individual assignment 5

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```r
#(a)
set.seed(1)
x=rnorm(100)
noise=rnorm(100)
```

In this chunk, I generate a predictor x and noise vector by rnorm() function.

```r
#(b)

y=10+3*x+4*x^2+5*x^3+noise
```

In this chunk, I choose intercept as 10 and the three coefficients for x to x^3 are 3,4,5 respectively.

```r
#(c)
library(leaps)
newdata=data.frame(cbind(x,y))
newdata=data.frame(cbind(y,poly(x,10)))

regfit.best=regsubsets(y~.,data=newdata,nvmax=10)
reg.summary=summary(regfit.best)
names(reg.summary)
```

```
## [1] "which"  "rsq"    "rss"    "adjr2" "cp"     "bic"    "outmat" "obj"
```

```r
#check with adjusted R square
which.max(reg.summary$adjr2)
```

```
## [1] 5
```

```r
plot(reg.summary$adjr2,xlab="number of predictors",ylab="adjusted RSq",type="l")
points(5,reg.summary$adjr2[5],col="red",cex=2,pch=20)
```
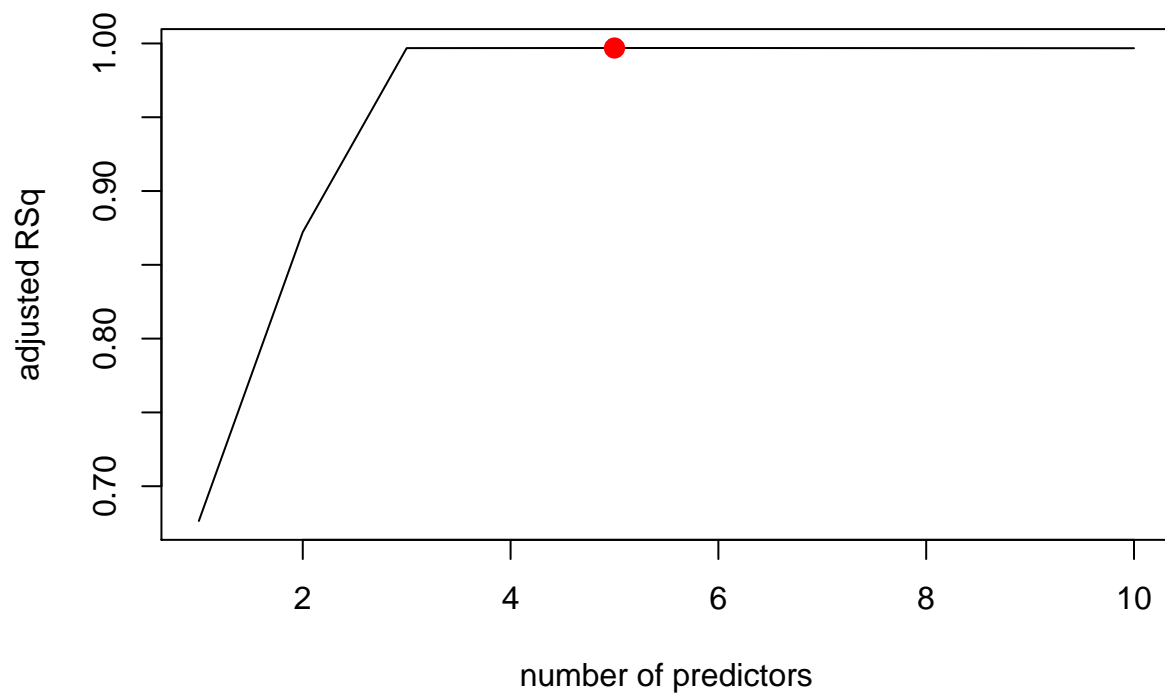
```r
coef(regfit.best,id=5)
```

