

# Assignment3

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## Problem 1

## Problem 2

```
# simulate data from a given MRF independence model
set.seed(123)
K <- cbind(c(10,7,7,0),c(7,20,0,7),c(7,0,30,7),c(0,7,7,40))
data <- as.data.frame(mvrnorm(n=10000,mu=c(0,0,0,0),Sigma=solve(K)))
colnames(data) <- c("X1","X2","X3","X4")

# fit the model (estimate the precision matrix subject to the graph constraints)
library(gRim)
# glist <- list()
# ddd <- cov.wt(data, method="ML")
# fit <- ggmlfit(ddd$cov, ddd$n.obs, glist) # Estimate parameters using IPF
# fit$K # estimated precision matrix
```

## Problem 3

```
# Gaussian Bayesian Network model
# covariance matrix
set.seed(123)
Sig <- cbind(c(3,-1.4,0,0),c(-1.4,3,1.4,1.4),c(0,1.4,3,0),c(0,1.4,0,3))
data <- as.data.frame(mvrnorm(n=10000,mu=c(0,0,0,0),Sigma=Sig))
colnames(data) <- c("X1","X2","X3","X4")
```

DAG  $\mathcal{G}$ :  $X_1 \rightarrow X_2 \leftarrow X_3$  and  $X_4 \rightarrow X_2$

- (a)
- (b)
- (c)

## Problem 4

```
library(dagitty)

# simulate 10000 observations from the following graph
g <- dagitty( "dag{ x <- u1; u1 -> m <- u2 ; u2 -> y }" )
```

## Problem 5

