This is a WinBUGS program for the real example in Chapter 6, Section 6.6.2.

Model: Structural Equation Model with Ordered Categorical Variables
Data Set Names: YO.dat, and XI.dat, where XI.dat are input initial values for xi.
Sample Size: N=338

```
model{
   for(i in 1:N){
      #measurement equation model
      for(j in 1:P){
         y[i,j]~dnorm(mu[i,j],psi[j])I(thd[j,z[i,j]],thd[j,z[i,j]+1])
         ephat[i,j]<-y[i,j]-mu[i,j]
      }
      mu[i,1]<-eta[i]
      mu[i,2]<-lam[1]*eta[i]
      mu[i,3]<-xi[i,1]
      mu[i,4]<-lam[2]*xi[i,1]
      mu[i,5]<-lam[3]*xi[i,1]
      mu[i,6]<-lam[4]*xi[i,1]
      mu[i,7]<-lam[5]*xi[i,1]
      mu[i,8]<-lam[6]*xi[i,1]
      mu[i,9]<-lam[7]*xi[i,1]
      mu[i,10]<-xi[i,2]
      mu[i,11]<-lam[8]*xi[i,2]
      mu[i,12]<-lam[9]*xi[i,2]
      mu[i,13]<-lam[10]*xi[i,2]
      mu[i,14]<-lam[11]*xi[i,2]
      mu[i,15]<-lam[12]*xi[i,2]
      mu[i,16]<-xi[i,3]
      mu[i,17]<-lam[13]*xi[i,3]
      mu[i,18]<-lam[14]*xi[i,3]
      mu[i,19]<-xi[i,4]
      mu[i,20]<-lam[15]*xi[i,4]
      mu[i,21]<-lam[16]*xi[i,4]
      mu[i,22]<-lam[17]*xi[i,4]
      mu[i,23]<-lam[18]*xi[i,4]
      mu[i,24]<-lam[19]*xi[i,4]
      mu[i,25]<-lam[20]*xi[i,4]
      mu[i,26]<-lam[21]*xi[i,4]


      #structural equation model
      xi[i,1:4]~dmnorm(u[1:4],phi[1:4,1:4])
      eta[i]~dnorm(nu[i],psd)
      nu[i]<-gam[1]*xi[i,1]+gam[2]*xi[i,2]+gam[3]*xi[i,3]+gam[4]*xi[i,4]
      dthat[i]<-eta[i]-nu[i]
   }# end of i

   for(i in 1:4){u[i]<-0.0}

   #priors on loadings and coefficients
   var.lam[1]<-4.0*psi[2]      var.lam[2]<-4.0*psi[4]      var.lam[3]<-4.0*psi[5]
   var.lam[4]<-4.0*psi[6]      var.lam[5]<-4.0*psi[7]      var.lam[6]<-4.0*psi[8]
   var.lam[7]<-4.0*psi[9]      var.lam[8]<-4.0*psi[11]     var.lam[9]<-4.0*psi[12]
   var.lam[10]<-4.0*psi[13]    var.lam[11]<-4.0*psi[14]    var.lam[12]<-4.0*psi[15]
```

```
    var.lam[13]<-4.0*psi[17]      var.lam[14]<-4.0*psi[18]   var.lam[15]<-4.0*psi[20]
    var.lam[16]<-4.0*psi[21]      var.lam[17]<-4.0*psi[22]   var.lam[18]<-4.0*psi[23]
    var.lam[19]<-4.0*psi[24]      var.lam[20]<-4.0*psi[25]   var.lam[21]<-4.0*psi[26]
    for(i in 1:21){lam[i]~dnorm(0.8,var.lam[i])}

    var.gam<-4.0*psd
    gam[1]~dnorm(0.6,var.gam)    gam[2]~dnorm(0.6,var.gam)
    gam[3]~dnorm(0.4,var.gam)    gam[4]~dnorm(0.4,var.gam)

    #priors on precisions
    for(j in 1:P){
       psi[j]~dgamma(10,8)
       sgm[j]<-1/psi[j]
    }
    psd~dgamma(10,8)
    sgd<-1/psd
    phi[1:4,1:4]~dwish(R[1:4,1:4], 30)
    phx[1:4,1:4]<-inverse(phi[1:4,1:4])

} #end of model
```

