

# LING82100: homework 4 solution

## 1 Power analysis

```
• > cohen.d <- function(xbar1, xbar2, s1, s2, n1, n2) {  
+   # Computes pooled standard deviation  
+   num <- (n1 - 1) * s1 * s1 + (n2 - 1) * s2 * s2  
+   den <- n1 + n2 - 2  
+   s <- sqrt(num / den)  
+   # Computes d.  
+   abs(xbar1 - xbar2) / s  
+ }  
> d <- cohen.d(2.77, 2.97, .31, .32, 50, 50)  
> round(d, 2)  
[1] 0.63
```

We obtain a Cohen's  $d = 0.63$ , which is an “medium” effect size according to Cohen's qualitative guidelines.

```
• > library(pwr)  
> power <- pwr.2pt.test(h = d, n = 50, sig.level = .01)$power  
> round(power, 2)  
[1] 0.73
```

We obtain a power of .73.

```
• > set.seed(11215) # This makes my result replicable.  
> versicolor.sw <- rnorm(50, 2.77, .31)  
> virginica.sw <- rnorm(50, 2.97, .32)  
> t.test(versicolor.sw, virginica.sw)
```

Welch Two Sample t-test

```
data: versicolor.sw and virginica.sw  
t = -4.4556, df = 91.376, p-value = 2.367e-05  
alternative hypothesis: true difference in means is not equal to 0  
95 percent confidence interval:  
 -0.3692771 -0.1415545  
sample estimates:
```

```
mean of x mean of y
2.713954 2.969370
```

The Welch two-sided  $t$ -test was significant at  $\alpha = .01$  ( $t = -4.46$ , d.f. = 91.38,  $p < .001$ ).

## 2 Correlation analysis

```
> d <- read.table(
+   "http://wellformedness.com/courses/LING82100/Data/albright_hayes.tsv",
+   header = TRUE)
```

- A histogram of the rating data shows a bimodal pattern. Coltheart's  $N$  is both integral (rather than continuous) and histograms of this sample illustrate the presence of a right tail. This motivates our choice to use non-parametric tests.
- `> with(d, cor.test(coltheart.N, rating, method = "spearman"))`

Spearman's rank correlation rho

```
data: coltheart.N and rating
S = 27776, p-value = 5.246e-16
alternative hypothesis: true rho is not equal to 0
sample estimates:
      rho
0.7379537
```

Warning message:

```
In cor.test.default(coltheart.N, rating, method = "spearman") :
  Cannot compute exact p-value with ties
```

The Spearman's rank correlation test returns a significant result at  $\alpha = .05$  ( $\rho = .74$ ,  $p < .001$ ).