Lösungen Testat STOC SW07

Daniel Winz

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Inhaltsverzeichnis

1 Aufgabe 1

1.1 a

Die gesamte Fläche unter der Kurve muss einen Wert von 1 haben.

$$\rightarrow \frac{20 \cdot c}{2} = 1$$

$$\rightarrow c = \frac{2}{20} = 0.1$$

1.2 b

$$f(x) = m \cdot x + c$$

$$m = \frac{0.1}{20} = 0.005$$

$$c = 0.1$$

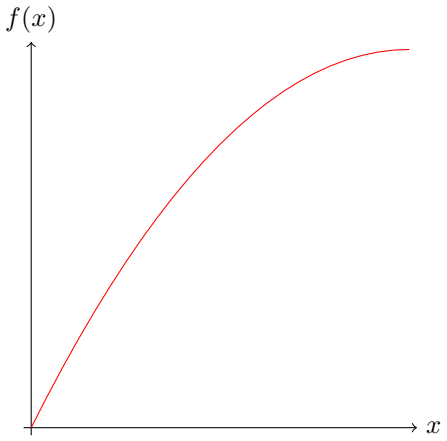
1. $X < 5$

$$P(X < 5) = \int_0^5 (-0.005 \cdot x + 0.1) dx = -0.0025 \cdot x^2 + 0.1 \cdot x|_0^5 = -0.0025 \cdot 5^2 + 0.1 \cdot 5 = 0.4375$$

2. $X < 10$

$$P(X < 10) = \int_0^{10} (-0.005 \cdot x + 0.1) dx = -0.0025 \cdot x^2 + 0.1 \cdot x|_0^{10} = -0.0025 \cdot 10^2 + 0.1 \cdot 10 = 0.75$$

1.3 c



1.4 d

Erwartungswert

$$E(X) = \int_{-\infty}^{\infty} x \cdot f(x) dx = \int_{-\infty}^{\infty} x \cdot (-0.005 \cdot x + 0.1) dx = \int_0^{20} (-0.005 \cdot x^2 + 0.1 \cdot x) dx$$

$$= \left(\frac{-0.005}{3} \cdot x^3 + 0.05 \cdot x^2 \right) \Big|_0^{20} = \frac{-0.005}{3} \cdot 20^3 + 0.05 \cdot 20^2 = 6.667$$

Median

$$P(X \leq q(0.5))$$

$$\int_0^x (-0.005 \cdot x + 0.1) dx \stackrel{!}{=} 0.5$$

$$-0.0025 \cdot x^2 + 0.1 \cdot x = 0.5$$

$$x = 5.858$$

Standardabweichung

$$\sigma_x = \sqrt{Var(x)} = \sqrt{E(X^2) - E(X)} = \sqrt{\int_0^{20} x^2 \left(0.1 \cdot \left(1 - \frac{x}{20}\right)\right) dx - \left(\frac{20}{3}\right)^2} = \sqrt{\frac{200}{9}} = 4.71$$

1.5 e

$P(K \leq 120'000) = P(40'000\sqrt{x} \leq 120'000) = P(\sqrt{x} \leq 3) = P(x \leq 9) = F(9) = 0.6975$

1.6 f

$$\lambda = \frac{1}{E} = \frac{1}{6.667} = 0.15$$

1.7 g

$$P(K \leq 120'000) = P(40'000\sqrt{x} \leq 120'000) = P(\sqrt{x} \leq 3) = P(x \leq 9)$$

```
> pexp(9,rate=0.15)

[1] 0.7407597
```

2 Aufgabe 2

```
> anz<-100
> x.rand <- runif(anz,min=-1,max=1)
> y.rand <- runif(anz,min=-1,max=1)
> rad.rand <- sqrt(x.rand^2 + y.rand^2)
> pi <- sum(rad.rand < 1)/anz*4
> pi

[1] 3.2
```

3 Aufgabe 3

3.1 a

Median

$$\frac{\ln(2)}{c} = \frac{\ln(2)}{0.04} 17.3287$$

Erwartungswert

$$\frac{1}{c} = \frac{1}{0.04} = 25$$

Lebensdauer

$$F(x) = 1 - e^{-cx} = 1 - e^{-0.04x}$$

3.2 b

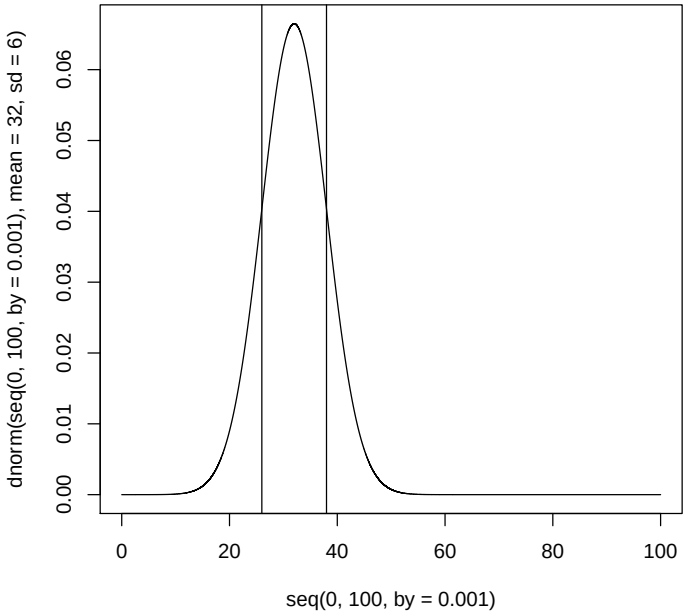
$$\begin{aligned}
&F(x = \mu \pm \sigma) \\
&= (1 - e^{-0.04(\mu+\sigma)}) - (1 - e^{-0.04(\mu-\sigma)}) \\
&= (1 - e^{-0.04(\mu+\sigma)}) - 1 + e^{-0.04(\mu-\sigma)} \\
&= e^{-0.04\mu} \cdot e^{-0.04\sigma} + e^{-0.04\mu} \cdot e^{0.04\sigma} \\
&= e^{-0.04\mu} \cdot \left(e^{-0.04\sigma} + e^{0.04\sigma}\right)
\end{aligned}$$

