Lab-3

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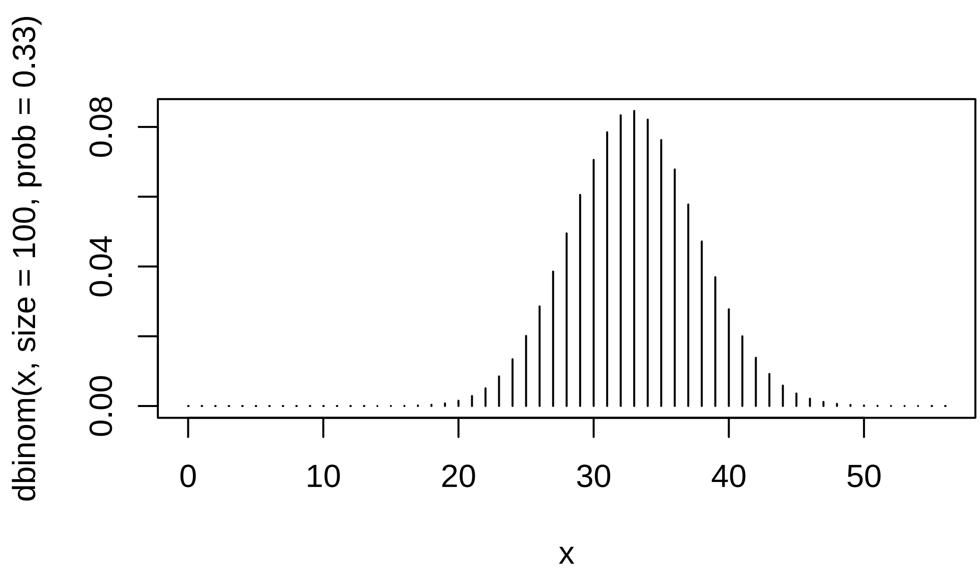
Problem 1:

Plot probability density histograms for these discrete distributions (hint: use the d…() function).

a. Binomial Distribution

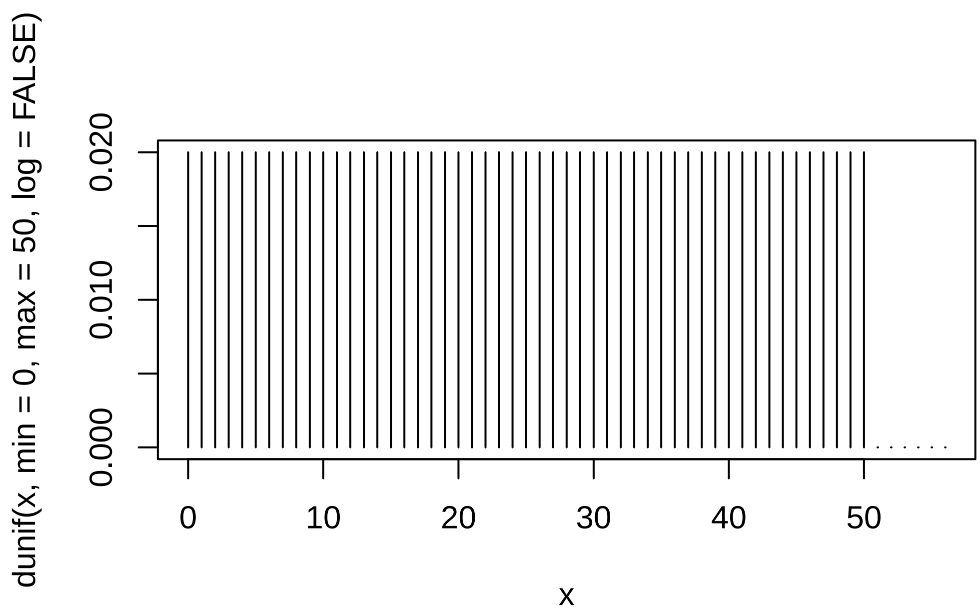
```
x <- 0:56
p = 0.33
plot(x,dbinom(x,size=100,prob=0.33),type="h")
```



