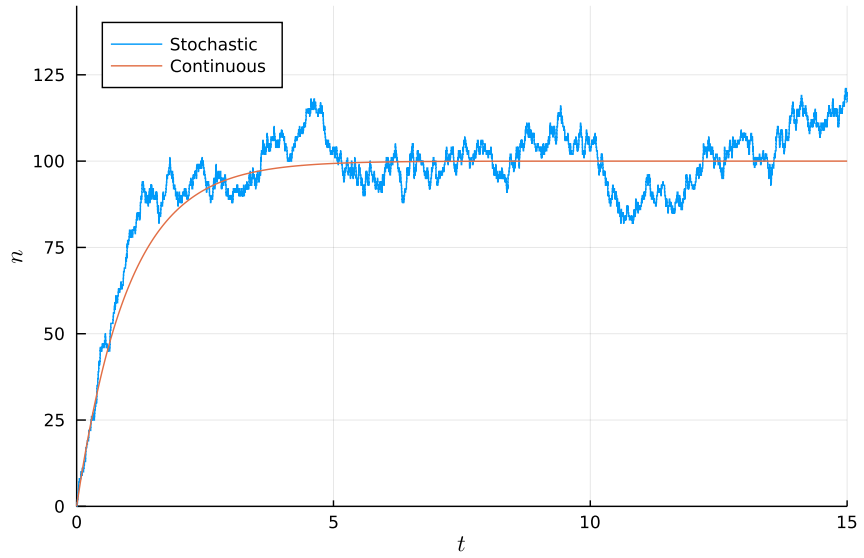
[5]:
```
retcode: Default
Interpolation: Piecewise constant interpolation
t: 2889-element Vector{Float64}:
  0.0
  0.00803435103868356
  0.01644228913571986
  0.02515650665638089
  0.02833672754581886
  0.03266186905902616
  0.0390289303161781
```

```
  0.04281924616315776
  0.05186817637866441
  0.08136623177880628
  0.08261580381083168
  0.10313997571557842
  0.10831136722146792

 14.975221905890992
 14.976954816256844
 14.98055245320968
 14.98329009595046
 14.983439819227131
 14.98465096125241
 14.987125848373976
 14.996258861782485
 14.996569550145967
 14.998414386829175
 14.999805487369157
 15.0
u: 2889-element Vector{Int64}:
   0
   1
   2
   3
   4
   5
   6
   7
   8
   9
  10
   9
  10

 119
 120
 119
 120
 121
```

```
120
119
120
119
118
117
117
```

[6]:
```
begin
        plot(sol1, label="Stochastic", legend=:topleft)
        p1 = plot!(continous(100), sol1.t,␣
 ↪label="Continuous", xlabel=L"t", ylabel=L"n",␣
 ↪ylimit=(0,145))
end
```

[6]:




[7]:
```
begin
        last_ones = []
        num_samples=10000
        for _   1:num_samples
```

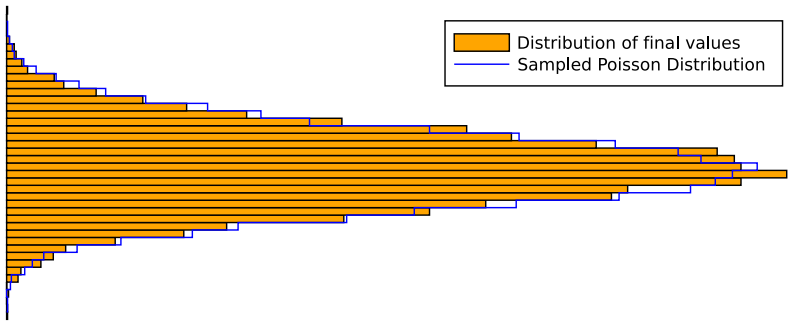
```
                push!(last_ones, solve(jprob1, SSAStepper()).
↪u[end])
        end
        last_ones
end
```

[7]:
```
10000-element Vector{Any}:
 105
 101
  94
  92
  91
 102
 106
 101
 113
  89
 114
  92
 102

  80
 112
  86
  89
  75
  96
  81
  93
  93
 112
 103
 107
```

[8]:
```
begin
        # poisson(mean)
        histogram(last_ones, label="Distribution of final␣
↪values", color=:orange, orientation=:h)
```

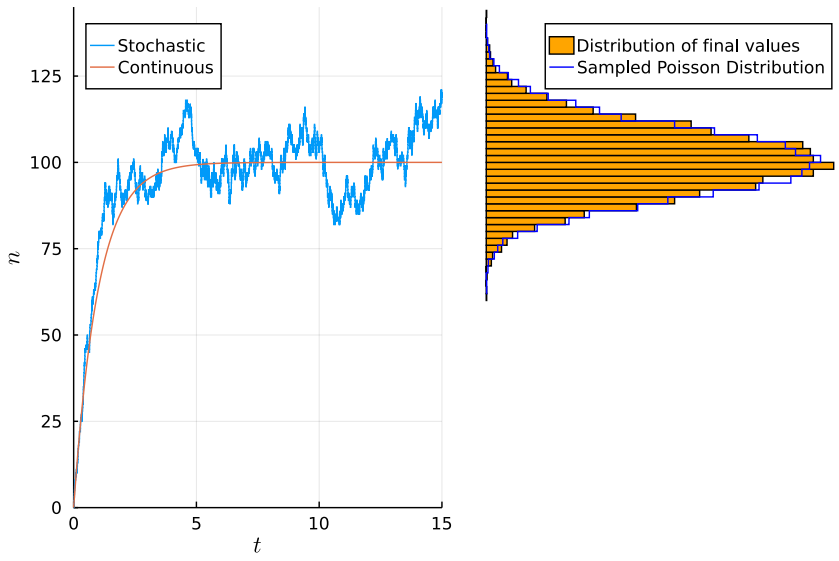
```
        p2 = plot!(rand(Poisson(100), num_samples),␣
 ↪seriestype=:stephist, label="Sampled Poisson␣
 ↪Distribution", color=:blue, orientation=:h,␣
 ↪ylimit=(0,145), ticks=nothing, yaxis=false, xaxis=false)
end
```

[8]:




[9]:
```
pf = plot(p1, p2)
```

[9]:




[10]:
```
savefig(pf, "ch1_stochastic.pdf")
```