3.3 c

4 Aufgabe 4

4.1 a

```
> plot(seq(0,100,by=0.001),dnorm(seq(0,100,by=0.001),mean=32,sd=6),type='l')
> abline(v=26)
> abline(v=38)
```



4.2 b

```
> pnorm(40,mean=32,sd=6)
[1] 0.9087888
```

4.3 c

```
> pnorm(27,mean=32,sd=6)
[1] 0.2023284
```

4.4 d

```
> qnorm(0.975,mean=32,sd=6)
[1] 43.75978
```

4.5 e

```
> qnorm(0.1,mean=32,sd=6)
[1] 24.31069
```

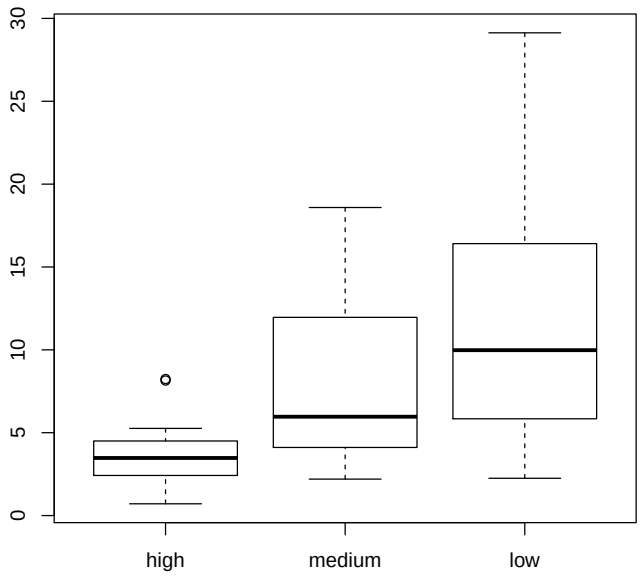
4.6 f

```
> pnorm(38,mean=32,sd=6)-pnorm(26,mean=32,sd=6)
[1] 0.6826895
```

5 Aufgabe 4

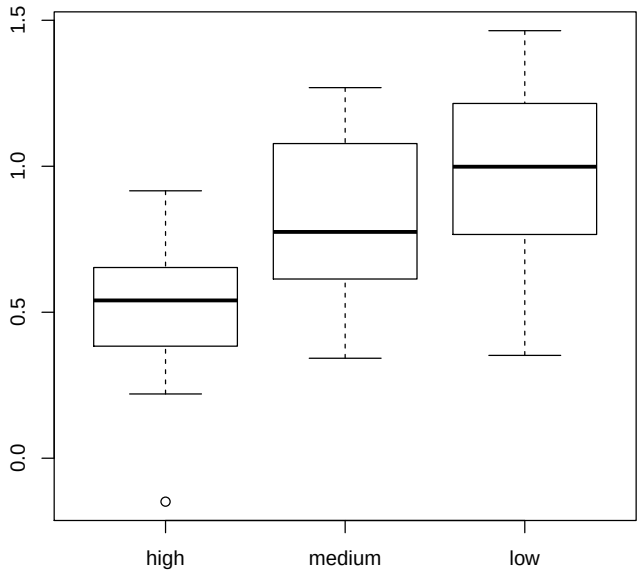
5.1 a

```
> iron<-read.table("ironF3.dat",header=TRUE)
> boxplot(iron[1:3])
```



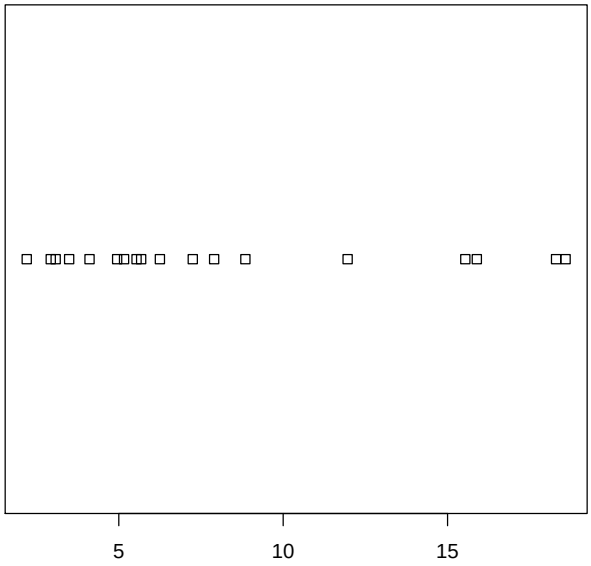
5.2 b

```
> iron.log=log10(iron)
> boxplot(iron.log[1:3])
```



5.3 c

```
> plot(iron[2])
```




```
> plot(iron.log[2])
```