b. Discrete uniform

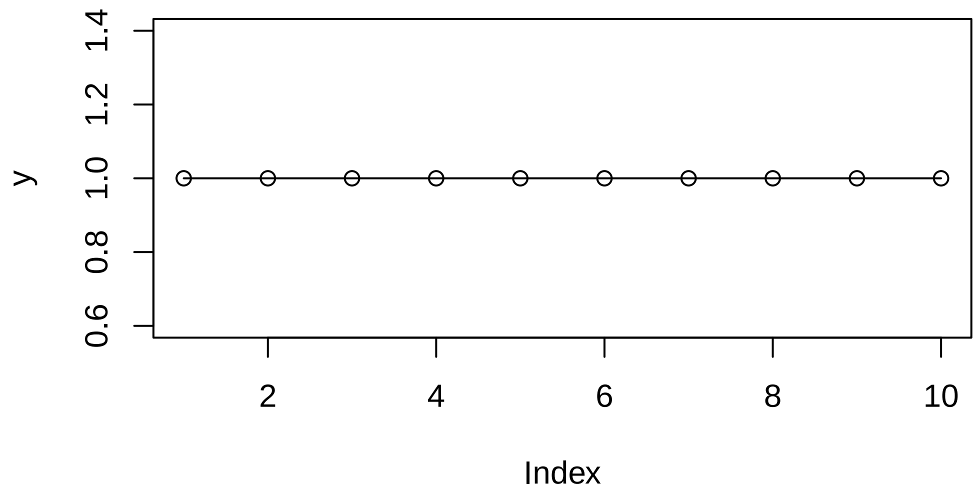
```r
library("extraDistr")

plot(x,dunif(x,min=0,max=50,log=FALSE),type="h")
```



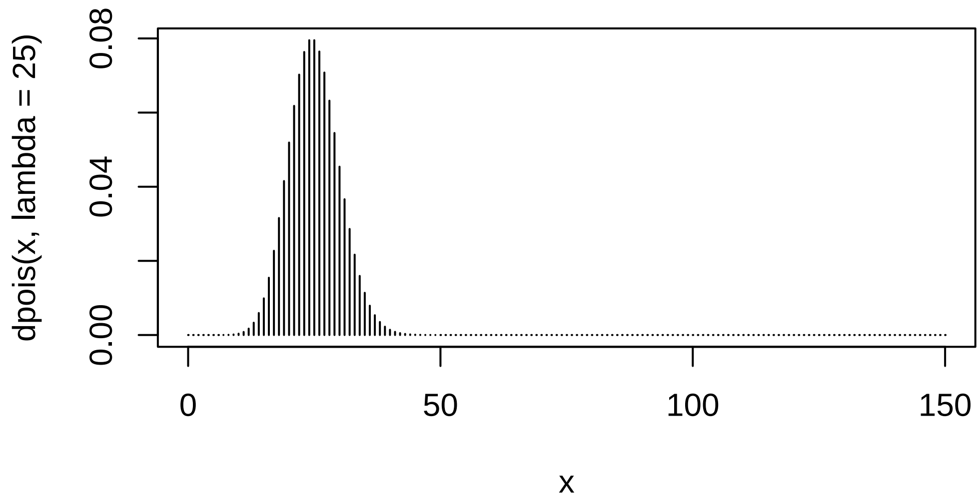
c. Bernoulli

```r
x <- seq(1,10,by=1)
y <- pbern(x, prob = 0.6)
plot(y, type = "o")
```



