# 2 x 2

# configuration:

# a c

# b d

## - changing observed, expected fixed Figure 1 & 3

# Figure 1 full x axis

#

Ex=50 # set cell value

E <- vector(length=4)

for (i in 1:4) {

 E[i] <- Ex

}

T <- sum(E); df = 1; Lo = 1; Hi = 99

layout(matrix(1))

curve(2\*(x\*log(x/E[1])+(100-x)\*log((100-x)/E[2])+(100-x)\*log((100-x)/E[3])+(x\*log(x/E[4]))),

 xlim = c(Lo,Hi), ylab = "Statistic",

 xlab = "Observed value", cex.lab = 1.4, lwd = 2) #LRT

##check specific values

x=20

2\*(x\*log(x/E[1])+(100-x)\*log((100-x)/E[2])+(100-x)\*log((100-x)/E[3])+(x\*log(x/E[4])))

curve((x-E[1])^2/E[1]+((100-x)-E[2])^2/E[2]+

 ((100-x)-E[3])^2/E[3]+(x-E[4])^2/E[4],

 add = TRUE, lty = 2, col = "blue", lwd = 2) #chi-sq

(x-E[1])^2/E[1]+((100-x)-E[2])^2/E[2]+((100-x)-E[3])^2/E[3]+(x-E[4])^2/E[4]

curve(2\*(df\*0.5\*log(df/((x-E[1])^2/E[1]+((100-x)-E[2])^2/E[2]+

 ((100-x)-E[3])^2/E[3]+(x-E[4])^2/E[4]))

 -0.5\*(df-((x-E[1])^2/E[1]+((100-x)-E[2])^2/E[2]+

 ((100-x)-E[3])^2/E[3]+(x-E[4])^2/E[4]))),

 add = TRUE, lty = 3, col = "red", lwd = 1) #2\*Svar

2\*(df\*0.5\*log(df/((x-E[1])^2/E[1]+((100-x)-E[2])^2/E[2]+

 ((100-x)-E[3])^2/E[3]+(x-E[4])^2/E[4]))

 -0.5\*(df-((x-E[1])^2/E[1]+((100-x)-E[2])^2/E[2]+

 ((100-x)-E[3])^2/E[3]+(x-E[4])^2/E[4])))

legend(60,230, inset=0.2, legend=c("LRT", expression(X^2), expression('S'[var])),

 col=c("black", "blue", "red"), lty=1:3, lwd = 2, cex=1, title = "Equation used")

# abline(v=20)

# Figure 2 expanded x axis

#

Ex=50 # set cell value

E <- vector(length=4)

for (i in 1:4) {

 E[i] <- Ex

}

T <- sum(E); df = 1; Lo = 30; Hi = 70

layout(matrix(1))

curve(2\*(x\*log(x/E[1])+(100-x)\*log((100-x)/E[2])+(100-x)\*log((100-x)/E[3])+(x\*log(x/E[4]))),

 xlim = c(Lo,Hi), ylab = "Statistic",

 xlab = "Observed value", cex.lab = 1.4, lwd = 2) #LRT

##check specific values

x=45

2\*(x\*log(x/E[1])+(100-x)\*log((100-x)/E[2])+(100-x)\*log((100-x)/E[3])+(x\*log(x/E[4])))

curve((x-E[1])^2/E[1]+((100-x)-E[2])^2/E[2]+

 ((100-x)-E[3])^2/E[3]+(x-E[4])^2/E[4],

 add = TRUE, lty = 2, col = "blue", lwd = 2) #chi-sq

(x-E[1])^2/E[1]+((100-x)-E[2])^2/E[2]+((100-x)-E[3])^2/E[3]+(x-E[4])^2/E[4]

curve(2\*(df\*0.5\*log(df/((x-E[1])^2/E[1]+((100-x)-E[2])^2/E[2]+

 ((100-x)-E[3])^2/E[3]+(x-E[4])^2/E[4]))

 -0.5\*(df-((x-E[1])^2/E[1]+((100-x)-E[2])^2/E[2]+

 ((100-x)-E[3])^2/E[3]+(x-E[4])^2/E[4]))),

 add = TRUE, lty = 3, col = "red", lwd = 1) #2\*Svar

2\*(df\*0.5\*log(df/((x-E[1])^2/E[1]+((100-x)-E[2])^2/E[2]+

 ((100-x)-E[3])^2/E[3]+(x-E[4])^2/E[4]))

