MAST20005/MAST90058: Week 4 Lab Solutions

```
invadopodia <- read.table("invadopodia.txt")
```

1. Following the same procedure as for groups 1 and 2:

```
x3 <- invadopodia[invadopodia$Condition == 3, 2]
x4 <- invadopodia[invadopodia$Condition == 4, 2]

x.bar3 <- mean(x3)
x.bar4 <- mean(x4)

# 95% CI for group 3.
x.bar3 + c(-1, 1) * 1.96 * sqrt(x.bar3 / length(x3))

## [1] 4.537680 6.195654

# 95% CI for group 4.
x.bar4 + c(-1, 1) * 1.96 * sqrt(x.bar4 / length(x4))

## [1] 3.33408 4.56592
```

2. The appropriate analysis is one that compares the mean for groups 3 and 4. We can calculate a 95% confidence interval for $\lambda_3 - \lambda_4$ using the same method that was used to compare groups 1 and 2.

```
# 95% CI for difference between groups 3 and 4.
x.bar3 - x.bar4 + c(-1, 1) * 1.96 *
    sqrt(x.bar3 / length(x3) + x.bar4 / length(x4))

## [1] 0.3839142 2.4494191
```

Like last time, this interval clearly above zero. Therefore, we conclude that we have evidence that isopropile treatment reduces the number of susceptible cells in mice tissues even in the presence of propile.

3.
```
x <- c(10.39, 10.43, 9.99, 11.17, 8.91,
       11.20, 11.38, 7.74, 10.61, 11.11)
t.test(x, conf.level = 0.75)

##
##  One Sample t-test
##
## data:  x
## t = 28.081, df = 9, p-value = 4.477e-10
## alternative hypothesis: true mean is not equal to 0
```

```
## 75 percent confidence interval:
##   9.842278 10.743722
## sample estimates:
## mean of x
##    10.293
```

A 75% confidence interval for the population mean is **9.84–10.7**.

4. Set up the simulation:

```r
theta <- 0.6
p <- c(1 - theta, 3 * theta / 4, theta / 4)
n <- 10      # sample size
B <- 10000   # simulation runs
t1 <- numeric(B)
t2 <- numeric(B)
for (i in 1:B) {
    x <- sample(c(0, 1, 2), n, prob = p, replace = TRUE)
    t1[i] <- 0.8 * mean(x)
    t2[i] <- 1 - mean(x == 0)
}
```

Let's check for bias:

```r
mean(t1)

## [1] 0.603416

mean(t2)

## [1] 0.60314
```

Looks very similar to $\theta = 0.6$, so likely unbiased. Now check the variances:

```r
var(t1)

## [1] 0.03108264

var(t2)

## [1] 0.02352449
```

Here we see that $\text{var}(T_1) > \text{var}(T_2)$.