1.a) Yes it will pass the 3 tests, as the observations genarated are iid's.

In [27]:
```
using Distributions;
```

In [28]:
```
using Gadfly;
```

In [29]:
```
using StatsBase;
```

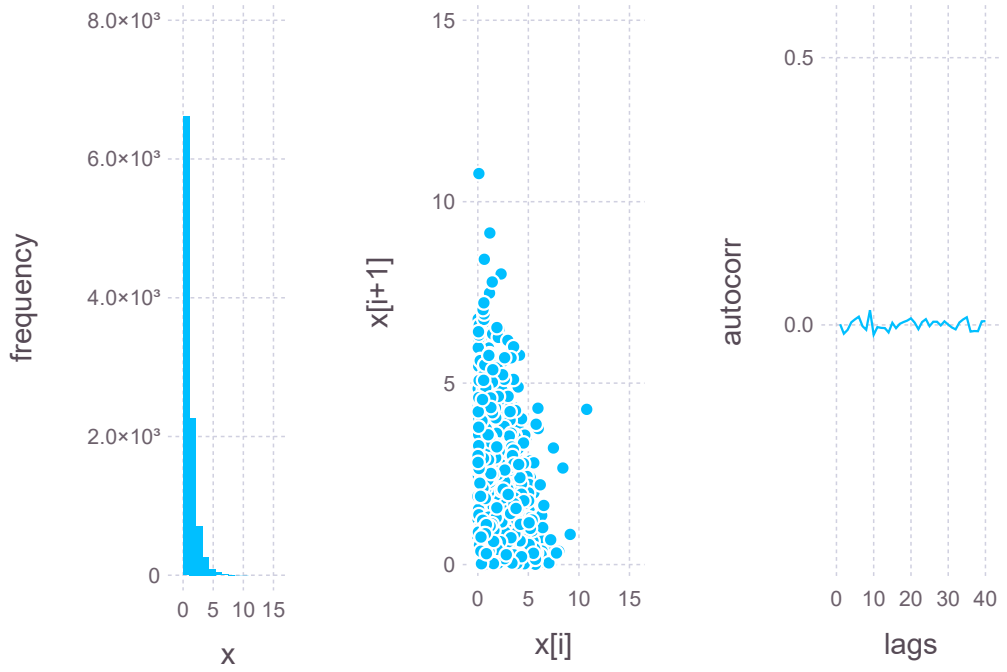
1.b

Obseravtions,

1. Observations are random and exponentially distributed
2. There seems to be no clear dependency between the ith value and i+1th value. It looks like exponential distribution
3. Autocorrelation is also very low, suggesting there is no long-term dependency

In [79]:
```
x = rand(Exponential(1),10000);
myplot1 = plot(x=x, Geom.histogram(bincount=10),
Guide.xlabel("x"),Guide.ylabel("frequency"));
myplot2 = plot(x=x[1:end-1],y=x[2:end], Geom.point,
Guide.xlabel("x[i]"),Guide.ylabel("x[i+1]"));
myplot3 = plot(x=1:40,y=autocor(x,1:40), Geom.line,
Coord.Cartesian(ymax=1),Guide.xlabel("lags"),
Guide.ylabel("autocorr"));
myplot = hstack(myplot1,myplot2,myplot3)
```

Out[79]:



2.a.

1. Find cdf of poisson(lambda = 2) using the pdf
2. Assign it to U
3. Inverse transform U
4. Draw U from unif(0,1)
5. then compute X by subsituting U in 3

2.b.

