Analytics_511_HW_2.R

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```
####Problem 9
r = 2.5
p = 5
###P<=10
pgamma(q = 10, shape = r, scale = p)
```

```
## [1] 0.450584
```

```
pgamma(q = 5, shape = r, scale = p, lower.tail = F)
```

```
## [1] 0.849145
```

```
#P(abs(X-8)<3)=P(X<11) & P(X>5) = P(5<X<11)
pgamma(q = 5, shape = r, scale = p, lower.tail = F) - pgamma(q = 11, shape = r, scale = p, lower.tail =
```

```
## [1] 0.3557715
```

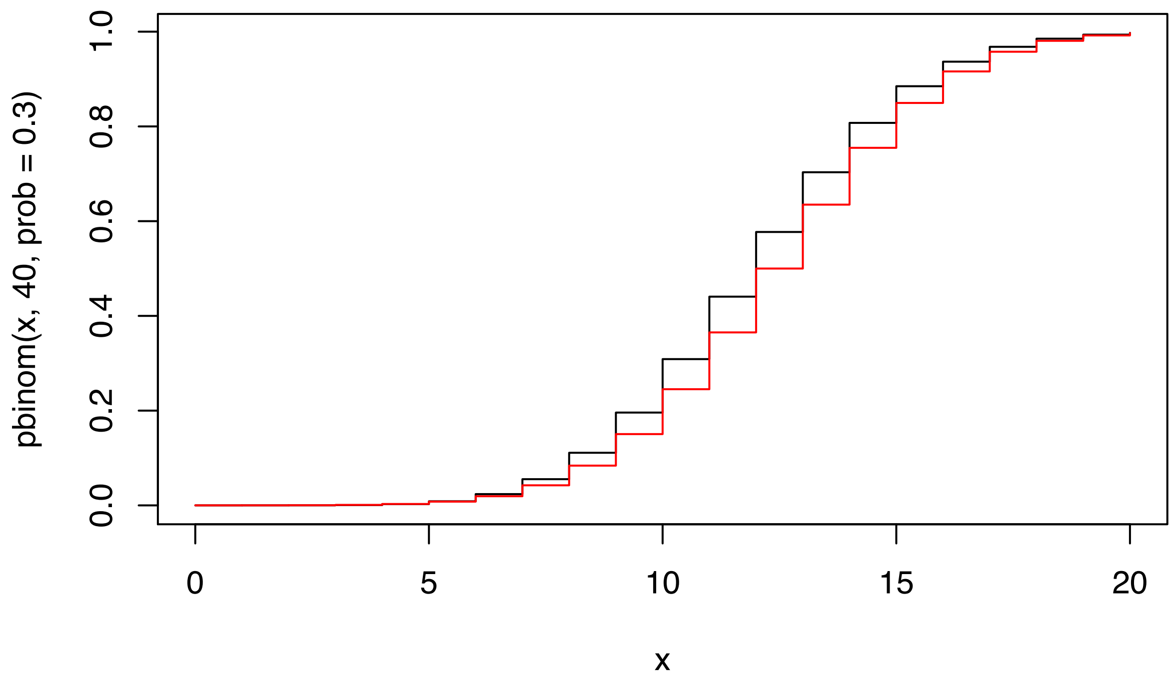
```
i = 4
z = pgamma(q = i, shape = r, scale = p)
while(z<.1){
i = i + .001
z = pgamma(q = i, shape = r, scale = p)
}
i
```

```
## [1] 4.026
```

```
####Problem 10
x = 0:20
#plot(x, pbinom(x, 20, prob = 1/3), type = 's')
#lines(x, phyper(x, m = 40, n = 80, k = 20), type = 's', col = "red")

#The two distributions nearly overlap one another with some minor
#deivation in the middle of the distributions

####Problem 11
x = 0:20
plot(x, pbinom(x, 40, prob = .3), type = 's')
lines(x, pnorm(x, mean = 12, sd = 2.9), type = 's', col = "red")
```




```
#With the exception of the tail ends, the normal distribution is
#under the binomial distribution in the middle of the plot.

####Problem 12
# par(mfrow=c(3, 2))
# sizes = c(10, 20, 40, 100, 1000)
# for(i in sizes){
#   qqnorm(rnorm(i), title = paste(c("sample size", as.character(i))))
# }

#rnorm with a size of 10 does not resemble anything like a line
#rnorm with a size of 20 does not resemble anything like a line,
#but shows some aspects of straight ening out in the middle
#rnorm with a size of 40 is straight ening out in the middle
#rnorm with a size of 100 is straight ening out in the middle a little more
#rnorm with a size of 1000 is straightening out in the middle, but not at the tail
####Problem 13

par(mfrow=c(3, 2))
sizes = seq(from = 20, to = 1000, by = 245)
for(i in sizes){

    qqnorm(rbinom(i, 40, prob = .3), main = paste(c("sample size", as.character(i))))
  }
#As the size increases, the plots represents a sort of step image. The magnitude of the
#steps increases. Please note, the plots are located after Problem 14.
```