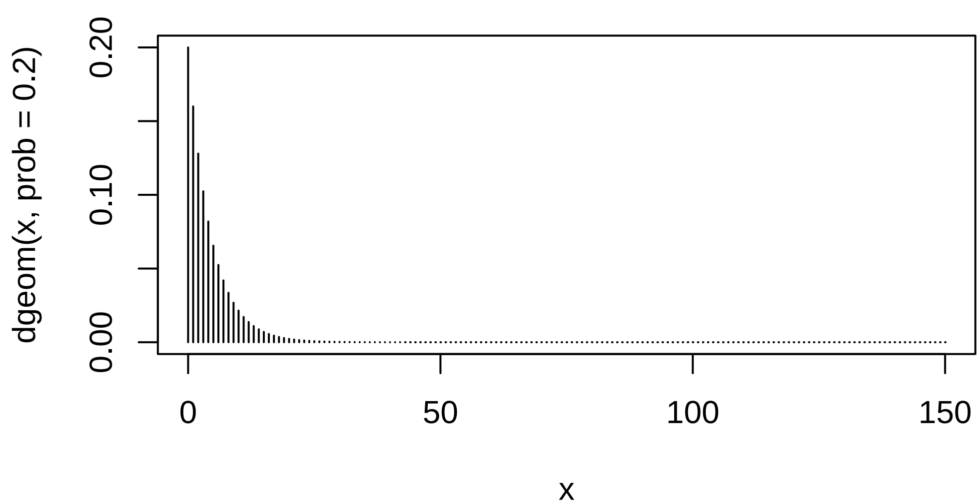
d. Poisson

```
x <- 0:150
plot(x,dpois(x,lambda=25),type="h")
```



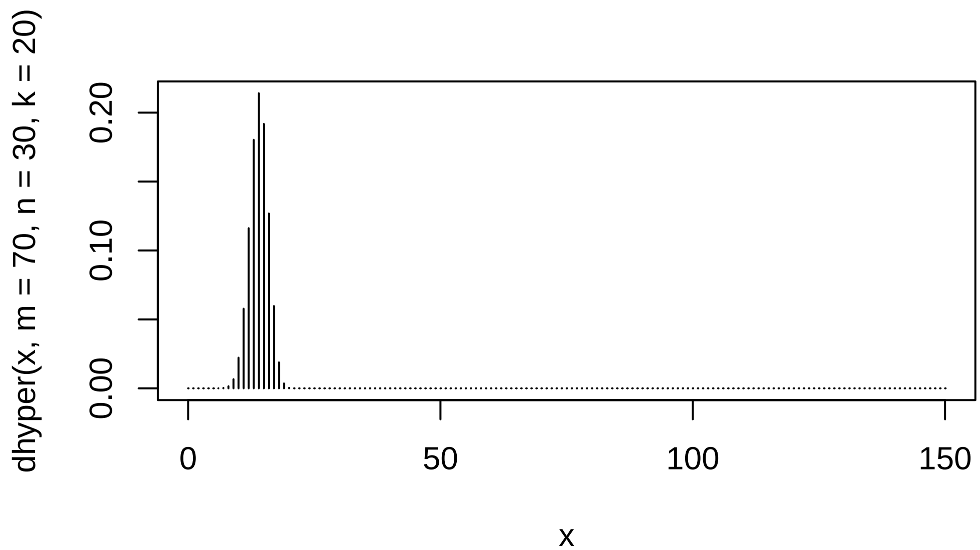
e. Geometric

```
plot(x,dgeom(x,prob=.2),type="h")
```



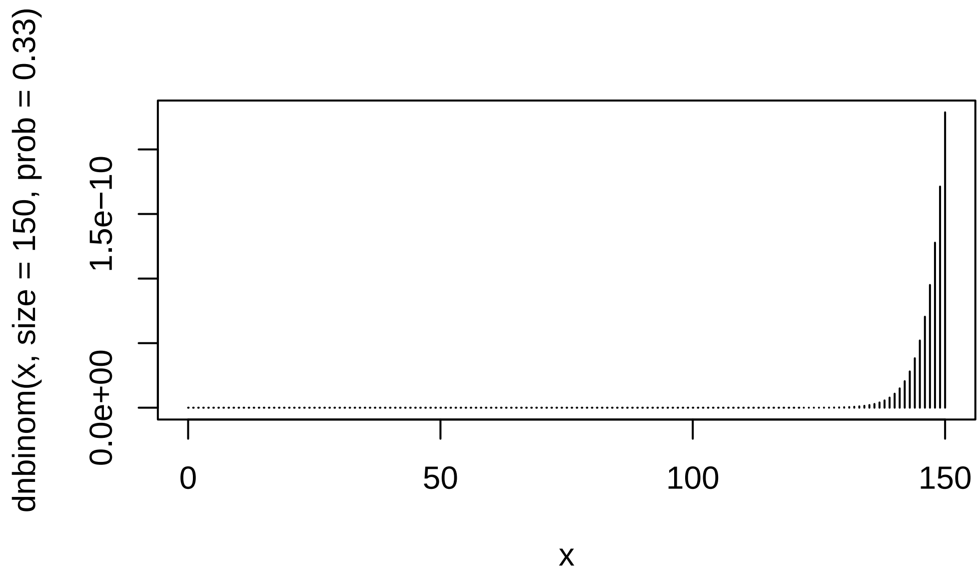
f. Hyper-geometric

```
plot(x,dhyper(x,m=70,n=30,k=20),type="h")
```



