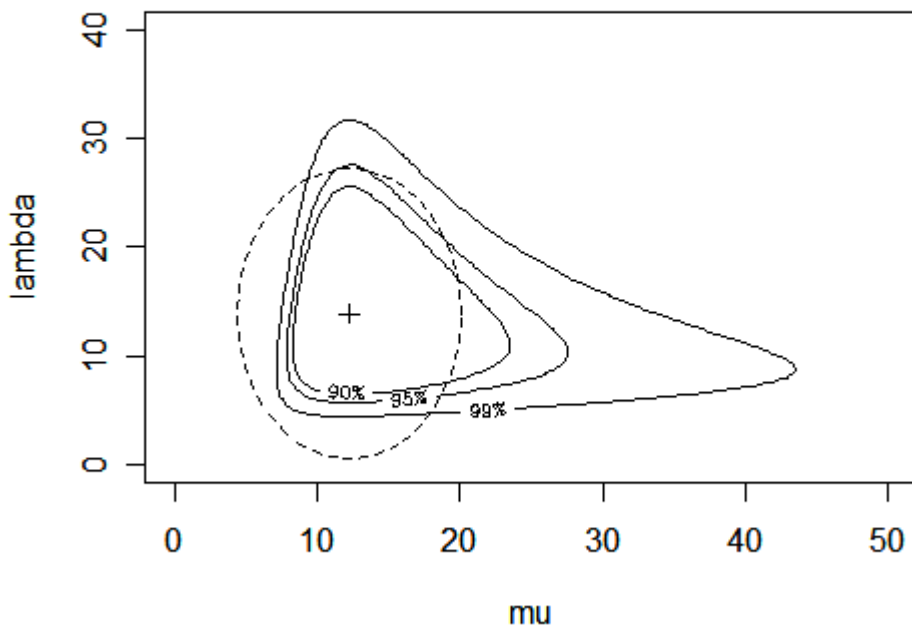# Inverse Gaussian Confidence Regions
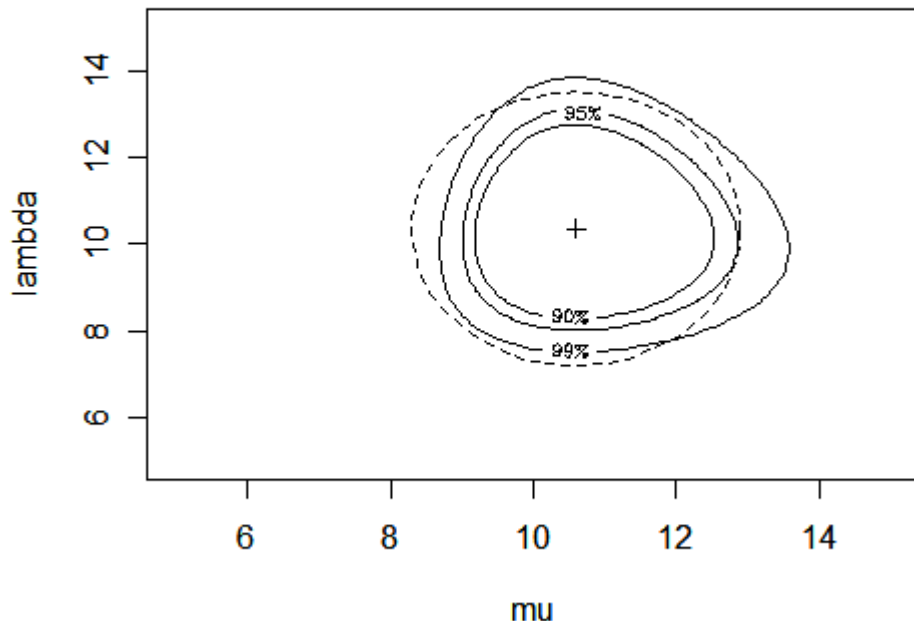
```
> IGconfLLR
function (xx, mgr, lgr, ...)
{
    n = length(xx)
    xbar <- mean(xx)
    xbar1 <- mean(1/xx)
    muhat <- xbar
    lambdahat <- 1/(xbar1 - 1/xbar)
    contour(mgr, lgr, outer(mgr, lgr, neg2LLRIG, n = n, xbar = xbar,
        xbar1 = xbar1), levels = qchisq(c(0.9, 0.95, 0.99), 2),
        labels = c("90%", "95%", "99%"), xlab = "mu", ylab = "lambda",
        ...)
    ellipsem(c(muhat, lambdahat), n * diag(c(lambdahat/muhat^3,
        1/(2 * lambdahat^2))), qchisq(0.99, 2), lty = 2)
    points(muhat, lambdahat, pch = 3)
}

> neg2LLRIG
function (mu, lambda, n, xbar, xbar1)
{
    muhat <- xbar
    lambdahat <- 1/(xbar1 - 1/xbar)
    negLL <- function(mu, lambda, n, xbar, xbar1) -(n/2) * (log(lambda) -
        lambda * (xbar/mu - 2 + mu * xbar1)/mu)
    2 * (negLL(mu, lambda, n, xbar, xbar1) - negLL(muhat, lambdahat,
        n, xbar, xbar1))
}

> xxig1
 [1]   9.589359 46.853136  3.241903 26.681170 24.020465  6.851572  6.463341
 [8]   8.290286  3.425824  4.843495 13.809297  4.212797  8.309223  8.464925
[15]   3.576289 37.117973 16.066626  3.028943  4.602975  5.758892
> IGconfLLR(xxig1, seq(0,50,len=101),seq(0,40,len=101))
```

```
> library(SuppDists)
> xxig2 <- rinvGauss(200,10,10)
> IGconfLLR(xxig2, seq(5,15,len=101),seq(5,15,len=101))
```



```
> IGconfscore
function (xx, mgr, lgr, ...)