```
## (Intercept)          X1          X2          X3          X4          X5
##   14.584237   140.267685    59.466313    75.130049     1.257095     1.480188
```
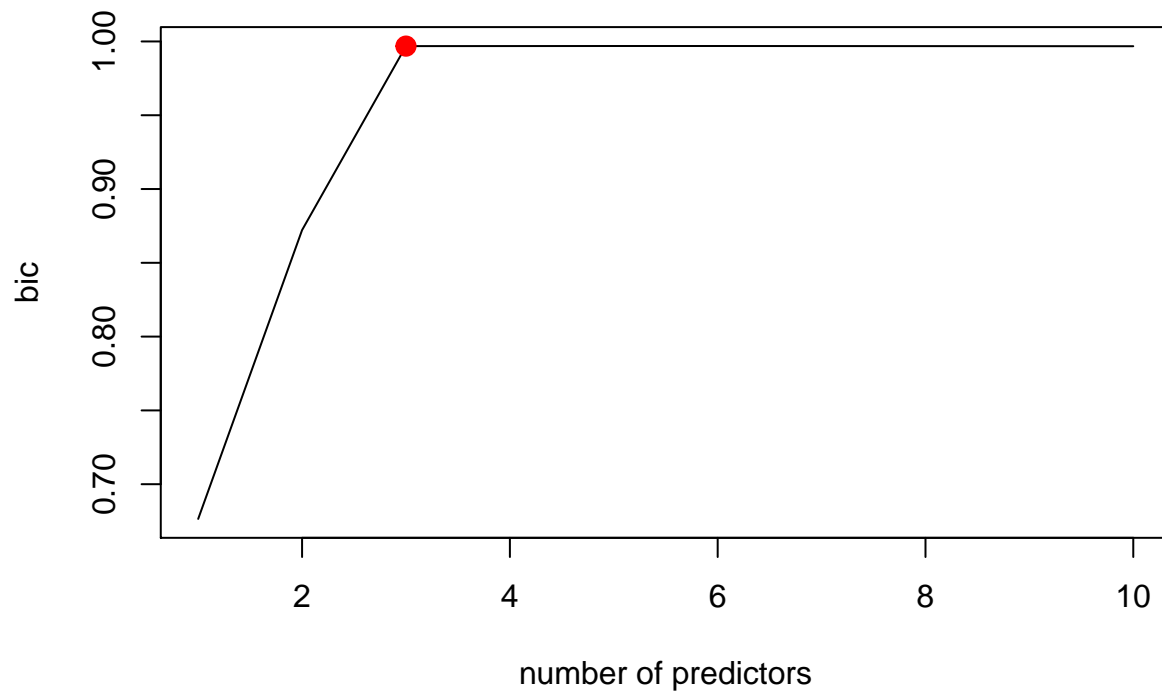
```r
#check with bic
which.min(reg.summary$bic)
```

```
## [1] 3
```

```r
plot(reg.summary$adjr2,xlab="number of predictors",ylab="bic",type="l")
points(3,reg.summary$adjr2[3],col="red",cex=2,pch=20)
```

```r
coef(regfit.best,id=3)
```

```
## (Intercept)          X1          X2          X3
##    14.58424    140.26769    59.46631    75.13005
```
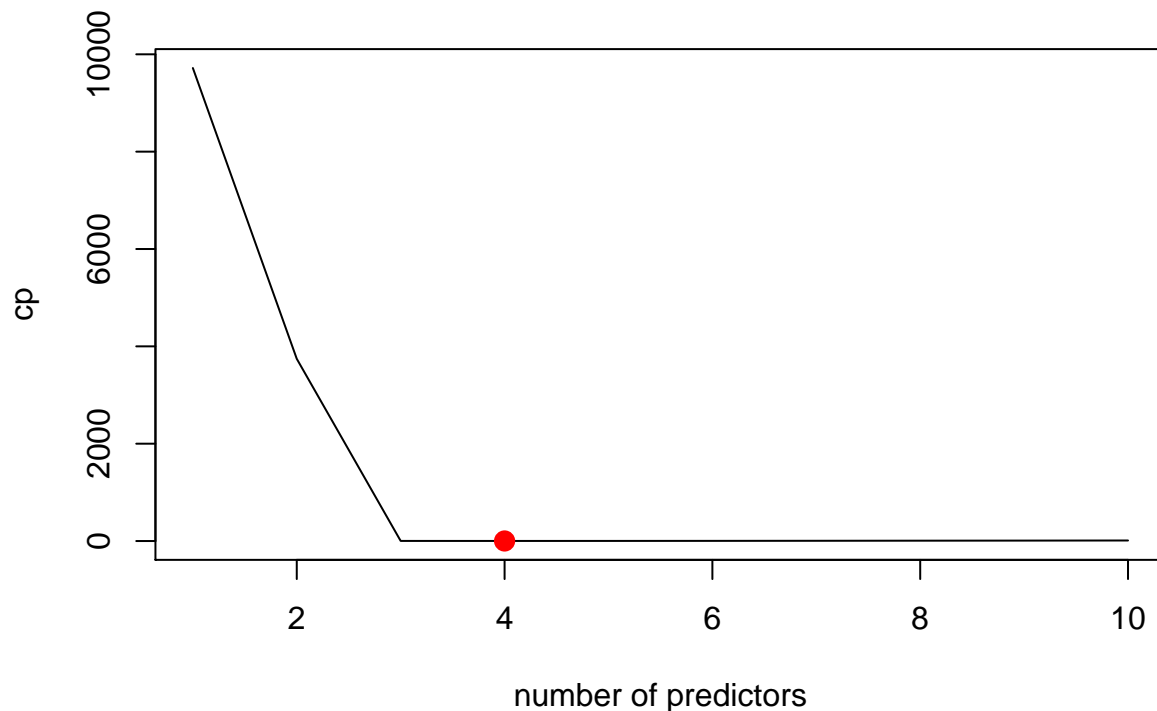
```r
#check with cp
which.min(reg.summary$cp)
```