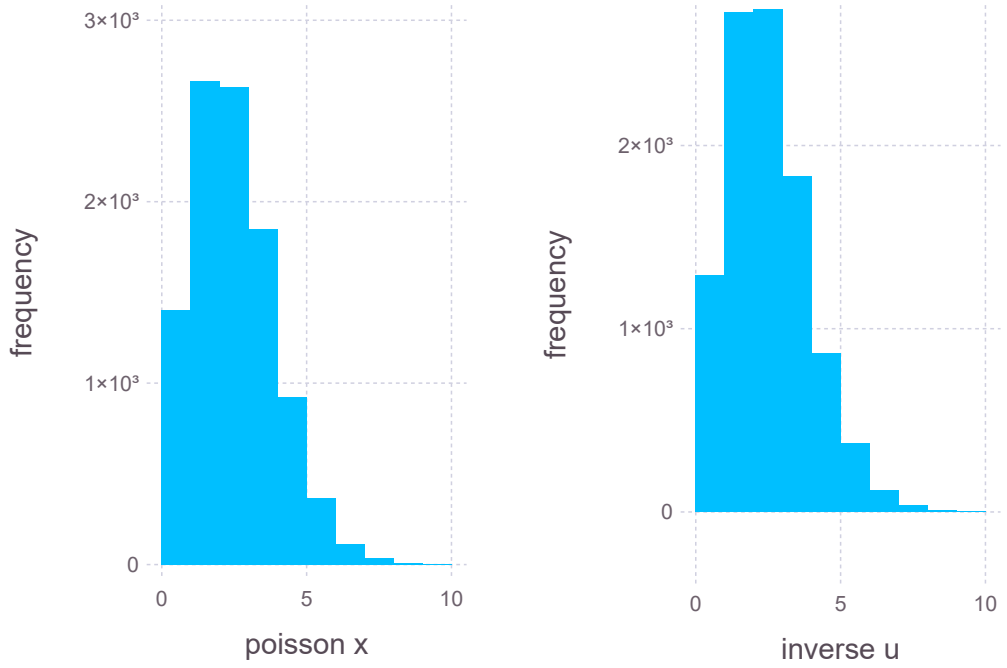
In [95]:
```
u = rand(10000);
pois_dis=Poisson(2);
pois_samples = cdf.(pois_dis,0:12)
samples=[];
k = 0
for item in u
    itr=1;
    while(itr<14)
        if( (pois_samples[itr]>=item))
            append!(samples,itr-1);
            break;
        end
        itr=itr+1;
    end
end
samples = convert(Array{Float64,1}, samples)
```

Out[95]:
```
10000-element Array{Float64,1}:
 2.0
 5.0
 1.0
 4.0
 2.0
 4.0
 1.0
 2.0
 1.0
 1.0
 4.0
 1.0
 0.0
 ⋮
 4.0
 3.0
 2.0
 2.0
 0.0
 1.0
 0.0
 4.0
 0.0
 1.0
 3.0
 2.0
```

2.c. Yes the distributions generated via posiison function and via CDF method are nearly the same

In [98]:
```
x = rand(Poisson(2),10000);
myplot1 = plot(x=x, Geom.histogram(bincount=10),
Guide.xlabel("poisson x"),Guide.ylabel("frequency"));
myplot2 = plot(x=samples, Geom.histogram(bincount=10),
Guide.xlabel("inverse u "),Guide.ylabel("frequency"));
myplot = hstack(myplot1,myplot2)
```

Out[98]:

