CS146 #3

Code

Create your own probability distribution.

I chose to go with the poisson distribution. the support is all natural numbers N, and 0 for K. i.e.

$k \in \mathbb{N} \cup 0$

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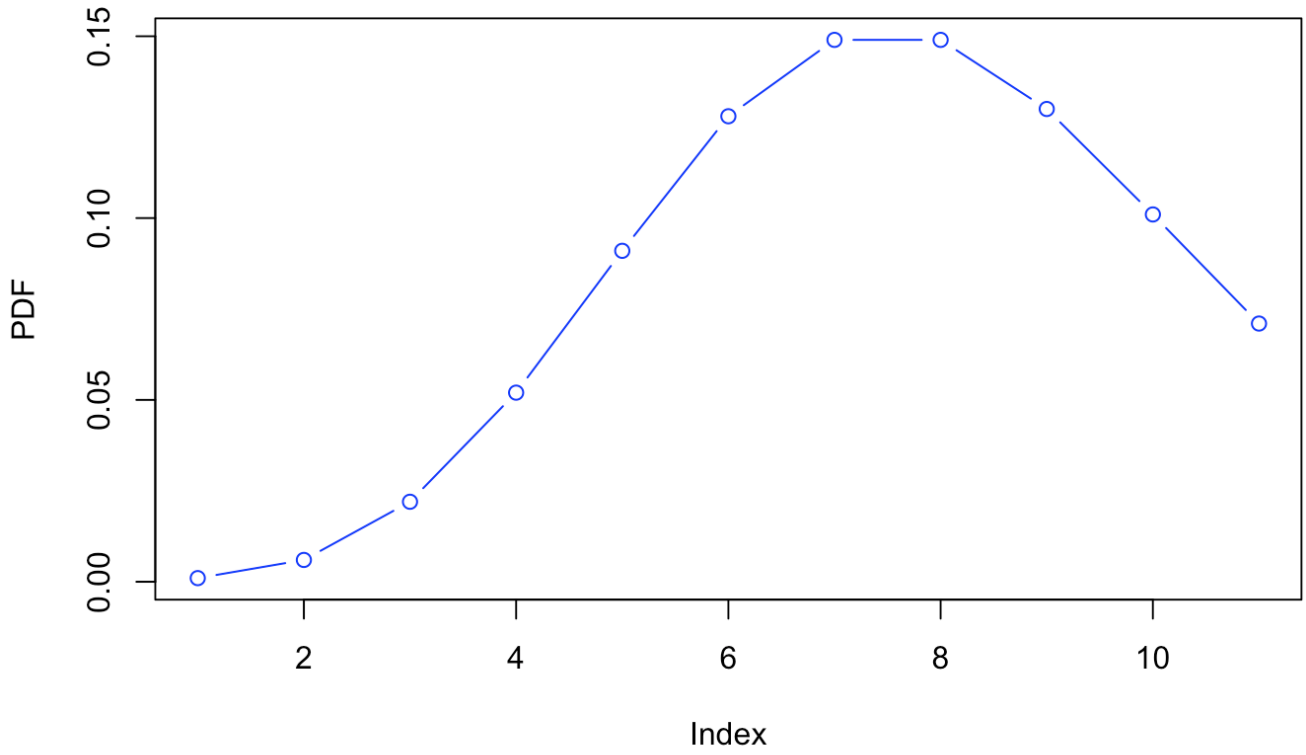
```
Lambda <-7
K = 0:10
PDF<-round(dpois(K,lambda = Lambda),3)
plot(PDF, col="blue", type="b")
```



Will your pdf have one mode or multiple modes?

One, over Lambda.

Will it be skew or symmetric? It is skewed because of the vector I decided to draw (1:20) which is not symmetric in relation to the mean (or Lambda).

Where will most of the probability mass be?

