

## Solutions for chapter Fold-Changes, Log-Ratios, Background Correction, Shrinkage Estimation, and Variance Stabilization

### Exercise 1

```
a > r1 = rnorm(10000, mean=2000, sd=50)
> g1 = rnorm(10000, mean=1000, sd=50)
> hist(r1/g1, breaks=33, col="azure")
```

```
b > r2 = rnorm(10000, mean=200, sd=50)
> g2 = rnorm(10000, mean=100, sd=50)
> ratio = r2/g2
> ratio = ratio[(ratio>0)&(ratio<6)]
> hist(ratio, breaks=33, col="azure",
      main="Histogram of r2/g2", xlab="r2/g2",
      sub="restricted to [0,6]")
```

```
c > hist(log2(r1/g1), breaks=33, col="azure")
```

```
> hist(log2(r2/g2), breaks=33, col="azure")
```

### Exercise 2

For the kidney data:

```
> library("geneplotter")
> pcol = c("green3", "red1")
> plty = 1:2
> multidensity(exprs(kidney), xlim=c(-200, 1000),
  main = "kidney", xlab="Intensity",
  lty = plty, col = pcol, lwd = 2)
> legend("topright", c("green", "red"),
  lty = plty, col = pcol, lwd = 2)
```

For the CCl<sub>4</sub> data:

```
> multidensity(cbind(assayData(CCl4s)$G[,1],
  assayData(CCl4s)$R[,1]), xlim=c(0, 200),
  main = expression(CCl[4]), lwd=2, xlab="Intensity",
  col = pcol, lty = plty)
```

### Exercise 3

```
a > px = seq(-100, 500, length=50)
> f = function(x, b) log2(x+b)
> h = function(x, a) log2((x+sqrt(x^2+a^2))/2)
> matplot(px, y=cbind(h(px, a=50), f(px, b=50)),
  type="l", lty=1:2, xlab="x", ylab="f, h")
```

b Repeat the plot command above, with

```
> px = seq(0, 1e8, length=50)
```

c This question is very nicely explored in a paper by ?.

#### *Exercise 4*

```
> ax1 = c(30, 300)
> plot(assayData(CC14s)$R[,1],
      assayData(CC14s)$G[,1],
      xlim=ax1, ylim=ax1, pch=".", col="grey",
      asp=1)
> abline(a=0, b=1, col="blue", lty=2, lwd=3)
> abline(a=18, b=1.2, col="red", lty=3, lwd=3)
```

The comparison of the dashed line with the data shows that there are systematic dye-related differences between the two channels. The dotted line shows that they can be fitted by an affine transformation, that is, a shift and a scaling of the data from one dye to adjust them to the other.