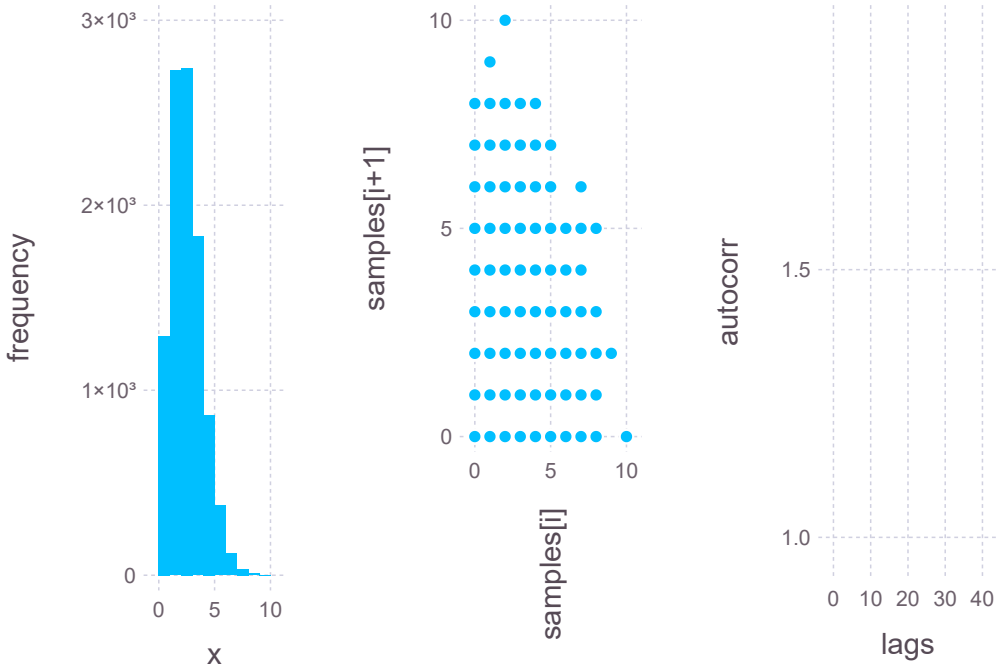


2.d

Yes based on the below plots, these are random numbers

In [97]:
```
myplot1 = plot(x=samples, Geom.histogram(bincount=10),
Guide.xlabel("x"),Guide.ylabel("frequency"));
myplot2 = plot(x=samples[1:end-1],y=samples[2:end], Geom.point,
Guide.xlabel("samples[i]"),Guide.ylabel("samples[i+1]"));
myplot3 = plot(x=1:40,y=autocor(samples,1:40), Geom.line,
Coord.Cartesian(ymax=1),Guide.xlabel("lags"),
Guide.ylabel("autocorr"));
myplot = hstack(myplot1,myplot2,myplot3)
```

Out[97]:



3a)

1. Generate two sets (u1 & u2) of 10000 random numbers using the rand() function
2. Generate x1 = sqrt(-2 x ln(u1)) x cos(2 x pi x u2)
3. Generate x2 = sqrt(-2 x ln(u1)) x sin(2 x pi x u2)

*x above represents multplication

3.b.

In [25]:
```
u1 = rand(10000)
u2 = rand(10000)

x1 = sqrt.(-2*log.(u1)) .* cos.(2*3.14*u2)
x2 = sqrt.(-2*log.(u1)) .* sin.(2*3.14*u2)
```

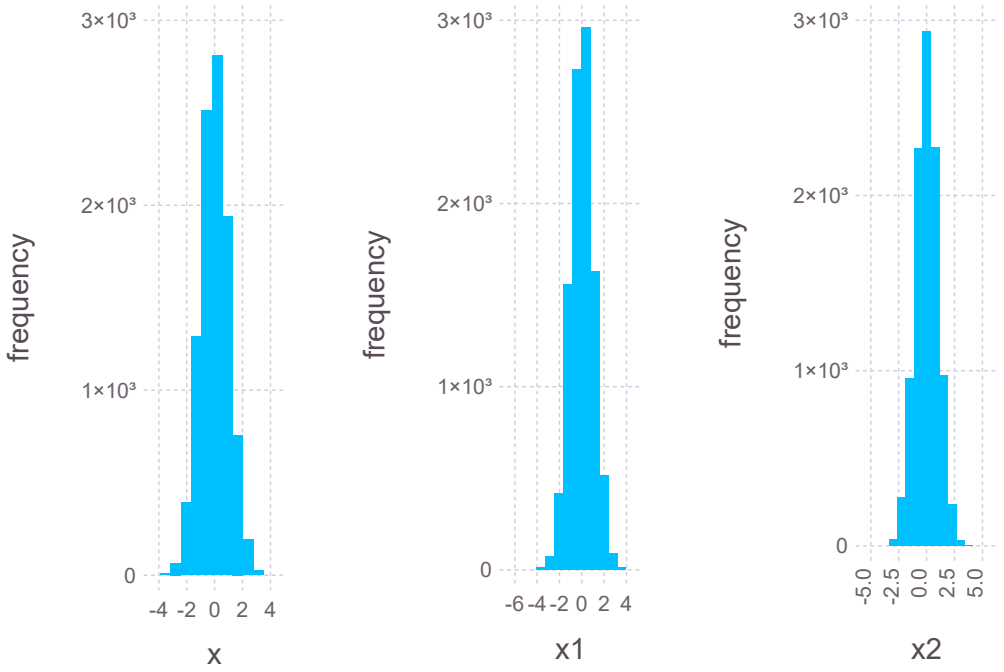
Out[25]:
```
10000-element Array{Float64,1}:
 -2.37969
  0.116217
  0.591173
  0.201583
  0.0181575
 -0.0263957
 -0.634383
  3.68806
 -1.67153
 -0.131862
 -0.993059
 -0.51319
 -1.4883
  ⋮
  0.0209654
 -0.420971
 -1.61862
  0.714688
 -1.74322
  1.50601
 -2.82293
  0.546002
 -0.521084
 -0.401142
  0.208412
 -0.765049
```

