

SHC 798 Assignment 1, 2025

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Part 3: Simple regression

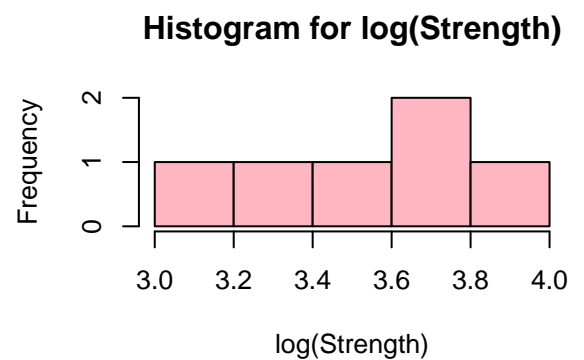
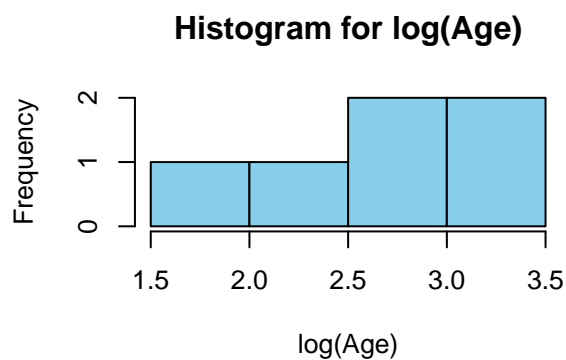
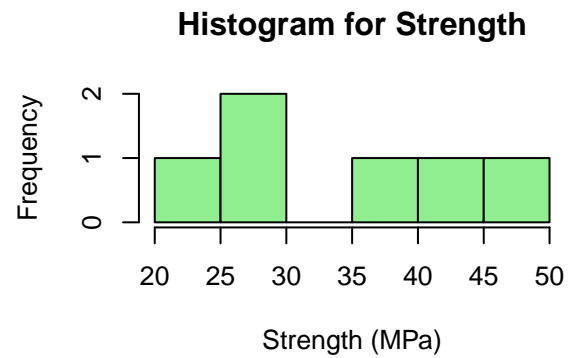
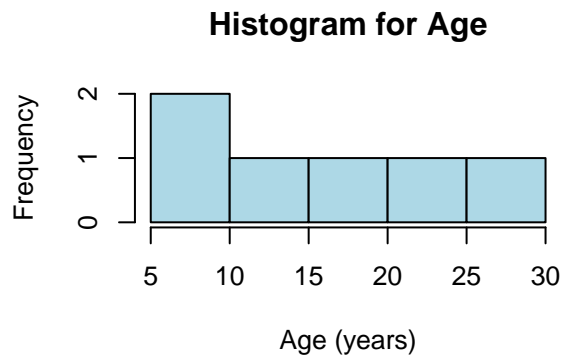
Question 4

Validating the Hand Calculations

```
age <- c(5, 10, 15, 20, 25, 30)
strength <- c(48, 42, 37, 30, 27, 21)
a_beams <- data.frame(age, strength)
```

```
par(mfrow = c(2,2))
hist(a_beams$age, main = "Histogram for Age", xlab = "Age (years)", col = "lightblue")
hist(a_beams$strength, main = "Histogram for Strength", xlab = "Strength (MPa)", col = "lightgreen")

#Applying natural logarithms
a.age <- log(a_beams$age)
a.strength <- log(a_beams$strength)
hist(a.age, main = "Histogram for log(Age)", xlab = "log(Age)", col = "skyblue")
hist(a.strength, main = "Histogram for log(Strength)", xlab = "log(Strength)", col = "lightpink")
```



(a) and (b)

```
par(mfrow = c(1,1))
```

```
log_beam <- lm(log(strength) ~ log(age), data = a_beams)
summary(log_beam)
```