```
## [1] 4
```

```r
plot(reg.summary$cp,xlab="number of predictors",ylab="cp",type="l")
points(4,reg.summary$adjr2[3],col="red",cex=2,pch=20)
```

```
coef(regfit.best,id=4)
```

```
## (Intercept)          X1          X2          X3          X5
##    14.584237   140.267685    59.466313    75.130049     1.480188
```

In this chunk, we can see that, from Cp, the best model is with 4 predictors, the coefficients are 14.584237 for intercept, 140.267685 for X1, 59.466313 for X2, 75.130049 for X3, 1.480188 for X5.

From BIC, the best model is with 3 predictors.The coefficients are 14.58424 for intercept, 140.26769 for x1, 59.46631 for x2,75.13005 for x3.

And from adjusted r square, the best model is with 5 predictors, which can be proved by the plot after that. The coefficients are 14.584237 for intercept, 140.267685 for x1, 59.466313 for x2, 75.130049 for x3, 1.257095 for x4, 1.480188 for x5.

```
#(d)
#using forward stepwise selection
forward.fit=regsubsets(y~.,data=newdata,nvmax=10,method="forward")
summary.fwd=summary(forward.fit)

#check with adjusted R square
which.max(summary.fwd$adjr2)
```

```
## [1] 5
```

```
plot(summary.fwd$adjr2,xlab="number of predictors",ylab="adjusted RSq",type="l")
points(5,summary.fwd$adjr2[5],col="red",cex=2,pch=20)
```
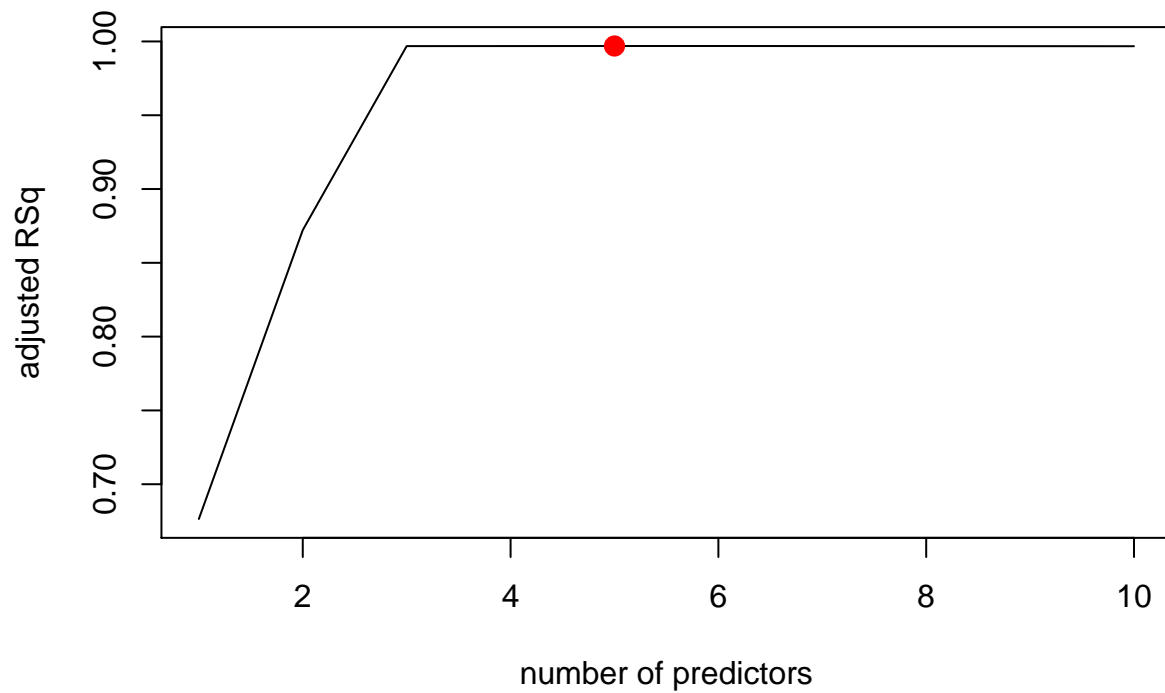
```
coef(forward.fit,id=5)
```

