sensorer øving 1

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Oppgave 1:

a

```
temps <- c(20.6,20.4,20.4,20.6,20.4,20.8,20.5,20.5,20.5,20.4,20.5,20.5,20.5,20.5,20.4,20.4,20.4,
20.5,20.3,20.6)
temps.mean <- mean(temps)
n<-length(temps)
"standard deviation"
```

```
## [1] "standard deviation"
```

```
temps.s <- sd(temps)
```

b

```
error <- qt(0.975,n-1)*temps.s/sqrt(n)
left<- temps.mean-error
right<- temps.mean+error
"95% confidence interval"
```

```
## [1] "95% confidence interval"
```

```
c(left,right)
```

```
## [1] 20.43401 20.53599
```

c

```
perror <- qt(0.975,n-1)
pleft<- temps.mean-perror*temps.s*sqrt(1+1/n)
pright<- temps.mean+perror*temps.s*sqrt(1+1/n)
"95% prediction interval"
```

```
## [1] "95% prediction interval"
```

```
c(pleft,pright)
```

```
## [1] 20.25135 20.71865
```

oppgave 2:

a, b

```
temps2<- c(20.4,20.4,20.4,20.2,20.4,20.3,20.4,20.5,20.4,20.4,20.4,20.4,20.1,20.3,20.3,20.2,20.3,
20.2,20.3,20.3)
temps2.mean <- mean(temps2)
n2<-length(temps2)
temps2.s <- sd(temps2)
error2 <- qt(0.975,n2-1)*temps2.s/sqrt(n2)
left2<- temps2.mean-error2
right2<- temps2.mean+error2
c(left2,right2)
```

```
## [1] 20.28419 20.37581
```

de to konfidens intervallene overlapper ikke, vi kan si det er signifikant forksjell på de to verdiene

c

```
temps3<-c(20.4,20.4,20.4,20.2,20.4,20.3,20.4,20.5,20.4,20.4)
temps3.mean=mean(temps3)
n3=length(temps3)
temps3.mean
```

```
## [1] 20.38
```

```
temps3.s <-sd(temps3)
err3 <- qt(0.975,n3-1)
left3 <-temps3.mean-err3
right3<- temps3.mean+err3
c(left3,right3)
```

```
## [1] 18.11784 22.64216
```

med bare de 10 første verdiene er intervallet for oppg 2 stort nok til at intervallet overlapper, vi kan da ikke si de er statistisk signifikant forskjellige.

oppgave 3:

a, b

```
maxval=1000*1.01
minval=1000*0.99
c(minval,maxval)
```

```
## [1]  990 1010
```

```
sd.1k_resistor = sqrt((maxval-minval)**2/12)
sd.1k_resistor
```

```
## [1] 5.773503
```

```
rel.sd.1kresistor=sd.1k_resistor*100/1000
rel.sd.1kresistor
```

```
## [1] 0.5773503
```

c

antar fortsatt 1% presisjon den nye sannsynlighetstettheten er gitt ved konvolusjonen av sannsynlighetstettheten til hver av de to andre, skalert for areal 1.

$$f(x) = 1/10(u(x-495) - u(x-505))$$
$$f(y) = Conv(f(x), f(x))$$
$$f(y) = 1/100((x-1010)u(x-1010) - 2(x-1000)u(x-1000) + (x-990)u(x-990)$$

f(y) blir en trekant funksjon fra 990-1010 med top på 0.1 ved 1000.

d

standard avviket er gitt ved

$$sd(x) = Var(x)^{1/2} = (E[x^2] - E[x]^2)^{1/2}$$
$$E[x] = 1000, frasymetri.$$
$$E[x^2] = \int_{990}^{1010} f(y)x^2 = 2013400 - 3040150 = \frac{3000050}{3}$$
$$Var(x) = \frac{3000050}{3} - 1000^2 = \frac{50}{3}$$
$$sd(x) = \sqrt{\overline{Var(x)}} = \sqrt{\frac{50}{3}} \implies \sqrt{\frac{50}{3}} * 100/1000 = 0.408\%$$