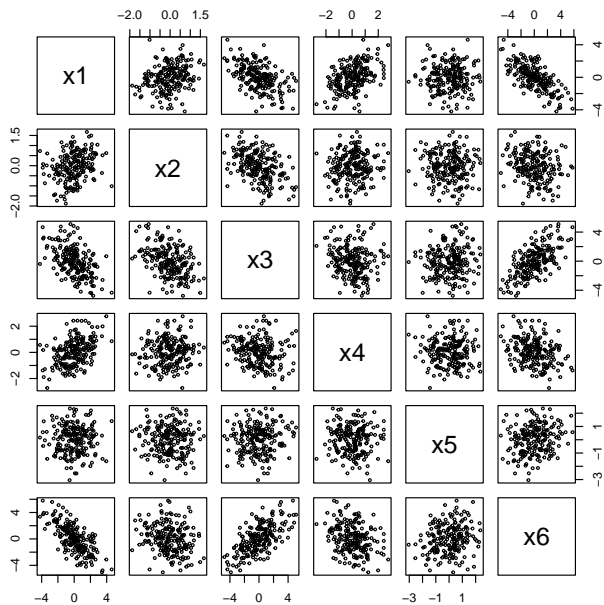# UG structure learning

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Data on six simulated variables

The data set

```r
source("simdat.R")

pairs(simdat,  pch = 1, cex = .5)
```



```r
su <- apply(simdat, 2, function(x) rbind(mean(x), sd(x)))
rownames(su) <- c("mean", "sd")
print(round(su, 3))
```

```
          x1     x2     x3    x4    x5    x6
mean  -0.006 -0.036 -0.049 0.041 0.029 0.030
sd     1.576  0.699  2.010 1.004 1.046 2.137
```

```
round(cor(simdat), 3)
```

```
       x1     x2     x3     x4     x5     x6
x1  1.000  0.265 -0.514  0.440  0.002 -0.717
x2  0.265  1.000 -0.423  0.075 -0.032 -0.226
x3 -0.514 -0.423  1.000 -0.158  0.082  0.655
x4  0.440  0.075 -0.158  1.000 -0.045 -0.301
x5  0.002 -0.032  0.082 -0.045  1.000  0.187
x6 -0.717 -0.226  0.655 -0.301  0.187  1.000
```

Partial correlations

```
S<- cov(simdat)
P <- parcor(S)
round(P, 3)
```

```
       x1     x2     x3     x4     x5     x6
x1  1.000  0.132 -0.046  0.347  0.205 -0.573
x2  0.132  1.000 -0.365 -0.018 -0.037  0.141
x3 -0.046 -0.365  1.000  0.074 -0.044  0.485
x4  0.347 -0.018  0.074  1.000 -0.057 -0.005
x5  0.205 -0.037 -0.044 -0.057  1.000  0.257
x6 -0.573  0.141  0.485 -0.005  0.257  1.000
```

```
G <- 0+(abs(P)>0.05)
diag(G) <- 0
drawGraph(G, layout = layout_in_circle)
```
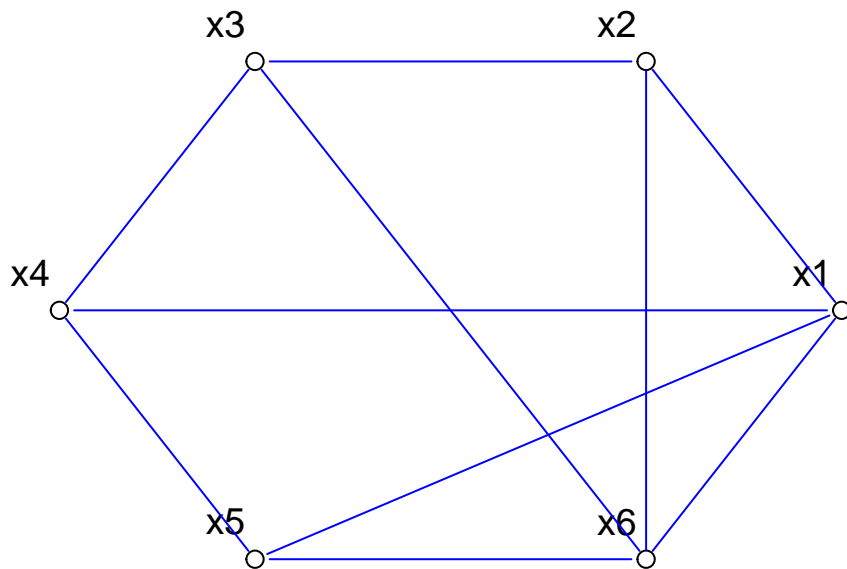
MLE fit graph of G

```
out <- fitConGraph(G,S, n = ncol(simdat))
out
```

```
$Shat
            x1           x2          x3          x4           x5         x6
x1  2.485218932  0.291400308 -1.5457704  0.69693839  0.002859092 -2.4147010
x2  0.291400308  0.487919173 -0.5933878  0.06524697 -0.008774948 -0.3367596
x3 -1.545770407 -0.593387850  4.0395543 -0.31966182  0.240089720  2.8129414
x4  0.696938390  0.065246971 -0.3196618  1.00875647 -0.047098406 -0.6454886
x5  0.002859092 -0.008774948  0.2400897 -0.04709841  1.093722417  0.4179746
x6 -2.414701046 -0.336759557  2.8129414 -0.64548858  0.417974557  4.5688786

$dev
[1] 0.03685723

$df
[1] 5

$it
[1] 4
```

Concentration matrix

```
Khat <- solve(out$Shat)
round(Khat,3)
```

```
       x1     x2     x3     x4     x5     x6
x1  0.997 -0.220  0.000 -0.380 -0.202  0.476
x2 -0.220  2.566  0.424  0.000  0.000 -0.188
x3  0.000  0.424  0.506 -0.051  0.000 -0.287
x4 -0.380  0.000 -0.051  1.241  0.066  0.000
x5 -0.202  0.000  0.000  0.066  0.990 -0.188
x6  0.476 -0.188 -0.287  0.000 -0.188  0.651
```

Check decomposability

```
is.triangulated(G)
```

```
[1] FALSE
```