MATH 3080 Lab Project 7

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Remember: I expect to see commentary either in the text, in the code with comments created using `#`*, or (preferably) both!* ***Failing to do so may result in lost points!***

Problem 1

REMINDER: Power is the probability of accepting the alternative hypothesis when it is true!

We can construct simulated power curves by the following procedures:

1. Make a function that:

- takes as parameters \(n\), \(\mu\) (as a vector), and \(\sigma\) (as a vector)
- generates 3 normal samples of size 200 with \(\mu=0\) and \(\sigma=1\)
- runs the analysis of variance test
- returns the p-value (HINT: `p.value=summary(res)[[1]][["Pr(>F)"]][1]`)
- Run this function 100 times. Compute the proportions of rejections (\(\alpha = 0.05\)).

```
set.seed(1e+05)  # DON'T CHANGE THIS SEED!
```

```
# Your code here
name <- function(n, mu, sd) {
    n1 = rnorm(n, mu[1], sd[1])
    n2 = rnorm(n, mu[2], sd[2])
    n3 = rnorm(n, mu[3], sd[3])
    data = stack(list(n1 = n1, n2 = n2, n3 = n3))
    test <- aov(values ~ ind, data = data)
    p.value = summary(test)[[1]][["Pr(>F)"]][1]
    return(p.value)
}

mu = c(0, 0, 0)
sd = c(1, 1, 1)
p = 0
for (i in 1:100) {
    p[i] = name(200, mu, sd)
}
sum(p < 0.05)/100
```

```
## [1] 0.07
```

2. Now change the mean \(\mu_1\) to be 0.1, run the ANOVA test 100 times, compute the proportion of rejections.

```
# Your code here
mu = c(0.1, 0, 0)
sd = c(1, 1, 1)
p = 0  ## change the mean mu_1 to be 0.1

for (i in 1:100) {
    p[i] = name(200, mu, sd)
}
sum(p < 0.05)/100
```

```
## [1] 0.17
```

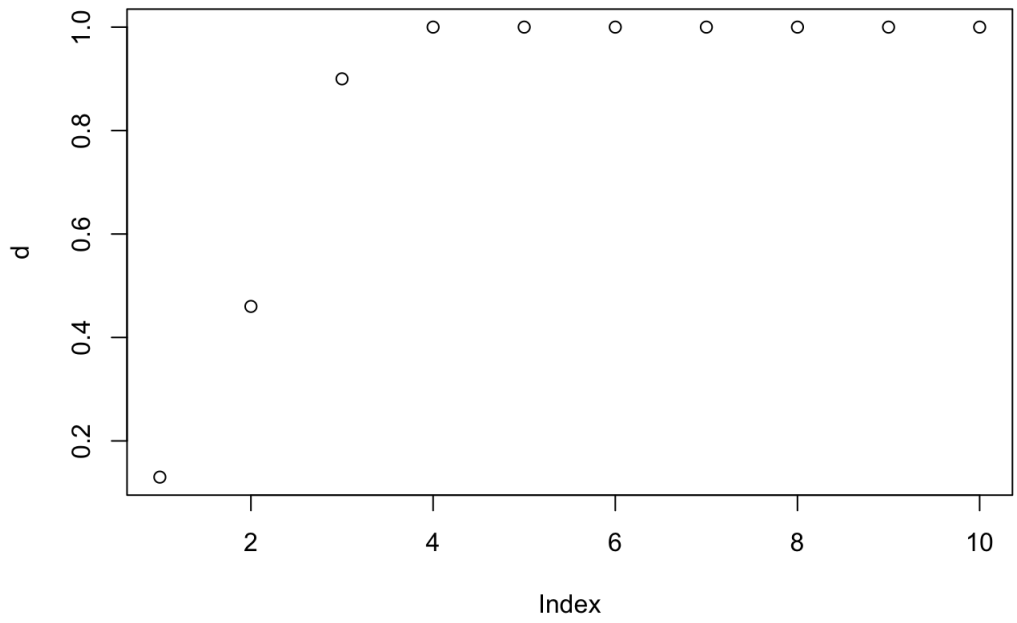
3. Repeat step 2 for the values: 0.2, 0.3, 0.4, 0.5, 0.6, 0.7, 0.8, 0.9, 1.0

```
# Your code here
d = 0
for (i in 1:10) {
    mu = c(0.1 * i, 0, 0)
    sd = c(1, 1, 1)
    p = 0
    for (j in 1:100) {
        p[j] = name(200, mu, sd)
    }
    d[i] = sum(p < 0.05)/100
}
d
```

```
##  [1] 0.13 0.46 0.90 1.00 1.00 1.00 1.00 1.00 1.00 1.00
```

4. Plot the proportion of rejections.

```
# Your code here
plot(d)
```



BONUS

5. Set \(\mu_1 = 1\), run ANOVA 100 times and compute the proportion of rejections for varying values of sample size. Instead of sample size=200 as in the previous problem, try size=5, 10, …, 45, 50. Plot and explain results.

```
# Your code here
d = 0
for (i in 1:10) {
    mu = c(1, 0, 0)
    sd = c(1, 1, 1)
    p = 0
    for (j in 1:100) {
        p[j] = name(5 * i, mu, sd)
    }
    d[i] = sum(p < 0.05)/100
}
d
```

```
##  [1] 0.34 0.57 0.85 0.88 0.99 0.99 0.99 1.00 1.00 1.00
```

```
plot(d)
```