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```
plot(PDF, col="blue", type="b")
most_mass <- qpois(0.51, lambda = Lambda, lower.tail = TRUE)
most_mass
```

```
[1] 7
```

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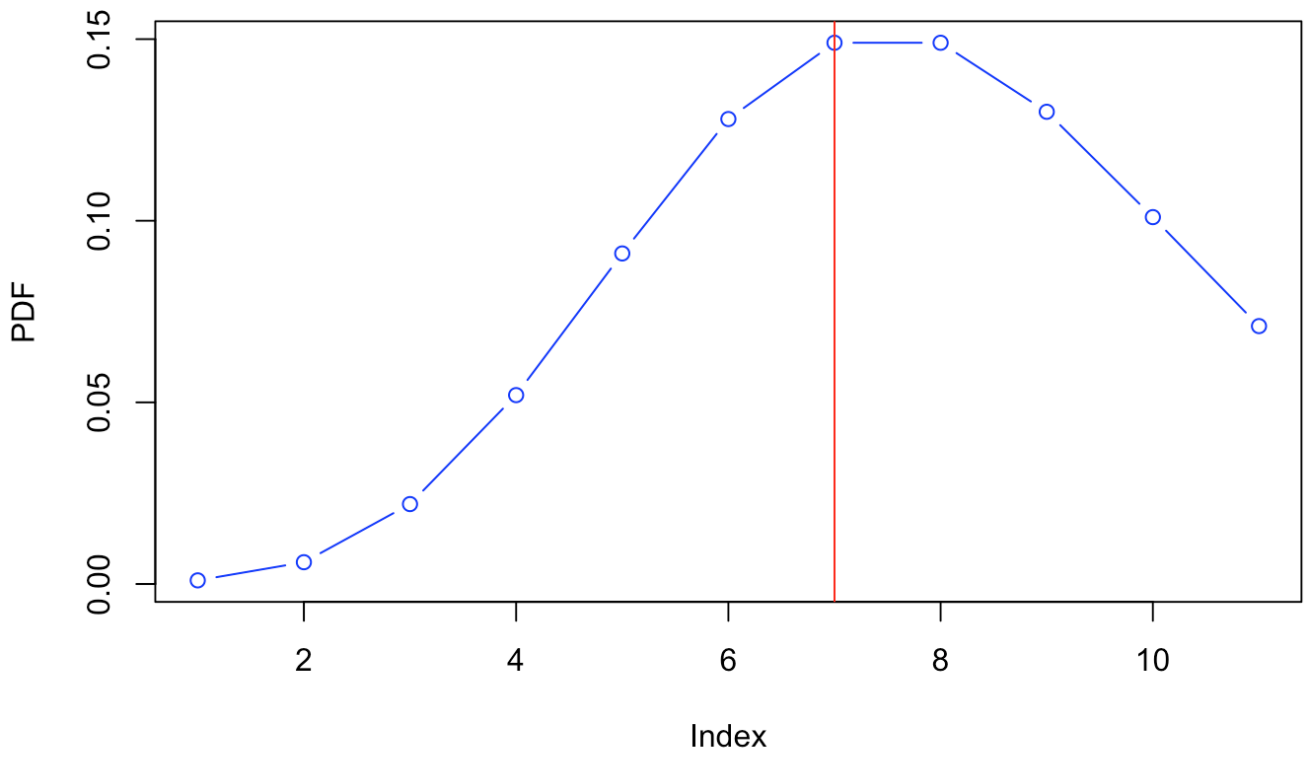
```
abline(v=most_mass,col="red")
```



We can observe that exactly half of the mass is left to the red line, and in interval o to:

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```
most_mass
```

```
[1] 7
```

What are the parameters of your distribution?

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```
# The parameter is K, which describes some known mean, or average rate in a given vol
ume/time.
K
```

```
 [1]  0  1  2  3  4  5  6  7  8  9 10
```

(Optional) Stretch goal: write R functions for the cdf, pdf, qf and random samples from your distribution.

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```
Lambda = 10
K=10
#the CDF function, instead of using ppois:
sum(dpois(0:K,Lambda))
```

```
[1] 0.5830398
```

3.2 Derive the posterior distribution, including its parameter values, from an exponential likelihood function with a gamma prior over the exponential parameter λ, and with data y_i for i = 1, 2, …, n.