```
## (Intercept)           X1           X2           X3           X4           X5
##    14.584237   140.267685    59.466313    75.130049     1.257095     1.480188
```
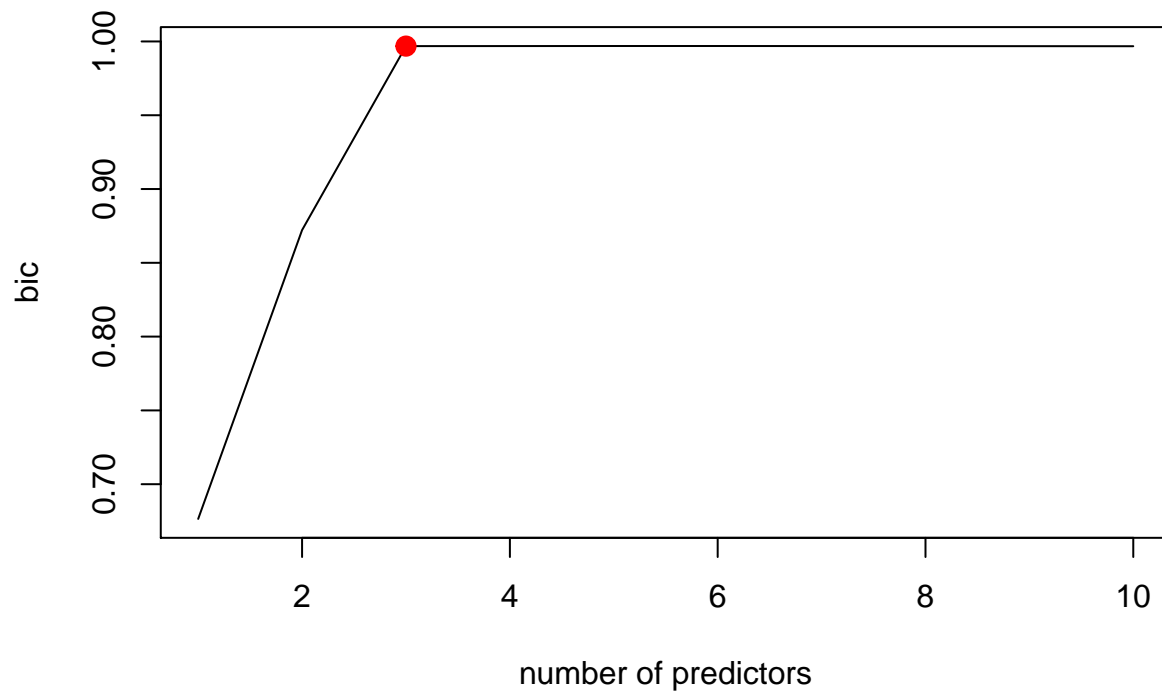
```
#check with bic
which.min(summary.fwd$bic)
```

```
## [1] 3
```

```
plot(summary.fwd$adjr2,xlab="number of predictors",ylab="bic",type="l")
points(3,summary.fwd$adjr2[3],col="red",cex=2,pch=20)
```

number of predictors

