babies

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babies

reference:
- Cannon, et al., Stat2, chapter 07, example 7.10

Import the data.

```
data <- read.csv("WalkingBabies.csv", header=TRUE)
head(data)
```

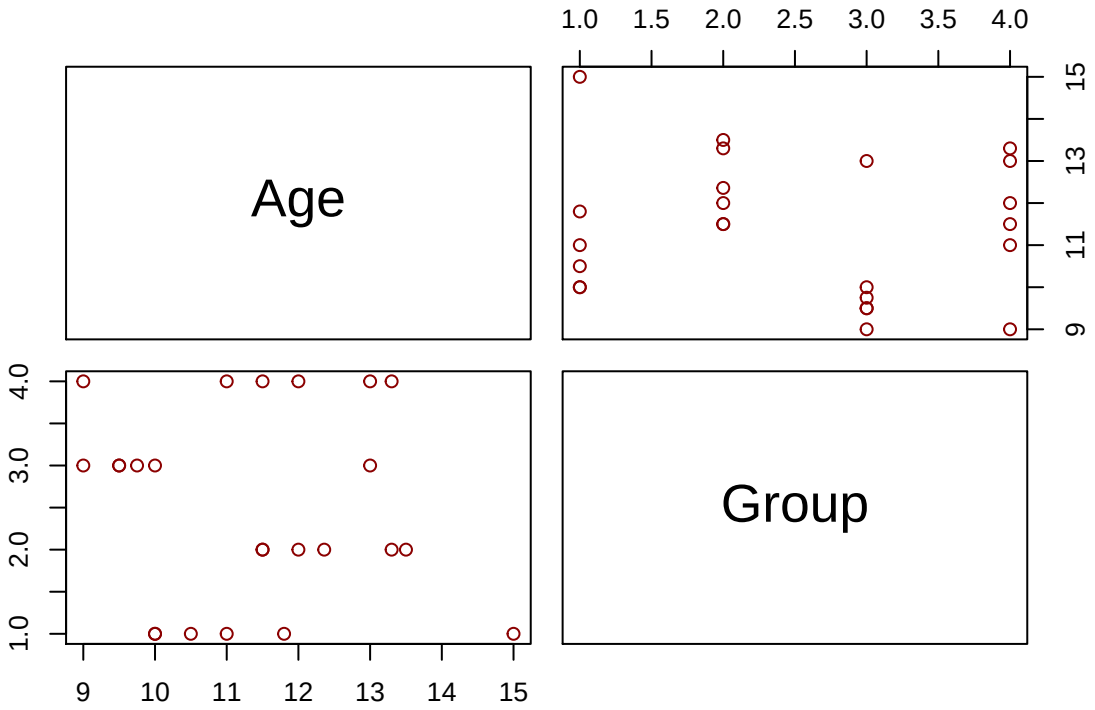
```
##                Group   Age
## 1 special exercises  9.00
## 2 special exercises  9.50
## 3 special exercises  9.75
## 4 special exercises 10.00
## 5 special exercises 13.00
## 6 special exercises  9.50
```

```
dim(data)
```

```
## [1] 24  2
```

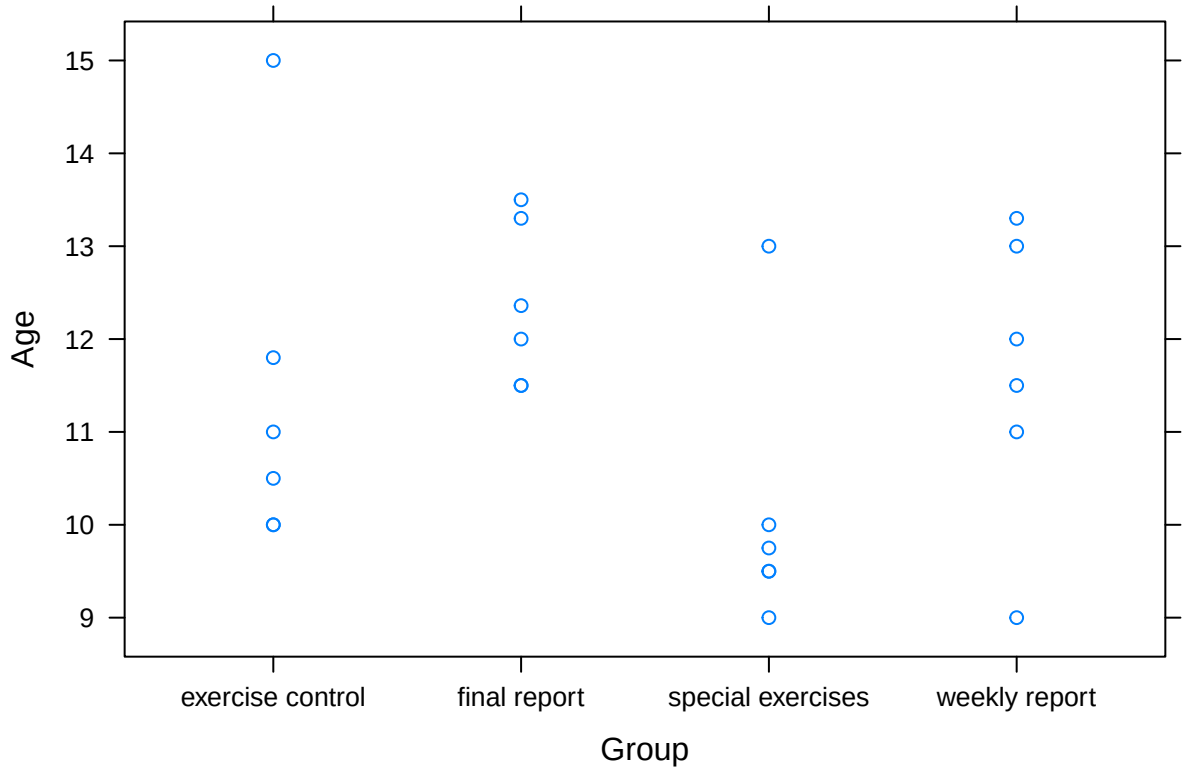
Scatterplot matrix.

```
pairs(~ Age + Group, data=data, col="darkred")
```



Use Lattice graphics to view the data.

```
library(lattice)
xyplot(Age ~ Group, data=data)
```



Standard deviations.

```
sd <- with(data, round(tapply(Age, Group, sd), 3))
sd
```

```
##  exercise control      final report special exercises     weekly report
##             1.898             0.871             1.447             1.558
```

```
max(sd) / min(sd)
```

```
## [1] 2.179104
```

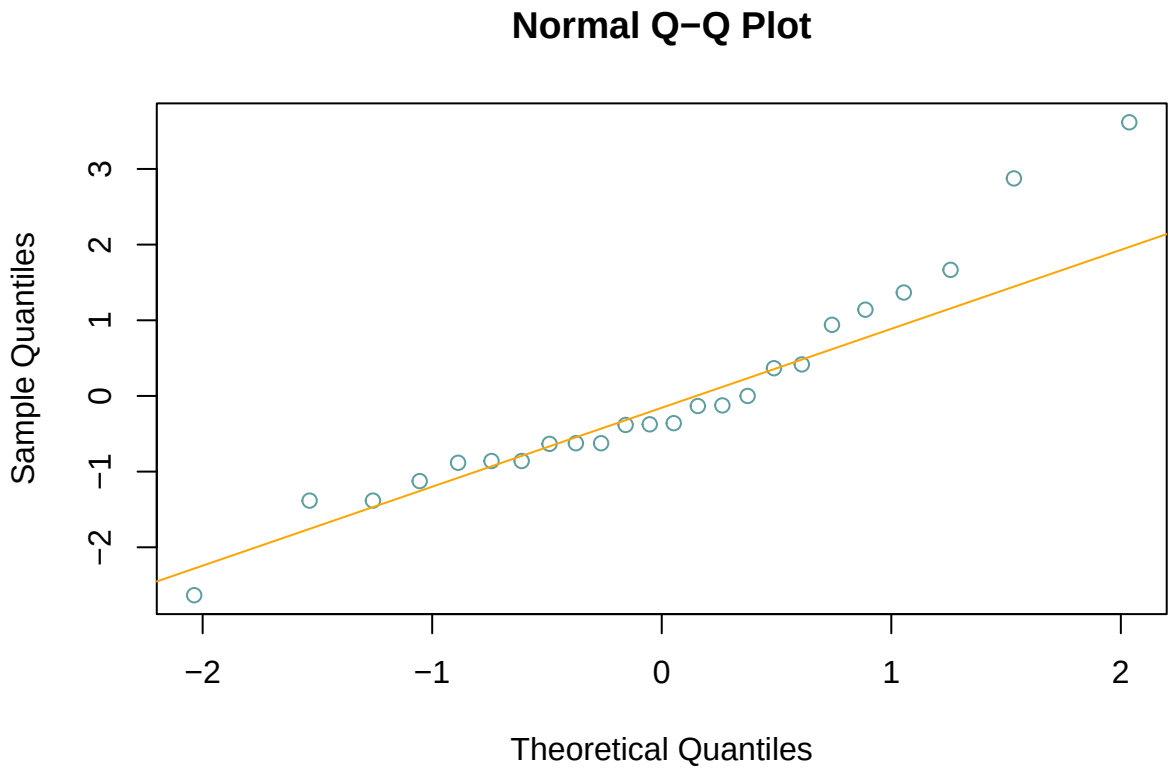
Linear model.

```
babies.aov <- aov(Age ~ Group, data=data)
options(show.signif.stars=FALSE)
summary(babies.aov)
```