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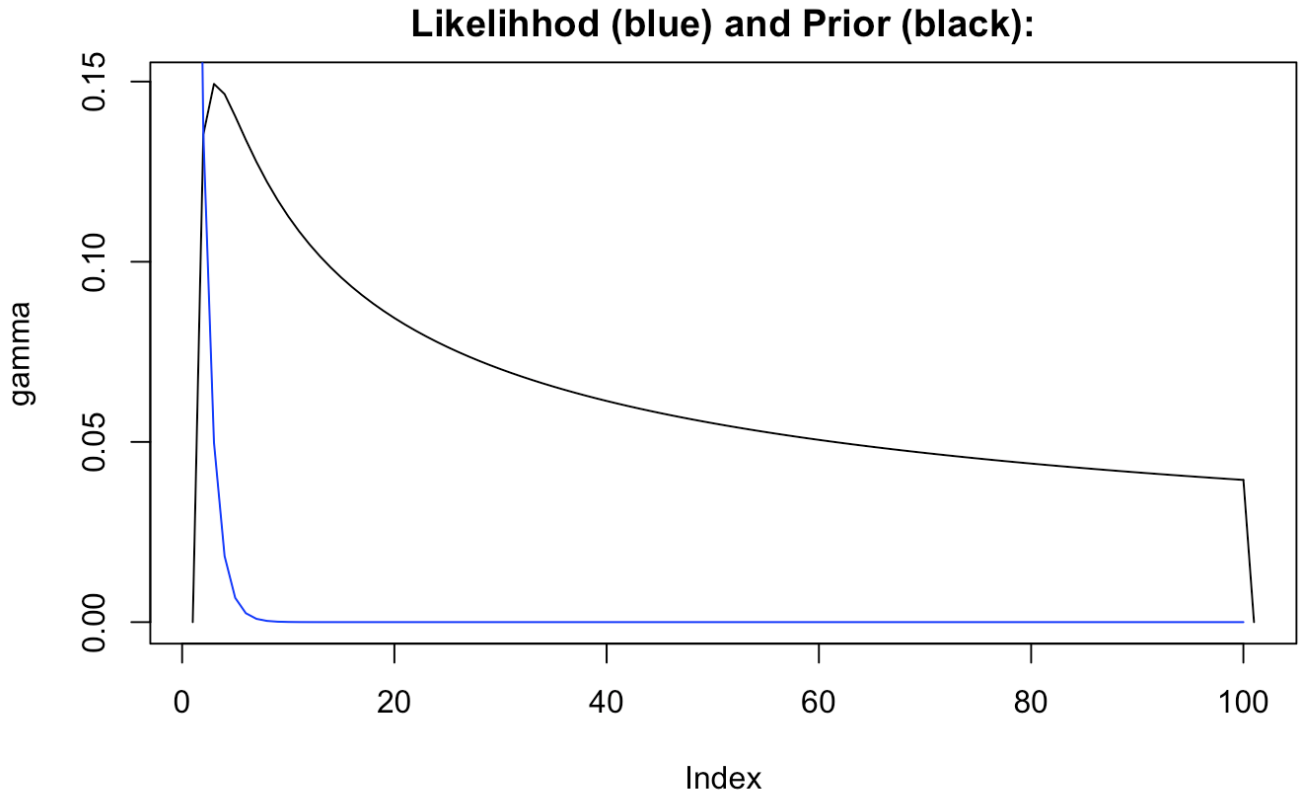
```
# posterior = exponential_likelihood * gamma, for natural numbers.
x <- seq(1,100, 1)
lambda <- 0:100  #"The random variable of the prior, is the parameter of the likelihh
od"
gamma = dgamma(x,lambda) #Gamma is the  prior for exponential distribution.
likelihood = dexp(x)
plot(gamma, type='l', main = "Likelihhod (blue) and Prior (black):")
lines(likelihood, type='l', col="blue")
```