```r
####Problem 14
###A
pnorm(3, lower.tail = F)
```

```
## [1] 0.001349898
```

```r
###B
pnorm(42, mean = 35, sd = 6, lower.tail = F)
```

```
## [1] 0.1216725
```

```r
###C
dbinom(10, 10, prob = 0.8)
```

```
## [1] 0.1073742
```

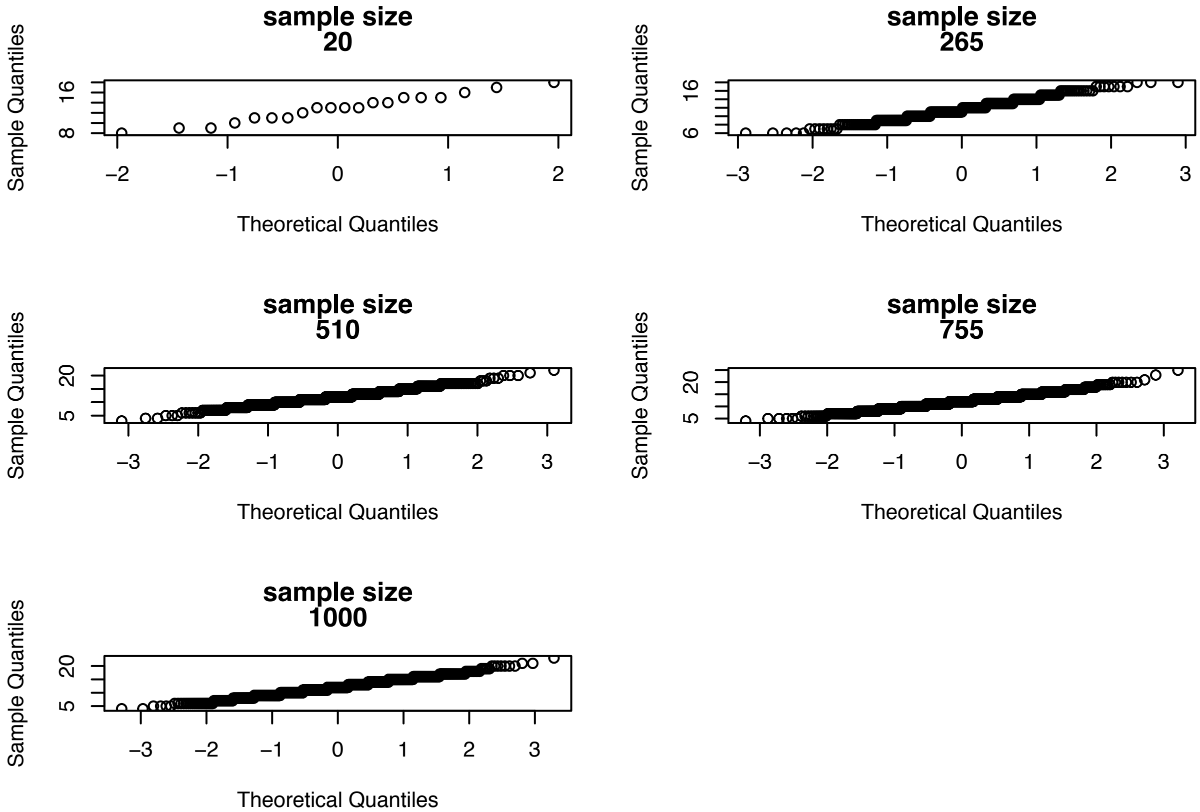
```r
###D
punif(0.9)
```