g. Negative binomial

```
plot(x,dnbinom(x,size=150,prob=.33),type="h")
```



Problem 2.

Suppose there are fifteen multiple choice questions in `DSAN-5100` midterm test. Each question has four possible answers, and only one of them is correct. Find the probability of having four or less correct answers if a student attempts to answer every question at random.

a. Compute the probability of having exactly 4 correct answers by random attempts using *dbinom()* and *pbinom()*.

b. Find the the probability of having four or less correct answers by random attempts using *dbinom()*.

```
(p4 <- dbinom(4,6,p=0.5) + dbinom(3,6,p=0.5) + dbinom(2,6,p=0.5) + dbinom(1,6,p=0.5) + dbi
```

```
[1] 0.890625
```

c. Compute the above probability(part-b) using *pbinom()*.

```
pbinom(4,6,p=0.5)
```

```
[1] 0.890625
```

Problem 3:

`use r to find the probability`

a. Assume an insurance company receives 3 motor vehicle insurance claims per week. What is the probability that they recieve 11 or fewer claims during a month?

$$P(X \leq 11)?$$

```
a <- ppois(11,3*4)
a
```

```
[1] 0.4615973
```

b. While you are at the Georgetown library terrace, you notice that airplanes fly at an average rate of 1 every 4 hours. What is the probability that you will see at least one plane in the next hour?

```
1 - ppois(0,0.25)
```

```
[1] 0.2211992
```

Problem 4:

`Try this example with _..nbinom()_`

(This relates to Problem-1 in Lab-1 Assignment)

Mike had the first three successes in trials 6, 8, and 9. He had six failures until he reached three successes.

Do you think Mike has *success probability p = 0.5 or better?* Can a simulation give an answer?Let's try.

1. If Mike's success probability is p = 0.5 What is the probability that he will obtain these 3 successes?.

```
successes <- 3
p <- 0.5
x <- 6
(prob <- dnbinom(x, size=successes, prob=p))
```

```
[1] 0.0546875
```

2. Run many simulations (say 10,000) with this success probability to find the same probability $P(X = 6)$? *Hint: Use rnbinom()*

```r
simulations <- rnbinom(1000000,size=successes,prob=p)
sum(simulations == 6)/length(simulations)
```

```
[1] 0.054791
```

3. If Mike's success probability were 0.5 or better, he would not need a lot of attempts. Find the probability that three successes were reached after 9 tosses or later by somebody with success probability 0.5. $P(X \geq 6)$

a. Calculate the probabiliy using both *dnbinom()* and *pnbinom()*.

```r
#Mike's success probability
pnbinom1 <- (1 - pnbinom(5,size=successes,prob=p))

dnbinom1 <- (1 - sum(sapply(0:5, function(x) dnbinom(x,size=successes,prob=p))))

pnbinom1
```

```
[1] 0.1445312
```

```r
dnbinom1
```

```
[1] 0.1445312
```

b. Calculate this probability using a Simulation(10,000)

```r
#probability using simulations
sim <- rnbinom(1000000,size=successes,prob=p)
sum(sim >= 6)/length(sim)
```

```
[1] 0.144482
```

c. Is this probability (part b) the same as you got from "myattempts": Lab 1 Assignment Problem 1 part 3?

No, this is not the same probabability.