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```
posterior = likelihood * gamma
```

```
longer object length is not a multiple of shorter object length
```

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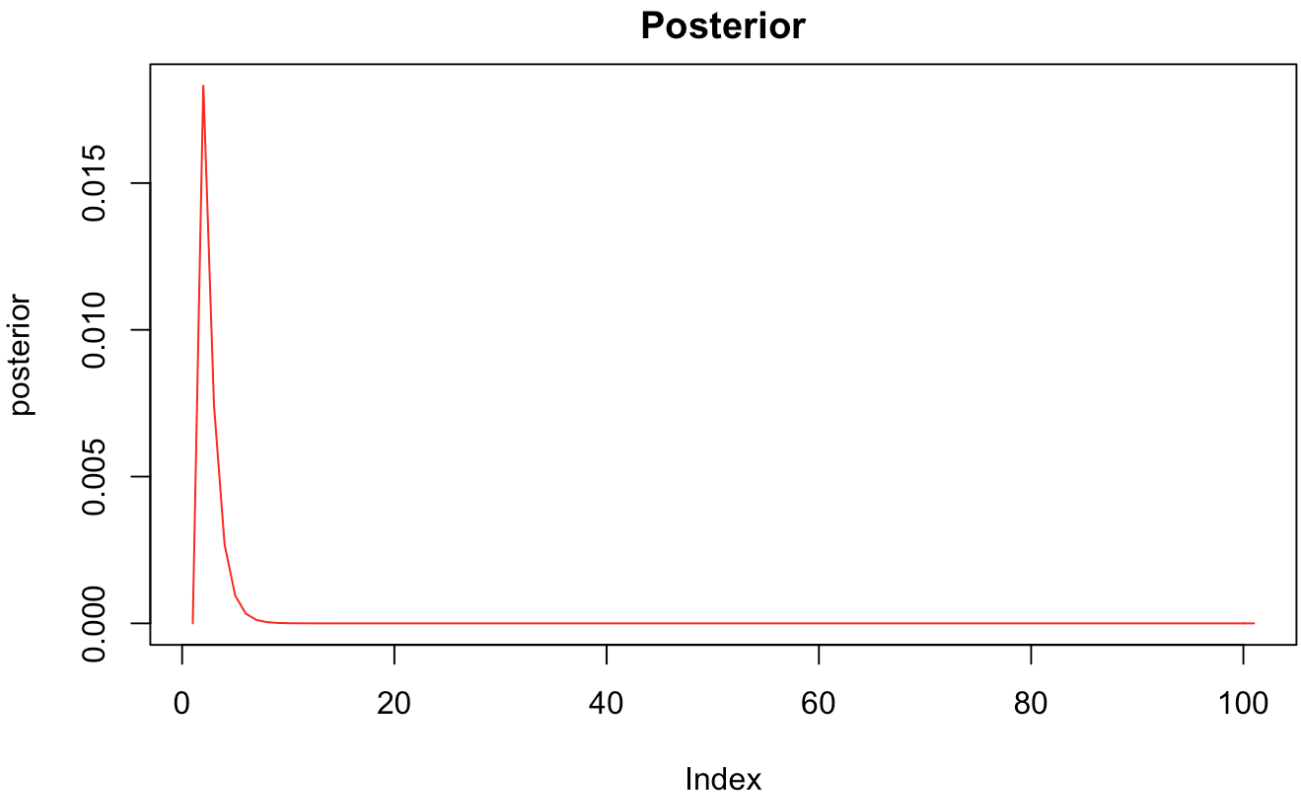
```
plot(posterior, type = 'l', col='red', main = "Posterior")
```


Posterior
posterior
0.000
0.005
0.010
0.015
0
20
40
60
80
100
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