NMAI061-22-EX1

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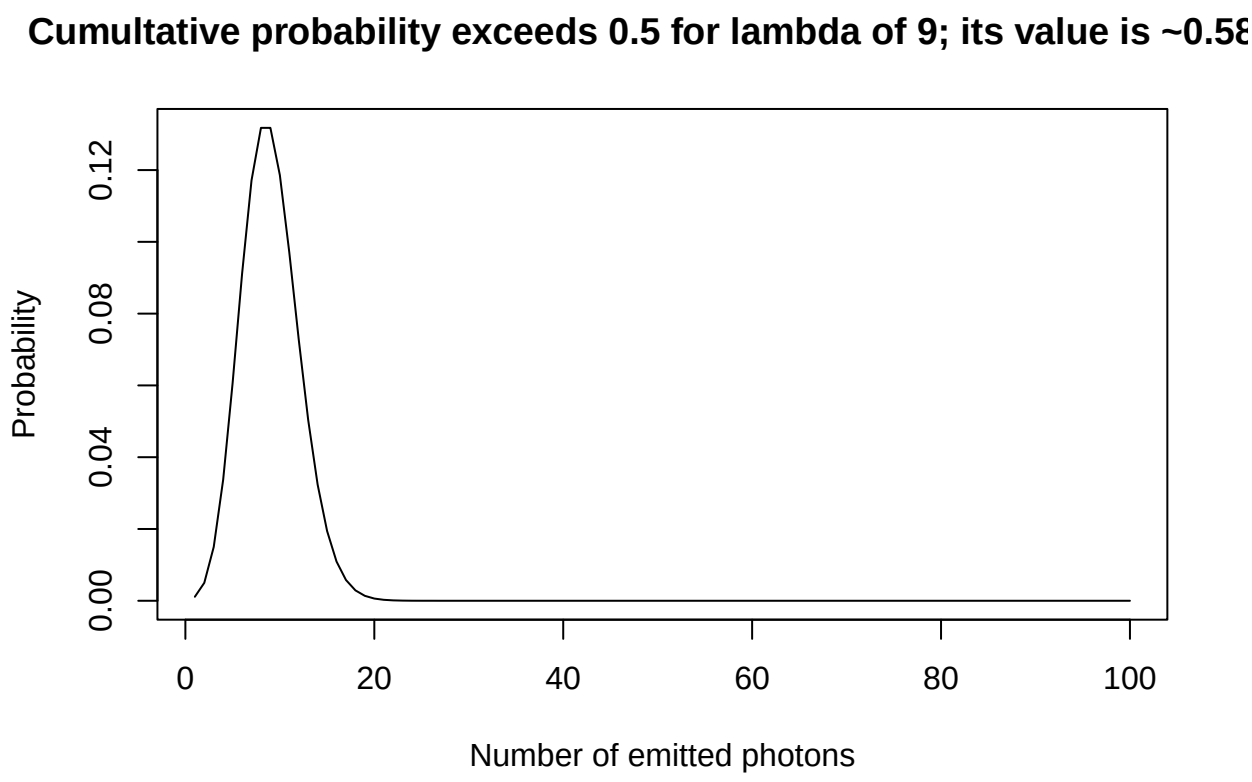
1)Poisson distribution

This distribution is discrete and can model for example a number of photons hitting an area in a given timeframe. The expected rate of occurence λ is set to 9. We are only looking at probabilites from 1 to 100 ocurrences. We can use qpois function to determine for which value of parameter λ cumultative probability exceeds 0.5. This value is (unsurprisingly) 9.

```
pd=dpois(x=1:100,lambda=9)
plot(pd,type="l",main=paste0('Cumultative probability exceeds 0.5 for lambda of ',qpois(0.5,9), '; its
```



2a)Random sampling

Unfair dice throws:

```
n=1000
real_probability=c(rep(1/7,5),2/7)
simulated_probability <- sample(1:6, size=n, replace=TRUE, prob=real_probability)
table(simulated_probability)/n
```

```
## simulated_probability
##     1     2     3     4     5     6
## 0.146 0.142 0.139 0.165 0.113 0.295
```

```
names(real_probability)=1:6
cat('real_probability')
```

```
## real_probability
```

```
print(round(real_probability,digits = 2))
```

```
##    1    2    3    4    5    6
## 0.14 0.14 0.14 0.14 0.14 0.29
```

2b)Confidence interval

We will calculate the confidence interval for 6 from simulated probability.

```
prob=length(which(simulated_probability==6))/n
margin <- qnorm(0.975)*sqrt(prob*(1-prob))/sqrt(n)
ci=c(prob-margin,prob+margin)
cat(paste0('Confidence interval for throwing 6 on our unfair dice from ',n,' throws is (',round(ci[1],d
```

```
## Confidence interval for throwing 6 on our unfair dice from 1000 throws is (0.267 ; 0.323)
```