

Problem Set 1

INF 511

Muhammad

1 χ^2 distribution

1.1 Write the probability distribution function.

A chi-square distributed random variable X has n degrees of freedom and follows a probability density function.

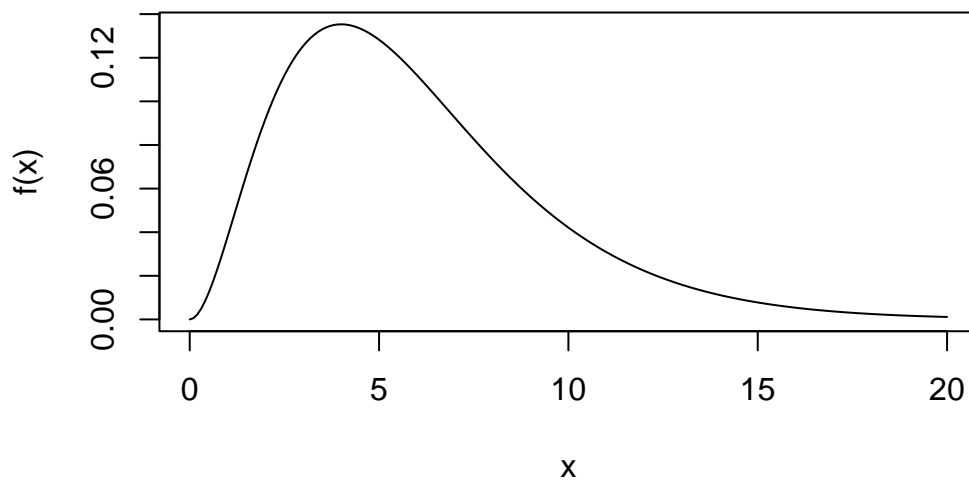
$$f(x) = \frac{x^{n/2-1}e^{-x/2}}{2^{n/2}\Gamma(n/2)} \quad x > 0,$$

for $n = 1, 2, \dots$

```
pdf <- dchisq(seq(0, 20, by=0.1), 6)
```

1.2 Plot the PDF.

```
plot(seq(0, 20, by=0.1), pdf, type="l", xlab="x", ylab="f(x)")
```



2 Discrete distribution

For Question 2, the chosen distribution is the Binomial distribution.

$$\binom{n}{k} = \frac{\text{factorial}(n)}{\text{factorial}(k) \cdot \text{factorial}(n - k)}$$

```
n <- 10
p <- 0.5
x <- 0:n
k <- 6
binom_coef <- factorial(n) / (factorial(k) * factorial(n - k))
pmf <- binom_coef * p^k * (1 - p)^(n - k)
pmf
```

```
[1] 0.2050781
```

2.1 Plot the PMF

```
# Define the parameters of the binomial distribution
n <- 10
p <- 0.5

# Generate the values of x
x <- 0:n

# Calculate the PMF
pmf <- dbinom(x, n, p)

# Plot the PMF
plot(x, pmf, type = "l", xlab = "x", ylab = "P(x | n, p)")
points(x, pmf, pch = 19)
```