{
    n <- length(xx)
    xbar <- mean(xx)
    xbar1 <- mean(1/xx)
    muhat <- xbar
    lambdahat <- 1/(xbar1 - 1/xbar)
    contour(mgr, lgr, outer(mgr, lgr, scorepivotIG, n = n, xbar = xbar,
        xbar1 = xbar1), levels = qchisq(c(0.9, 0.95, 0.99), 2),
        labels = c("90%", "95%", "99%"), xlab = "mu", ylab = "lambda",
        ...)
    ellipsem(c(muhat, lambdahat), n * diag(c(lambdahat/muhat^3,
        1/(2 * lambdahat^2))), qchisq(0.99, 2), lty = 2)
}

> scorepivotIG
function (mu, lambda, n, xbar, xbar1)
{
    stiinvs <- function(s1, s2, i11, i12, i22) {
        (s1 * s1 * i22 - 2 * s1 * s2 * i12 + s2 * s2 * i11)/(i11 *
            i22 - i12 * i12)
    }
    n * stiinvs(lambda * (xbar - mu)/mu^3, (1/lambda - (xbar/mu -
        2 + mu * xbar1)/mu)/2, lambda/mu^3, 0, 1/(2 * lambda^2))
}

> IGconfscore(xxig1, seq(0,50,len=101),seq(0,40,len=101))
```
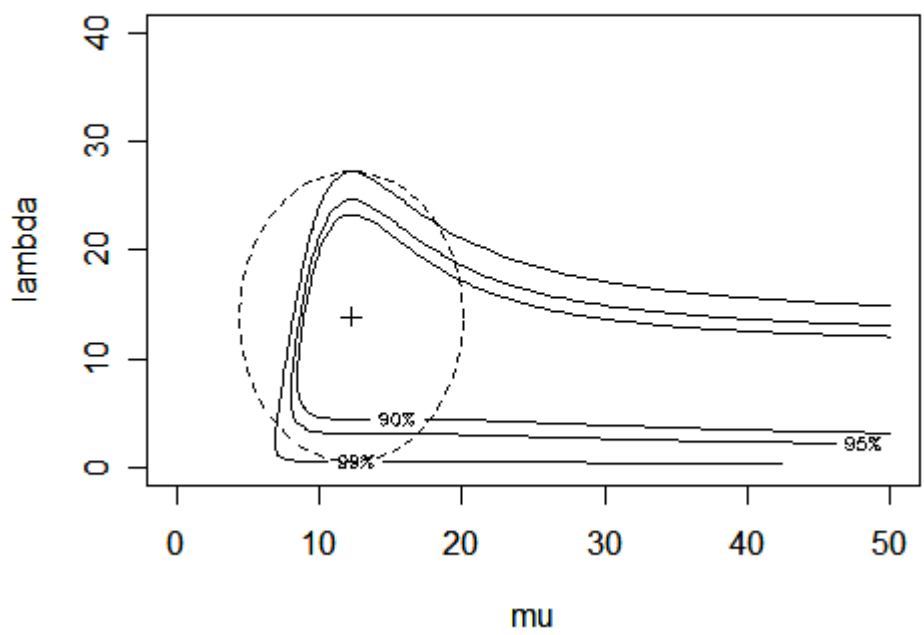
```
> IGconfscore(xxig2, seq(5,15,len=101),seq(5,15,len=101))
```
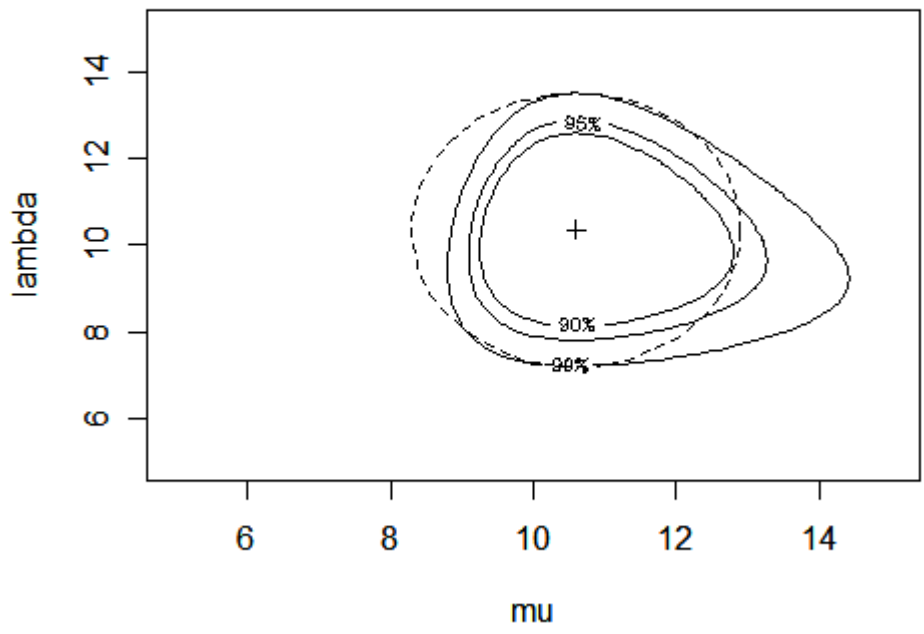

Try repeating the following pair of commands many times; how often does the dashed ellipse (Wald 99% region) exclude the true value of the parameter? How often does the score 99% region miss?

```
> IGconfscore(rinvGauss(200,10,10), seq(5,15,len=101),seq(5,15,len=101))
> points(10,10,pch=2)
```