```
coef(forward.fit,id=3)
```

```
## (Intercept)          X1          X2          X3
##    14.58424   140.26769    59.46631    75.13005
```
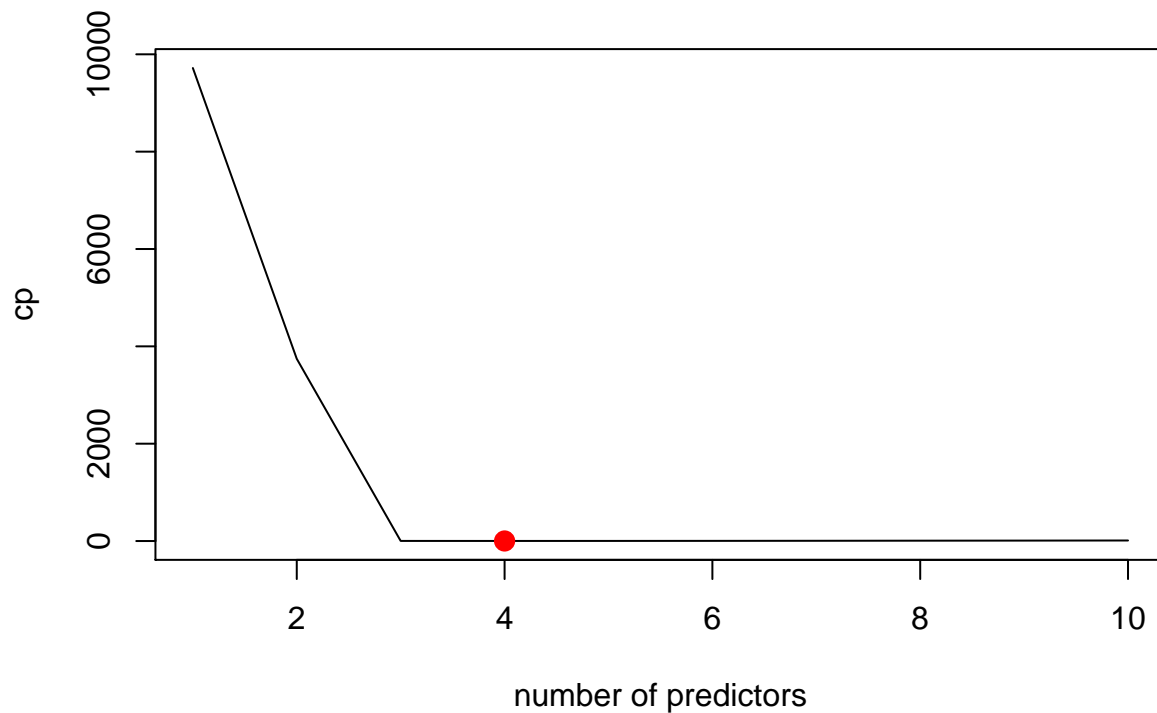
```
#check with cp
which.min(summary.fwd$cp)
```

```
## [1] 4
```

```
plot(summary.fwd$cp,xlab="number of predictors",ylab="cp",type="l")
points(4,summary.fwd$adjr2[3],col="red",cex=2,pch=20)
```

```
coef(forward.fit,id=4)
```

```
## (Intercept)           X1           X2           X3           X5
##    14.584237   140.267685    59.466313    75.130049     1.480188
```

From the results above, we can find that the best model chosen by forward stepwise method is the same with best subset selection. The coefficients for every predictor and intercept are the same with the results.

```
#using backwards stepwise selection
backward.fit=regsubsets(y~.,data=newdata,nvmax=10,method="backward")
summary.bwd=summary(backward.fit)

