Q1)

install.packages("readxl")

library(readxl)

d<- read\_excel("C:/Users/ch4ex1.xlsx")

d

i=d$i

i

y=d$y

y

#Plot the number of cases y against time period i ( i= 1,...,20)

plot(i,y,pch=16)

# plot logi against logy

plot(log(i),log(y))

# Fit the model

model<-glm(y~log(i),family=poisson(link="log"),data=d)

summary(model)

# an approximate 95% confidence interval for beta1 and beta 2

CI\_of\_beta <- confint.default(model,level=0.95)

CI\_of\_beta

# The variance-covariance matrix of the MLE

Tauinver<-vcov(model)

Tauinver

# use the iterative formula to fit model

# Initial values b0

beta<-c(1,1)

beta

#Design matrix (X)

X=matrix(c(rep(1,20),log(i)),nrow=20,ncol = 2,byrow = F)

X

#Transform Design matrix (Xt)

Xt<-t(X)

Xt

#Working weights matrix (W )

W<-exp(beta[1])\*diag(c(i^beta[2]),nrow = 20,ncol = 20)

W

#Information matrix, Tau= Xt\*W\*X

# Multiply the matrices.

tau<- Xt%\*%W%\*%X

tau

#The score statistics are: (U1 and U2)

U1<-sum(y-exp(beta[1]+beta[2]\*log(i)))

U2<-sum(y\*log(i)-log(i)\*exp(beta[1]+beta[2]\*log(i)))

#The vector of scores (U)

U<-matrix(c(U1,U2))

U

##iterative equation to find an approximate estimate of beta: b1, b2

b<-beta+solve(tau)%\*%U

b

Q2)

#Design matrix (X) :

X=matrix(c(rep(1,17),xi),nrow=17,ncol = 2,byrow = F)

X

#Transpose of design matrix :

Xt<-t(X)

Xt

#The matrix of working weights (W) is :

W<-diag(c(rep(1,17)),nrow = 17,ncol = 17)

W

##Information matrix, Tau= Xt\*W\*X (Multiply the matrices):

tau<- Xt%\*%W%\*%X

tau

#The score statistics are: (U1 and U2

U1<-sum(-1+(yi/exp(beta[1]+beta[2]\*xi)))

U2<-sum(-xi+(yi\*xi/exp(beta[1]+beta[2]\*xi)))

U<-matrix(c(U1,U2))

U

#We make the following Calculation: (to compute b

b<-beta+solve(tau)%\*%U

b

#Fit the model described in (c) using statistical software

model<-glm(yi~xi ,family =Gamma(link = "log"))

summary(model, dispersion =1)

#Find the 95% confidence interval

CI\_of\_beta <- confint.default(model,level=0.95)

CI\_of\_beta

#The variance-covariance matrix of the MLE

Tauinver<-vcov(model, dispersion =1)

Tauinver

#Find approximate of the information matrix evaluated at b

Tau\_at\_b<-solve(vcov(model, dispersion =1))

Tau\_at\_b

#the model fitted

yhat<-exp(8.4775-1.1093\*xi) #or yhat=fitted.values(m,dispersion =1)

yhat

#residuals

ri<-(yi-yhat)/yhat

ri

#test statistics

test\_statistc<- sum(ri^2)

test\_statistc

#table value

chi\_table<-qchisq(1-0.05,17-2)

chi\_table