 -0.5\*(df-((x-E[1])^2/E[1]+((100-x)-E[2])^2/E[2]+

 ((100-x)-E[3])^2/E[3]+(x-E[4])^2/E[4])))

legend(52,7.5, inset=0.2, legend=c("LRT", expression(X^2), expression('S'[var])),

 col=c("black", "blue", "red"), lty=1:3, lwd = 2, cex=1, title = "Equation used")

#abline(v=20)

## - MATRIX - changing observed, expected fixed - Figure 3

#

layout(matrix(1))

layout(matrix(1:4, nrow = 2))

O1 = 50; O2 = 50; O3 = 50; O4 = 50; T = O1 + O2 + O3 + O4; df = 1

CT1 = O1 + O2; CT2 = O3 + O4; RT1 = O1 + O3; RT2 = O2 + O4

#Ep = 0.2

E1 = 20; E2 = (CT1-E1); E3 = (RT1-E1); E4 = (RT2-E2)

Lo = 1; Hi = 60

x=1

curve(2\*(x\*log(x/E1)+(CT1-x)\*log((CT1-x)/E2)+(RT1-x)\*

 log((RT1-x)/E3)+(RT2+(x)-CT1)\*log((RT2+(x)-CT1)/E4)),

 xlim = c(Lo,Hi), ylim = c(0,155), ylab = "Statistic",

 xlab = "", cex.lab = 1.4, lwd = 2) #LRT

curve((x-E1)^2/E1+((CT1-x)-E2)^2/E2+

 ((RT1-x)-E3)^2/E3+((RT2+x-CT1)-E4)^2/E4,

 add = TRUE, lty = 2, col = "blue", lwd = 2) #chi-sq

legend(20,150, legend=substitute(italic("E = 20 ")), box.lty=0)

Ep = 50

E1 = 50; E2 = CT1-E1; E3 = RT1-E1; E4 = RT1-E2

Lo = 10; Hi = 90

curve(2\*(x\*log(x/E1)+(CT1-x)\*log((CT1-x)/E2)+(RT1-x)\*

 log((RT1-x)/E3)+(RT2+(x)-CT1)\*log((RT2+(x)-CT1)/E4)),

 xlim = c(Lo,Hi), ylab = "Statistic",

 xlab = "Observed Value", cex.lab = 1.4, lwd = 2) #LRT

curve((x-E1)^2/E1+((CT1-x)-E2)^2/E2+

 ((RT1-x)-E3)^2/E3+((RT2+(x)-CT1)-E4)^2/E4,

 add = TRUE, lty = 2, col = "blue", lwd = 2) #chi-sq

legend(40,145, legend=substitute(italic("E = 50 ")), box.lty=0)

Ep = 30

E1 = 30; E2 = CT1-E1; E3 = RT1-E1; E4 = RT1-E2

Lo = 1; Hi = 70

curve(2\*(x\*log(x/E1)+(CT1-x)\*log((CT1-x)/E2)+(RT1-x)\*

 log((RT1-x)/E3)+(RT2+(x)-CT1)\*log((RT2+(x)-CT1)/E4)),

 xlim = c(Lo,Hi), ylab = "",

 xlab = "", cex.lab = 1.4, lwd = 2) #LRT

curve((x-E1)^2/E1+((CT1-x)-E2)^2/E2+

 ((RT1-x)-E3)^2/E3+((RT2+(x)-CT1)-E4)^2/E4,

 add = TRUE, lty = 2, col = "blue", lwd = 2) #chi-sq

legend(25,132, legend=substitute(italic("E = 30 ")), box.lty=0)

Ep = 90

E1 = 90; E2 = CT1-E1; E3 = RT1-E1; E4 = RT1-E2

Lo = 61; Hi = 99

curve(2\*(x\*log(x/E1)+(CT1-x)\*log((CT1-x)/E2)+(RT1-x)\*

 log((RT1-x)/E3)+(RT2+(x)-CT1)\*log((RT2+(x)-CT1)/E4)),

 xlim = c(Lo,Hi), ylim = c(0,125), ylab = "",

 xlab = "Observed Value", cex.lab = 1.4, lwd = 2) #LRT

curve((x-E1)^2/E1+((CT1-x)-E2)^2/E2+

 ((RT1-x)-E3)^2/E3+((RT2+(x)-CT1)-E4)^2/E4,

 add = TRUE, lty = 2, col = "blue", lwd = 2) #chi-sq

legend(70,122, legend=substitute(italic("E = 90 ")), box.lty=0)

legend(85,125, inset=0.02, legend=c("LRT", expression(X^2)),

 col=c("black", "blue"), lty=1:2, lwd = 2, cex=1, title = "Equation used")

layout(matrix(1))