3.c.

x1 and x2 are somewhat similar to Normal(0,1) if not entirely same

In [35]:
```
x = rand(Normal(0,1),10000);
myplot1 = plot(x=x, Geom.histogram(bincount=10),
Guide.xlabel("x"),Guide.ylabel("frequency"));
myplot2 = plot(x=x1, Geom.histogram(bincount=10),
Guide.xlabel("x1"),Guide.ylabel("frequency"));
myplot3 = plot(x=x2, Geom.histogram(bincount=10),
Guide.xlabel("x2"),Guide.ylabel("frequency"));
myplot = hstack(myplot1,myplot2,myplot3)
```

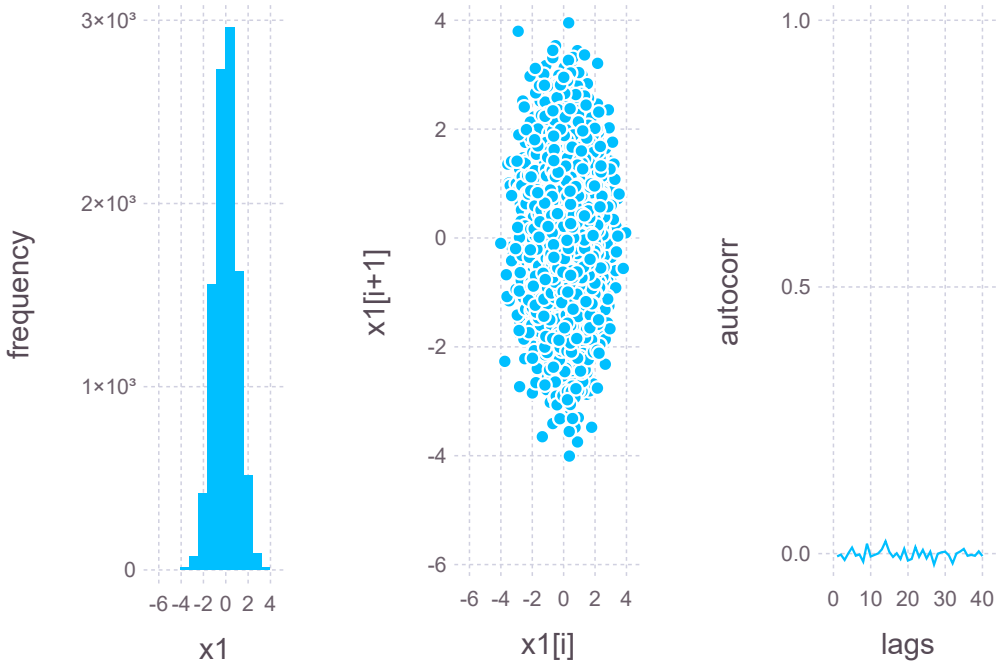
Out[35]:



3d) From the below plots we can say that both x1 & x2 are random numbers and pass all 3 test.

In [40]:
```
myplot1 = plot(x=x1, Geom.histogram(bincount=10),
Guide.xlabel("x1"),Guide.ylabel("frequency"));
myplot2 = plot(x=x1[1:end-1],y=x1[2:end], Geom.point,
Guide.xlabel("x1[i]"),Guide.ylabel("x1[i+1]"));
myplot3 = plot(x=1:40,y=autocor(x1,1:40), Geom.line,
Coord.Cartesian(ymax=1),Guide.xlabel("lags"),
Guide.ylabel("autocorr"));
myplot = hstack(myplot1,myplot2,myplot3)
```

Out[40]:



In [39]:
```
myplot1 = plot(x=x2, Geom.histogram(bincount=10),
Guide.xlabel("x2"),Guide.ylabel("frequency"));
myplot2 = plot(x=x2[1:end-1],y=x2[2:end], Geom.point,
Guide.xlabel("x2[i]"),Guide.ylabel("x2[i+1]"));
myplot3 = plot(x=1:40,y=autocor(x2,1:40), Geom.line,
Coord.Cartesian(ymax=1),Guide.xlabel("lags"),
Guide.ylabel("autocorr"));
myplot = hstack(myplot1,myplot2,myplot3)
```

Out[39]: