

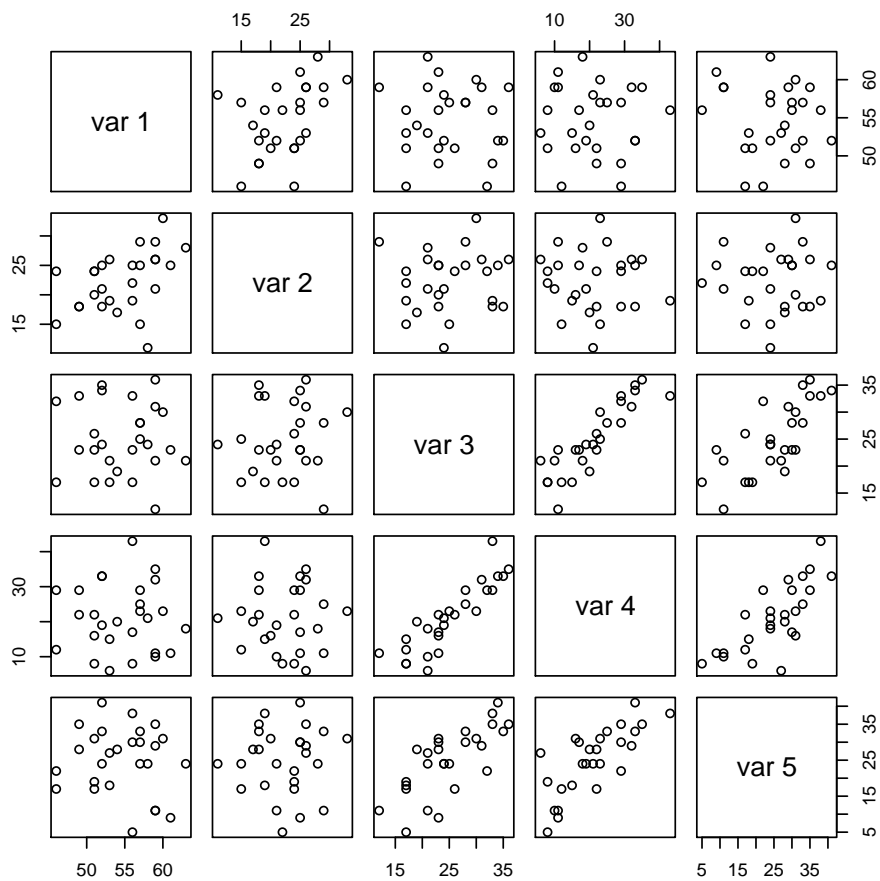
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Applied Statistics week 3.

1.

```
> pairs(weight, cex.labels = 1.5)
```



There is little correlation between initial weight and weight differences. The first week difference is also unrelated to the others but the differences in weeks 2,3,4 are highly positively correlated.

2.

```
> dif = weight[, 2:5]
> difbar = apply(dif, 2, mean)
> difbar

[1] 22.33333 24.92593 21.11111 24.96296

> difcov = var(dif)
> T2 = 27 * difbar %>% solve(difcov) %>% difbar
> T2

      [,1]
[1,] 922.0348

> F1 = ((27 - 4)/((27 - 1) * 4)) * T2
> F1

      [,1]
[1,] 203.9115

> 1 - pf(F1, 4, 27 - 4)

      [,1]
[1,] 0
```

There is a highly significant deviation from the hypothesis that the means of weekly increases are zero..

3.

```
> mat = matrix(c(-1, 1, 0, 0, 0, -1, 1, 0, 0, 0, -1, 1), 4, 3)
> ddif = dif %>% mat
> ddifbar = apply(ddif, 2, mean)
> ddifbar

[1] 2.592593 -3.814815 3.851852

> ddifcov = var(ddif)
> T22 = 27 * ddifbar %>% solve(ddifcov) %>% ddifbar
> T22

      [,1]
[1,] 35.0062

> F2 = (27 - 4 + 1)/((27 - 1) * (4 - 1)) * T22
> F2
```

```
      [,1]
[1,] 10.77114
```

```
> 1 - pf(F2, 3, 27 - 3)
```

```
      [,1]
[1,] 0.0001126584
```

This shows a highly significant deviation from the hypothesis that the weekly weight gains are equal.

4. Equality of weekly increases is the same as asserting that the weekly weight increases linearly.

5. Note that here it makes sense to use unstandardized variables.

```
> dif.pc = princomp(dif)
> round(dif.pc$sdev[1:2], 3)
```

```
Comp.1 Comp.2
13.413  5.054
```

```
> round(dif.pc$loadings[, 1:2], 3)
```

```
      Comp.1 Comp.2
[1,] -0.007  0.934
[2,] -0.431  0.041
[3,] -0.664 -0.258
[4,] -0.610  0.241
```

```
> round(diag(dif.pc$sdev[1:2]) %*% t(dif.pc$loadings[, 1:2]) %*%
+       diag(1/sqrt(diag(difcov))), 3)
```

```
      [,1] [,2] [,3] [,4]
[1,] -0.018 -0.896 -0.935 -0.893
[2,]  0.934  0.032 -0.137  0.133
```

The first PC depends only on the differences in weeks 2,3 and 4. The second depends only on the week 1 differences.