#check with adjusted R square
which.max(summary.bwd$adjr2)
```
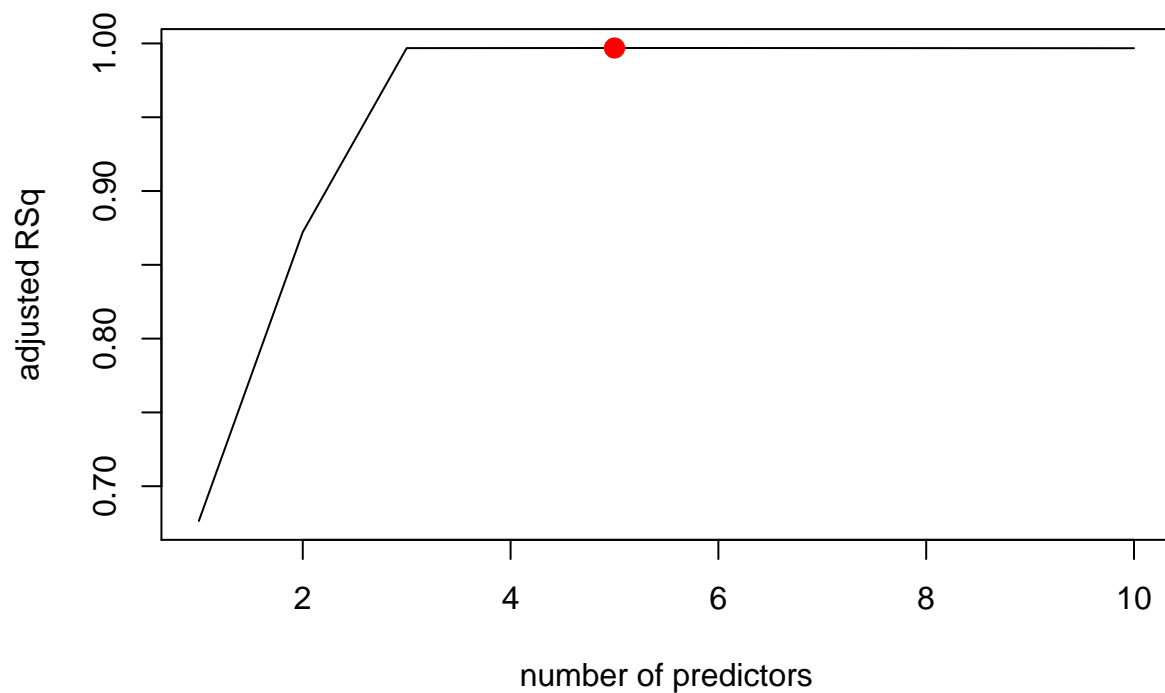
```
## [1] 5
```

```
plot(summary.bwd$adjr2,xlab="number of predictors",ylab="adjusted RSq",type="l")
points(5,summary.bwd$adjr2[5],col="red",cex=2,pch=20)
```

```r
coef(backward.fit,id=5)
```

```
## (Intercept)          X1          X2          X3          X4          X5
##   14.584237   140.267685   59.466313   75.130049    1.257095    1.480188
```
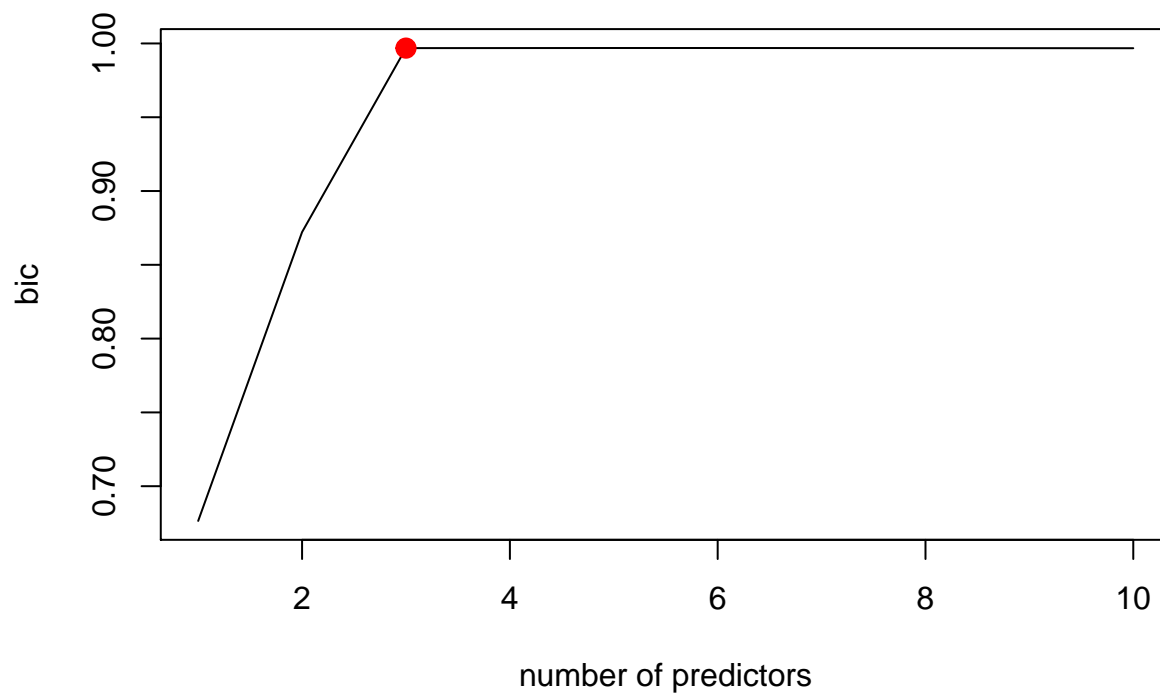
```r
#check with bic
which.min(summary.bwd$bic)
```

