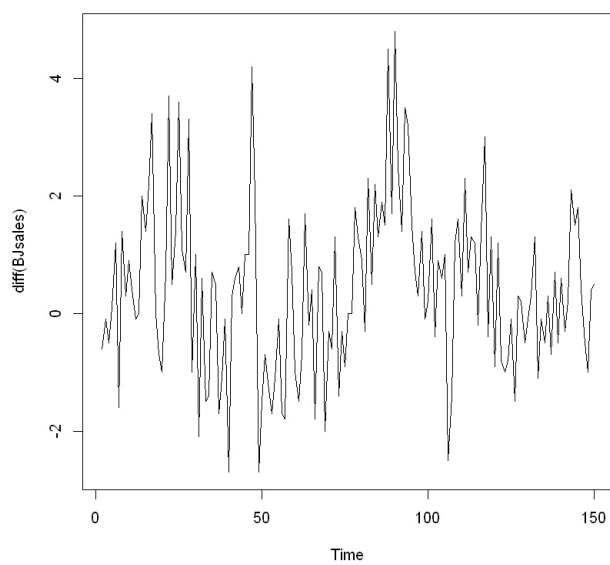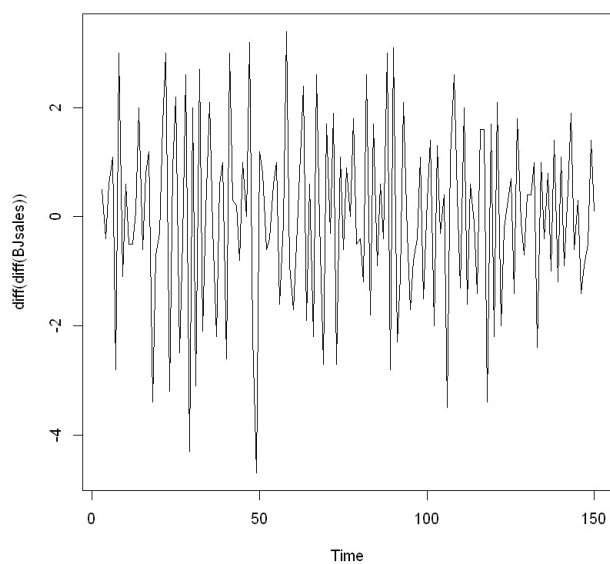In [2]: `plot(BJsales)`
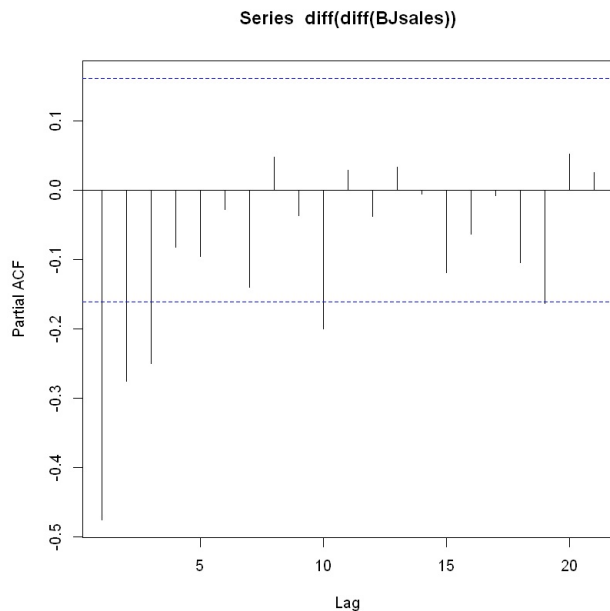

