AC_Dec_06

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Fit an Exponential distribution to the following data:

Waiting time to failure	No. of Bulbs
0-10	56
10-20	19
20-30	14
30-40	8
40-50	4
50 and more	1

$E(x) = \lambda, \ \ \hat{\lambda} = \frac{1}{\bar{x}}$.

```
library(pracma)
library(matlib)
```

```
##
## Attaching package: 'matlib'
```

```
## The following objects are masked from 'package:pracma':
##
##     angle, inv
```

```
library(ggplot2)
library(ggpubr)
```

```
class_int <- seq(0, 60, 10)
class <- c("0-10", "10-20", "20-30", "30-40", "40-50", "> 50")
x <- seq(5, 55, 10)
f <- c(56, 19, 14, 8, 4, 1)
```

```
x_bar <- dot(f, x)/sum(f)
x_bar
```

```
## [1] 14.01961
```

```
l_hat <- 1/x_bar
l_hat
```

```
## [1] 0.07132867
```

```
st_var <- sum(((x - x_bar)**2)*f)/(sum(f) - 1)
st_var
```

```
## [1] 151.5046
```

```
st_dev <- sqrt(st_var)
```

Here, $E(x) = 14.02$. We will fit an exponential distribution with parameter $\lambda = \frac{1}{14.02}$.

```
p <- c(pexp(10, l_hat) - pexp(0, l_hat),
       pexp(20, l_hat) - pexp(10, l_hat),
       pexp(30, l_hat) - pexp(20, l_hat),
       pexp(40, l_hat) - pexp(30, l_hat),
       pexp(50, l_hat) - pexp(40, l_hat),
       pexp(Inf, l_hat) - pexp(50, l_hat))

p
```

```
## [1] 0.50996904 0.24990062 0.12245904 0.06000872 0.02940613 0.02825645
```

Expected frequency:

```
exp_freq <- p*sum(f)
exp_freq
```

```
## [1] 52.016842 25.489863 12.490822  6.120889  2.999425  2.882158
```

Goodness of fit:

```
df <- data.frame(class, f, exp_freq, p)
colnames(df) <- c("Class_Intervals", "Observed_Frequency", "Expected_Frequency", "Probability")
df
```

```
##   Class_Intervals Observed_Frequency Expected_Frequency Probability
## 1            0-10                 56          52.016842  0.50996904
## 2           10-20                 19          25.489863  0.24990062
## 3           20-30                 14          12.490822  0.12245904
## 4           30-40                  8           6.120889  0.06000872
## 5           40-50                  4           2.999425  0.02940613
## 6            > 50                  1           2.882158  0.02825645
```

```
#Chi-square test statistic
#df = (k-1-r) = (6-1-1) = 4; k = no. of obs, r = no. of parameters
chi <- (f - exp_freq)**2/exp_freq
sum(chi)
```

```
## [1] 4.279494
```

```
qchisq(0.95, 4)
```

```
## [1] 9.487729
```

Here, $4.28 < 9.48$, so we accept H_0 that the fit with $Exp(0.7132)$ is good.

To compare the expected and observed frequencies for each class intervals, we use the following bar diagrams and the line diagrams:

```
gg_obj <- ggplot(NULL, aes())
```