```
## [1] 0.9
```

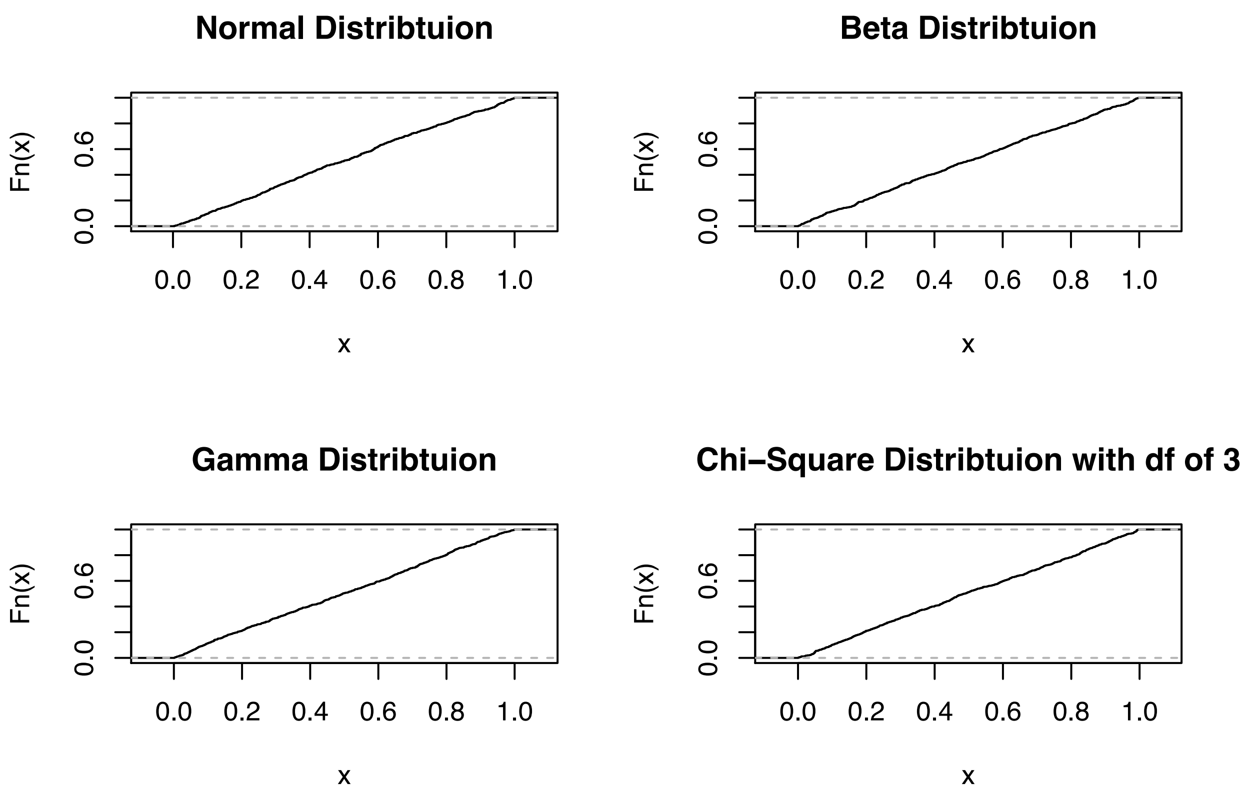
```r
###E
pchisq(6.5, df = 2, lower.tail = F)
```

```
## [1] 0.03877421
```

```r
####Problem 15
par(mfrow=c(2, 2))
```




```r
x = rnorm(1000)
Fx = pnorm(x)
plot(ecdf(Fx), main = "Normal Distribtuion")
x  = rbeta(1000, shape1 = 1, shape2 = 1)
Fx = rbeta(x, shape1 = 1, shape2 = 1)
plot(ecdf(Fx), main = "Beta Distribtuion")
x = rgamma(1000, shape = 2, scale = 1)
Fx = pgamma(q = x, shape = 2, scale = 1)
plot(ecdf(Fx), main = "Gamma Distribtuion")
x = rchisq(1000, df = 3)
Fx = pchisq(x, df= 3)
plot(ecdf(Fx), main = "Chi-Square Distribtuion with df of 3")
```




```
###In each of the plots the line are generally straight going diagonally from 0 to 1.
###Please see page after problem 16 for the Algebra section.

####Problem 16
#par(mfrow=c(2, 5))
X1 = rexp(1:1000,1)
X2 = rexp(1:1000,1)
X = X1+ X2
A = seq(from = .1, to = 1, by = .1)
# for(i in A){
#   qqnorm(X^i, main = paste("a is", i))
# }
# From this simulation we can infer a is between .2 and .3,
# but closer to .3
```

Problem 15 Algebra Proof

$f(x) = \lambda e^{-\lambda x}$ $F(X) = 1 - e^{-\lambda x}$

$U(0,1) = t$

$P(F(x) \leq t) = P(1 - e^{-\lambda x} \leq t) = P(e^{-\lambda x} \geq 1 - t) = P(x \leq (-\lambda^{-1} * ln(1-t))$

$= \int_0^{-\lambda^{-1} * ln(1-t)} \lambda e^{-\lambda x} = \left(-e^{-\lambda x}\right)_0^{-\lambda^{-1} * ln(1-t)} = -e^{-\lambda - \lambda^{-1} * ln(1-t)} + 1 = -(1-t) + 1 = t$

$\therefore P(F(x) \leq t) = t = U(0,1)$

This can also be done without the integrals by using only CDF

$P(F(x) \leq t) = P(1 - e^{-\lambda x} \leq t) = P(e^{-\lambda x} \geq 1 - t) = P(x \leq (-\lambda^{-1} * ln(1-t))$

$= F(-\lambda^{-1} * ln(1-t)) - F(0) = 1 - e^{-\lambda * (-\lambda^{-1} * ln(1-t))} = 1 - e^{ln(1-t)} - (1 - e^0) = 1 - (1-t) - 0 = t$