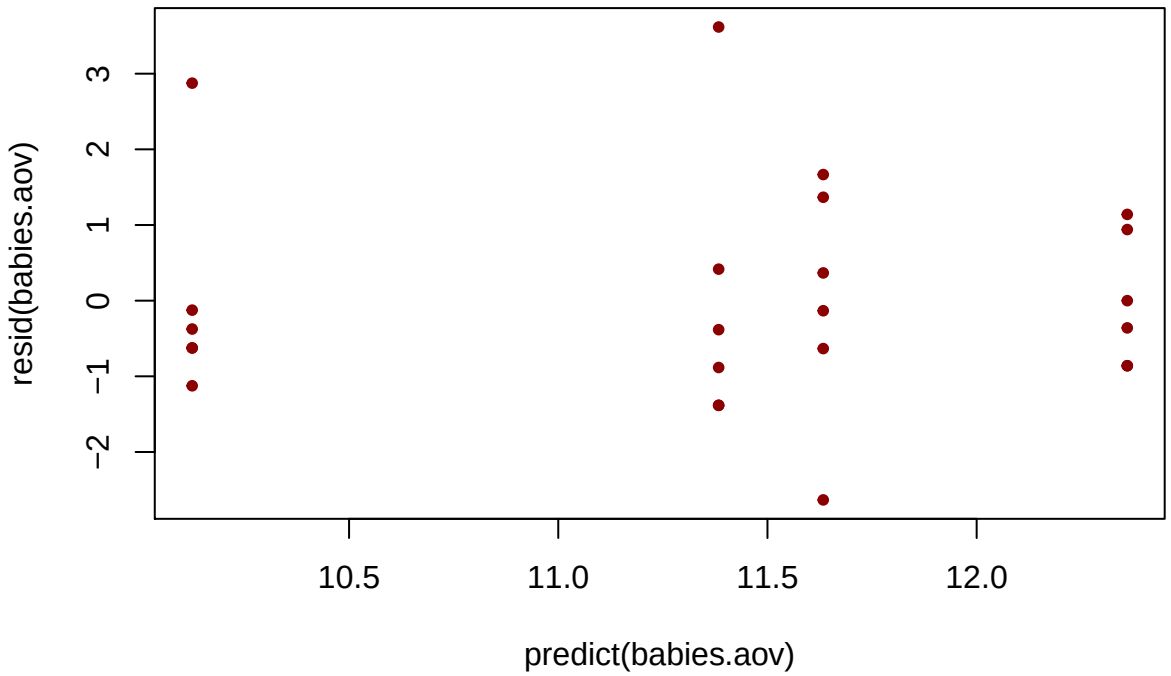
```
##             Df Sum Sq Mean Sq F value Pr(>F)
## Group        3   15.6   5.199   2.342  0.104
## Residuals   20   44.4   2.220
```

Residuals.

```
qqnorm(resid(babies.aov), col="cadetblue")
qqline(resid(babies.aov), col="orange")
```




```
plot(predict(babies.aov), resid(babies.aov),
     pch=20, col="darkred")
```



Comparison.

HT:

$$H_0 : \mu_{se} - \mu_{ce} = 0$$
$$H_a : \mu_{se} - \mu_{ce} \neq 0$$

```
means <-with(data,round(tapply(Age, Group, mean), 3))
means
```

```
##  exercise control      final report special exercises     weekly report
##            11.383            12.360            10.125            11.633
```

```
y.bar.se <- means[3]
y.bar.ec <- means[1]
mse <- 2.22  # from babies.aov
df <- 20
n.se <- n.ec <- 6
se <- sqrt(mse * (1^2 / n.se + (-1)^2 / n.ec))
t <- as.numeric((y.bar.se - y.bar.ec) / se)
t
```

```
## [1] -1.462395
```

```
p.value <- 2 * pt(t, df=df)
p.value
```

```
## [1] 0.1591701
```

Contrast.

HT:

$$H_0 : \frac{1}{2}(\mu_{se} + \mu_{ce}) - \frac{1}{2}(\mu_{wr} + \mu_{fr}) = 0$$
$$H_a : \frac{1}{2}(\mu_{se} + \mu_{ce}) - \frac{1}{2}(\mu_{wr} + \mu_{fr}) \neq 0$$

```
y.bar.wr <- means[4]
y.bar.fr <- means[2]
n.wr <- n.fr <- 6
contrast.estimate <- (1 / 2) * (y.bar.se + y.bar.ec) - (1 / 2) * (y.bar.wr + y.bar.fr)
se <- sqrt(mse * (1 / 2)^2 * (1 / n.se + 1 / n.ec + 1 / n.wr + 1 / n.fr))
t <- as.numeric(contrast.estimate / se)
t
```

```
## [1] -2.042657
```

```
p.value <- 2 * pt(t, df=df)
p.value
```

```
## [1] 0.05449111
```