**# Homework12**

流行病學與生物統計計算Homework 12

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**#EX 23-1**

beta <- **c**(0, 0.5, 0.8)

sig <- **seq**(0.01, 0.05, by = 0.01) *#significant level*

n <- 1000

norep <- 100

y <- **c**()

mle <- **matrix**(NA, norep, 3)

rejrate <- **matrix**(NA, **length**(beta), **length**(sig))

for (betaloop in 1 : **length**(beta)) {

pvalue <- **c**()

for (i in 1 : norep) {

**set.seed**(i)

gpa <- **rnorm**(n = n, mean = 3.1, sd = 0.3)

gre <- **rnorm**(n = n, mean = 580, sd = 80)

linear <- -6 + beta[betaloop] \* gpa + 0.005 \* gre

pii <- **exp**(linear) / (1 + **exp**(linear))

x <- **cbind**(**rep**(1, n), gpa, gre)

for (k in 1 : n) {

y[k] <- **sample**(**c**(0, 1), 1, **c**(1 - pii[k], pii[k]), replace = FALSE)

}

**ftn** <- function(betacoef) {

pi1 <- **exp**(x %\*% betacoef) / (1 + **exp**(x %\*% betacoef))

gradient <- **t**(x) %\*% (y - pi1)

hessian <- -**t**(x) %\*% **diag**(**c**(pi1 \* (1 - pi1)), n) %\*% x

return(list(gradient, hessian))

}

**highnew** <- function(ftn, x0, tol, maxiter) {

x <- x0

fx <- ftn(x)

iter <- 0

while ((**max**(**abs**(fx[[1]])) > tol) && (iter < maxiter)) {

x <- x - (**solve**(fx[[2]]) %\*% fx[[1]])

fx <- ftn(x)

iter <- iter + 1

}

if (**max**(**abs**(fx[[1]])) > tol) {

**cat**("algorithm failed to converge\n")

return(NA)

} else {

**cat**("algorithm converges\n")

return(x)

}

}

mle[i, ] <- highnew(ftn, x0 = **c**(0, 0, 0), tol = 1e-9, maxiter = 100)

vcov <- **solve**(-ftn(mle[i, ])[[2]])

semle <- **sqrt**(**diag**(vcov))

ward <- mle[i, ] / semle

pvalue[i] <- ((1 - **pt**(**abs**(ward), n - 3)) \* 2)[2]

}

for (z in 1:**length**(sig)) {

rejrate[betaloop, z] <- **sum**(pvalue < sig[z]) / norep *#rejection rate*

}

}

**setwd**("/Users/raymond/Desktop/R")

**png**(filename = "hw12.png", width = 6000, height = 6000, res = 500)

**matplot**(sig, **t**(rejrate),

col = **c**(1:**length**(beta)),

pch = **c**(1:**length**(beta)),

lty = **c**(**rep**(1, 3)),

type = "b",

frame = FALSE,

xlab = "Significance level",

ylab = "Rejection rate")

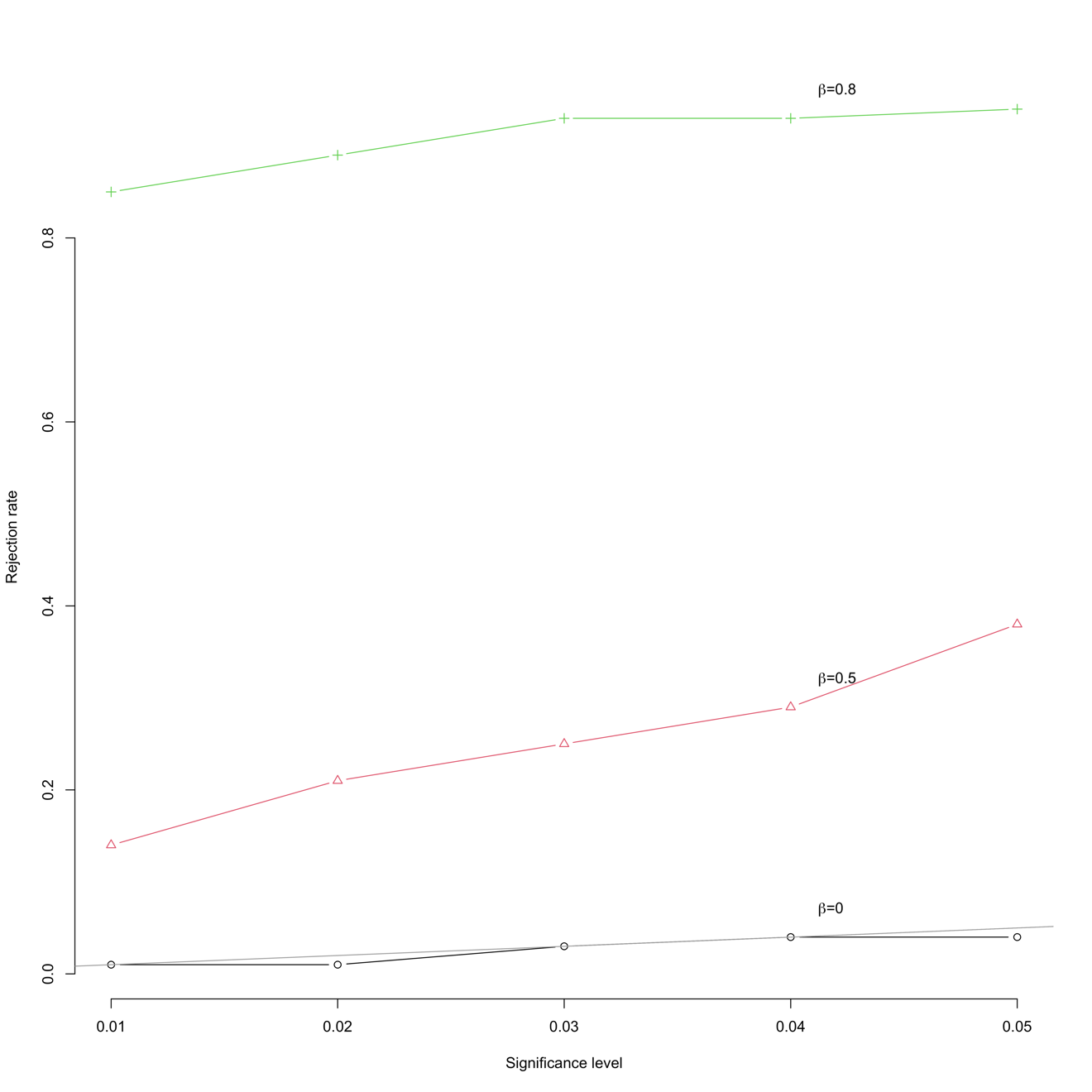
**abline**(a = 0, b = 1, col = 8)

**legend**(0.04, rejrate[1, 4] + 0.05, expression(**paste**(beta, "=0")), bty = "n")

**legend**(0.04, rejrate[2, 4] + 0.05, expression(**paste**(beta, "=0.5")), bty = "n")

**legend**(0.04, rejrate[3, 4] + 0.05, expression(**paste**(beta, "=0.8")), bty = "n")

**dev.off**()

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