Data Set

```
list(N=338, P=26,
   R=structure(
       .Data=c(8.0, 0.0, 0.0, 0.0,
               0.0, 8.0, 0.0, 0.0,
               0.0, 0.0, 8.0, 0.0,
               0.0, 0.0, 0.0, 8.0),
      .Dim=c(4,4)),
    thd=structure(
          .Data=c(-200.000,-2.517,-1.245,-0.444, 0.848,200.000,
-200.000,-1.447,-0.420, 0.119, 1.245,200.000,
-200.000,-1.671,-0.869,-0.194, 0.679,200.000,
-200.000,-1.642,-0.869,-0.293, 0.332,200.000,
-200.000,-1.671,-0.827, 0.052, 0.756,200.000,
-200.000,-1.769,-1.098,-0.469, 0.255,200.000,
-200.000,-1.490,-0.670,-0.082, 0.880,200.000,
-200.000,-1.933,-0.880,-0.317, 1.008,200.000,
-200.000,-1.587,-0.624, 0.000, 1.008,200.000,
-200.000,-1.983,-1.348,-0.348, 1.045,200.000,
-200.000,-1.983,-1.229,-0.247, 0.869,200.000,
-200.000,-2.262,-1.426, 0.037, 1.330,200.000,
-200.000,-2.371,-1.295,-0.224, 0.651,200.000,
-200.000,-2.039,-1.112,-0.149, 1.169,200.000,
-200.000,-2.262,-1.198,-0.309, 1.198,200.000,
-200.000,-2.176,-1.537,-0.717, 0.597,200.000,
-200.000,-1.447,-0.786, 0.119, 1.008,200.000,
-200.000,-2.039,-1.769,-0.661, 0.642,200.000,
-200.000,-2.262,-1.468, 0.015, 1.214,200.000,
-200.000,-2.039,-1.406, 0.000, 1.140,200.000,
-200.000,-1.702,-1.058, 0.149, 0.902,200.000,
-200.000,-2.262,-1.426,-0.309, 0.971,200.000,
-200.000,-1.702,-0.615, 0.179, 1.229,200.000,
-200.000,-2.262,-1.671,-1.033, 0.420,200.000,
-200.000,-2.262,-1.468,-0.689, 1.045,200.000,
-200.000,-2.176,-1.537,-0.880, 0.661,200.000),
```

```
        .Dim=c(26,6)),
    z=structure(
       .Data=c(paste YO.dat here),
       .Dim=c(338,26)))
```

Two different Initial Values

```
list(
   lam=c(0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0,
0.0),
   psi=c(1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0,
1.0, 1.0, 1.0, 1.0, 1.0, 1.0),
   psd=1.0,
   gam=c(1.0, 1.0, 1.0, 1.0),
   phi=structure(
      .Data=c(1.0, 0.0, 0.0, 0.0,
                0.0, 1.0, 0.0, 0.0,
                0.0, 0.0, 1.0, 0.0,
                0.0, 0.0, 0.0, 1.0),
      .Dim=c(4,4)),
   xi=structure(
       .Data=c(paste XI.dat here),
       .Dim=c(338,4)))

list(
   lam=c(0.5, 0.5, 0.5, 0.5, 0.5, 0.5, 0.5, 0.5, 0.5, 0.5, 0.5, 0.5, 0.5, 0.5, 0.5, 0.5, 0.5, 0.5, 0.5, 0.5, 0.5,
0.5),
   psi=c(0.5, 0.5, 0.5, 0.5, 0.5, 0.5, 0.5, 0.5, 0.5, 0.5, 0.5, 0.5, 0.5, 0.5, 0.5, 0.5, 0.5, 0.5, 0.5, 0.5, 0.5,
0.5, 0.5, 0.5, 0.5, 0.5, 0.5),
   psd=0.6,
   gam=c(0.0, 0.0, 0.0, 0.0),
   phi=structure(
      .Data=c(0.5, 0.0, 0.0, 0.0,
                0.0, 0.5, 0.0, 0.0,
                0.0, 0.0, 0.5, 0.0,
                0.0, 0.0, 0.0, 0.5),
      .Dim=c(4,4)),
    xi=structure(
       .Data=c(paste XI.dat here),
        .Dim=c(338,4)))
```