```
## [1] 3
```

```r
plot(summary.bwd$adjr2,xlab="number of predictors",ylab="bic",type="l")
points(3,summary.bwd$adjr2[3],col="red",cex=2,pch=20)
```

```r
coef(backward.fit,id=3)
```

```
## (Intercept)          X1          X2          X3
##    14.58424   140.26769    59.46631    75.13005
```
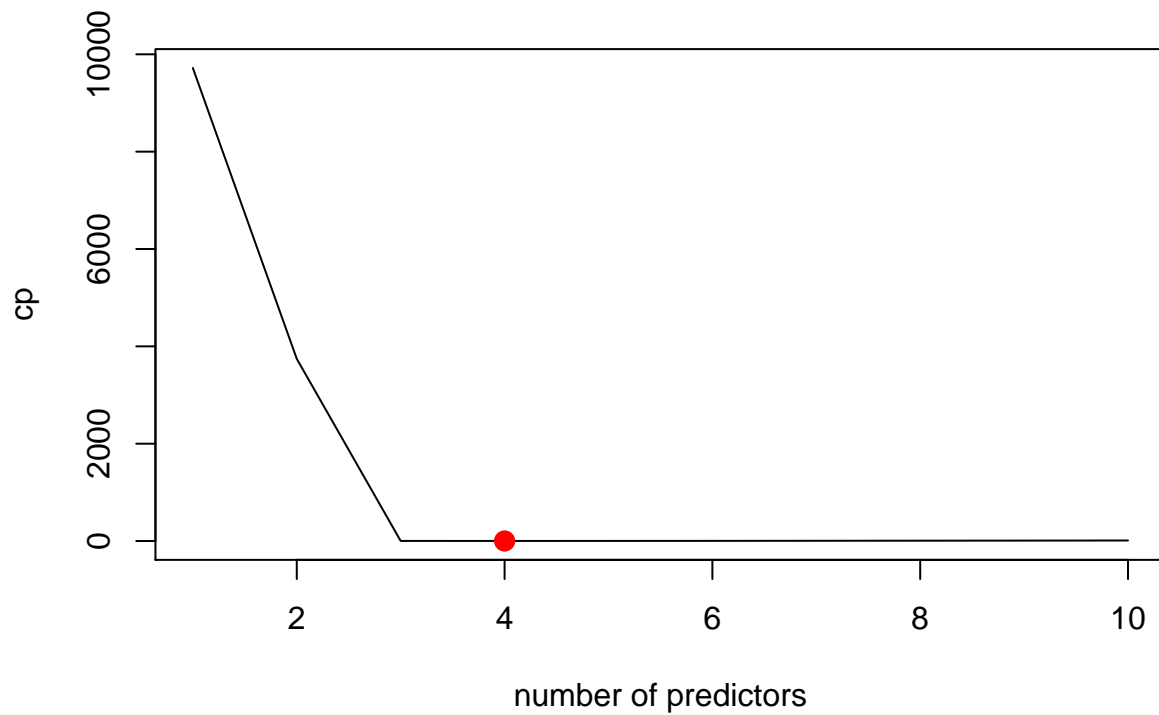
```r
#check with cp
which.min(summary.bwd$cp)
```

```
## [1] 4
```

```r
plot(summary.bwd$cp,xlab="number of predictors",ylab="cp",type="l")
points(4,summary.bwd$adjr2[3],col="red",cex=2,pch=20)
```

number of predictors

```r
coef(backward.fit,id=4)
```

```
## (Intercept)          X1          X2          X3          X5
##   14.584237  140.267685   59.466313   75.130049    1.480188
```

From the results above, compared with the results from best subset selection and forward stepwise selection, the best model and coefficients chosen by backward stepwise method are the same.