In [3]: `plot(diff(BJsales))`

In [4]: `plot(diff(diff(BJsales)))`

```
In [5]: pacf(diff(diff(BJsales)))
```


Series diff(diff(BJsales))

```
In [6]: acf(diff(diff(BJsales)))
```


Series diff(diff(BJsales))
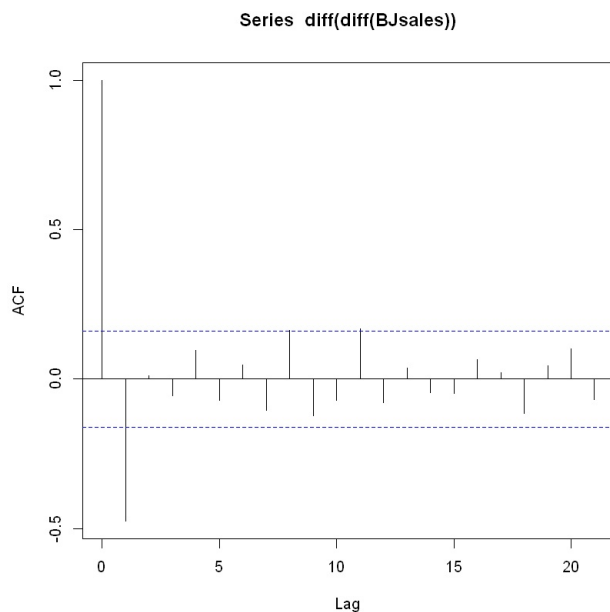
```
In [7]: d=2
        for(p in 1:4){
          for(q in 1:2){
              if(p+d+q<=6){
                model<-arima(x=BJsales, order = c((p-1),d,(q-1)))
                pval<-Box.test(model$residuals, lag=log(length(model$residuals)))
                sse<-sum(model$residuals^2)
                cat(p-1,d,q-1, 'AIC=', model$aic, ' SSE=',sse,' p-VALUE=', pval$p.value,'\n')
              }
            }
        }

        0 2 0 AIC= 577.6777  SSE= 423.7908  p-VALUE= 7.610494e-07
        0 2 1 AIC= 517.1371  SSE= 276.2293  p-VALUE= 0.9632467
        1 2 0 AIC= 541.9646  SSE= 327.92   p-VALUE= 0.003606979
        1 2 1 AIC= 518.9734  SSE= 275.8554  p-VALUE= 0.941776
        2 2 0 AIC= 532.2986  SSE= 302.7467  p-VALUE= 0.05824473
```

```
In [8]: d=2
        for(p in 1:4){
          for(q in 1:2){
              if(p+d+q<=8){
                model<-arima(x=BJsales, order = c((p-1),d,(q-1)))
                pval<-Box.test(model$residuals, lag=log(length(model$residuals)))
                sse<-sum(model$residuals^2)
                cat(p-1,d,q-1, 'AIC=', model$aic, ' SSE=',sse,' p-VALUE=', pval$p.value,'\n')
              }
            }
```

```
        }
```

```
0 2 0 AIC= 577.6777  SSE= 423.7908  p-VALUE= 7.610494e-07
0 2 1 AIC= 517.1371  SSE= 276.2293  p-VALUE= 0.9632467
1 2 0 AIC= 541.9646  SSE= 327.92   p-VALUE= 0.003606979
1 2 1 AIC= 518.9734  SSE= 275.8554  p-VALUE= 0.941776
2 2 0 AIC= 532.2986  SSE= 302.7467  p-VALUE= 0.05824473
2 2 1 AIC= 520.2684  SSE= 274.0474  p-VALUE= 0.795544
3 2 0 AIC= 524.7648  SSE= 283.4941  p-VALUE= 0.7035291
3 2 1 AIC= 519.4182  SSE= 264.0684  p-VALUE= 0.6948066
```

In [12]:
```r
model<-arima(BJsales, order=c(0,2,1))

par(mfrow=c(2,2))

plot(model$residuals)
acf(model$residuals)
pacf(model$residuals)
qqnorm(model$residuals)
```
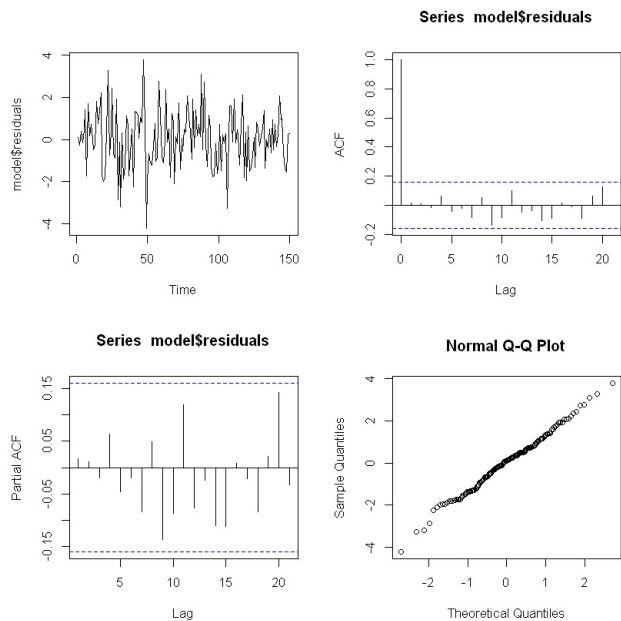

In [16]:
```r
library(astsa)
sarima(BJsales,0,2,1,0,0,0)
```

```
initial  value 0.525918
iter   2 value 0.353629
iter   3 value 0.330007
iter   4 value 0.329249
iter   5 value 0.315928
iter   6 value 0.313389
iter   7 value 0.312977
iter   8 value 0.312970
iter   9 value 0.312965
iter   9 value 0.312965
iter   9 value 0.312965
final  value 0.312965
converged
initial  value 0.314633
iter   1 value 0.314633
final  value 0.314633
converged
```

```
$fit

Call:
arima(x = xdata, order = c(p, d, q), seasonal = list(order = c(P, D, Q), period = S),
    include.mean = !no.constant, transform.pars = trans, fixed = fixed, optim.control = list(trace = trc,
        REPORT = 1, reltol = tol))

Coefficients:
          ma1
      -0.7480
s.e.   0.0662

sigma^2 estimated as 1.866:  log likelihood = -256.57,  aic = 517.14

$degrees_of_freedom
[1] 147

$ttable
    Estimate    SE  t.value p.value
ma1   -0.748 0.0662 -11.3045       0

$AIC
[1] 3.49417

$AICc
[1] 3.494355

$BIC
[1] 3.534672
```