(c)

```
##
## Call:
## lm(formula = log(strength) ~ log(age), data = a_beams)
##
## Residuals:
##      1      2      3      4      5      6
## -0.09818  0.06907  0.11826  0.03337  0.02484 -0.14736
##
## Coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept)  4.66776    0.21304   21.911 2.57e-05 ***
## log(age)    -0.43393    0.07683   -5.648  0.00484 **
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
```

```
## Residual standard error: 0.1138 on 4 degrees of freedom
## Multiple R-squared:  0.8886, Adjusted R-squared:  0.8607
## F-statistic: 31.9 on 1 and 4 DF, p-value: 0.004841
```

```
summary(log_beam)$r.squared
```

(d)

```
## [1] 0.8885725
```

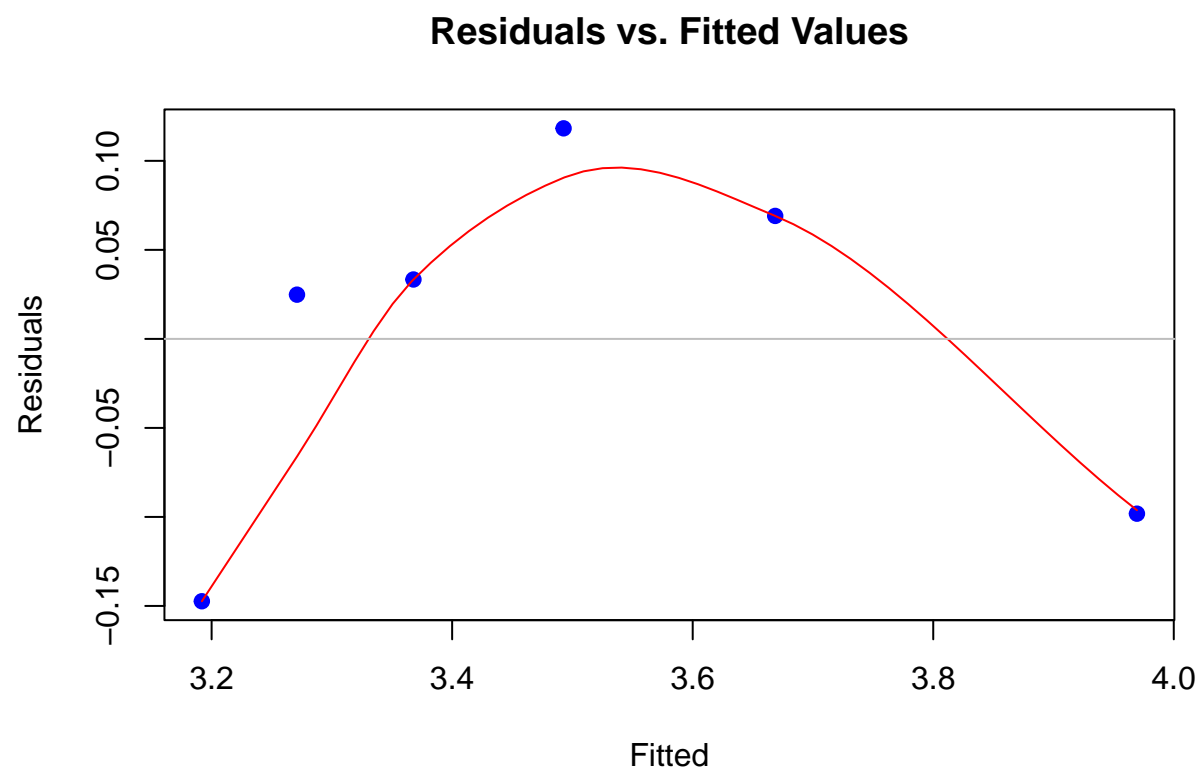
```
summary(log_beam)$coefficients["log(age)", "Pr(>|t|)"]
```

(e)

```
## [1] 0.00484069
```

####(f)

```
# Tukey-Anscombe Plot
plot(log_beam$fitted.values, log_beam$residuals, xlab="Fitted", ylab="Residuals", pch = 19, col = "blue",
      title("Residuals vs. Fitted Values") +
      lines(loess.smooth(log_beam$fitted.values, log_beam$residuals), col="red") +
      abline(h=0, col="grey"))
```



```
## integer(0)
```