Mini Project 1 Code – Group 3: Braedon and Dasha

##Here is a table showing our results

```
power <- function(alpha, alt_mean){

  set.seed(123)

  p = NULL
  M = 5000

  for (i in 1:M){
  ## Generate a new sample for each i with mu_A
  sample <- rnorm(30, alt_mean, 1)

  ## Calculate test statistic with mu_0, 0
  teststat <- (mean(sample)-0)/(1/sqrt(30))

  ## Check if the test statistic is in the region (one-sided upper-tailed test)
  ## AND store it in the "power" vector, position i.
  p[i] = teststat > qnorm(1-alpha)

}

  return(sum(p)/5000)

}

power(alpha = 0.05, alt_mean = 0)
```

```
## [1] 0.048
```

```
sig = c(0.001, 0.01, 0.05, 0.10)
mu = c(0, 0.2, 0.4, 0.6, 0.8, 1.0)

for (i in sig){
  for (j in mu) {
    print(c("alpha: ", i, "mean: ", j, "power: ", power(i,j)))
  }
}
```

```
## [1] "alpha: " "0.001"   "mean: "  "0"       "power: " "8e-04"
## [1] "alpha: " "0.001"   "mean: "  "0.2"     "power: " "0.0198"
## [1] "alpha: " "0.001"   "mean: "  "0.4"     "power: " "0.1838"
## [1] "alpha: " "0.001"   "mean: "  "0.6"     "power: " "0.5846"
## [1] "alpha: " "0.001"   "mean: "  "0.8"     "power: " "0.9088"
```

```
## [1] "alpha: " "0.001"   "mean: "  "1"       "power: " "0.9918"
## [1] "alpha: " "0.01"    "mean: "  "0"       "power: " "0.0084"
## [1] "alpha: " "0.01"    "mean: "  "0.2"     "power: " "0.1074"
## [1] "alpha: " "0.01"    "mean: "  "0.4"     "power: " "0.4492"
## [1] "alpha: " "0.01"    "mean: "  "0.6"     "power: " "0.8314"
## [1] "alpha: " "0.01"    "mean: "  "0.8"     "power: " "0.9808"
## [1] "alpha: " "0.01"    "mean: "  "1"       "power: " "0.9996"
## [1] "alpha: " "0.05"    "mean: "  "0"       "power: " "0.048"
## [1] "alpha: " "0.05"    "mean: "  "0.2"     "power: " "0.2944"
## [1] "alpha: " "0.05"    "mean: "  "0.4"     "power: " "0.7142"
## [1] "alpha: " "0.05"    "mean: "  "0.6"     "power: " "0.9554"
## [1] "alpha: " "0.05"    "mean: "  "0.8"     "power: " "0.9976"
## [1] "alpha: " "0.05"    "mean: "  "1"       "power: " "1"
## [1] "alpha: " "0.1"     "mean: "  "0"       "power: " "0.0986"
## [1] "alpha: " "0.1"     "mean: "  "0.2"     "power: " "0.4292"
## [1] "alpha: " "0.1"     "mean: "  "0.4"     "power: " "0.8172"
## [1] "alpha: " "0.1"     "mean: "  "0.6"     "power: " "0.9788"
## [1] "alpha: " "0.1"     "mean: "  "0.8"     "power: " "0.9994"
## [1] "alpha: " "0.1"     "mean: "  "1"       "power: " "1"
```

```
sig = c(rep(0.001,6), rep(0.01,6), rep(0.05,6), rep(0.10,6))
mu = rep(c(0, 0.2, 0.4, 0.6, 0.8, 1.0),4)
power = c(0.0008, 0.0198, 0.1838, 0.5846, 0.9088, 0.9918, 0.0084, 0.1074, 0.4492,
          0.8314, 0.9808, 0.9996, 0.048, 0.2944, 0.7142, 0.9554, 0.9976, 1,
          0.0986, 0.4292, 0.8172, 0.9788, 0.9994, 1)

table_power <- t(rbind(format(sig, digits = 4),
                       format(mu, digits = 2),
                       format(power, digits = 5)))
colnames(table_power) <- c("alpha", "mu_a", "power")

table_data <- as.data.frame(table_power) %>%
  rowwise() %>%
  mutate(meanname = paste0("$\\mu = ", mu_a, "$")) %>%
  select(-mu_a) %>%
  rename("$\\sigma$" = alpha) %>%
  pivot_wider(names_from = c(meanname), values_from = "power")


kable(table_data, format = "simple", position = "center", booktabs = T, escape = FALSE)
```

σ	$\mu = 0.0$	$\mu = 0.2$	$\mu = 0.4$	$\mu = 0.6$	$\mu = 0.8$	$\mu = 1.0$
0.001	0.0008	0.0198	0.1838	0.5846	0.9088	0.9918
0.010	0.0084	0.1074	0.4492	0.8314	0.9808	0.9996
0.050	0.0480	0.2944	0.7142	0.9554	0.9976	1.0000
0.100	0.0986	0.4292	0.8172	0.9788	0.9994	1.0000

```
#rename column names for easier variable call
colnames(table_power) <- c("alpha", "mu_a", "power")


#create data frame to use in ggplot
```

```r
power_data <- as.data.frame(table_power)

power_data$power <- as.numeric(as.character(power_data$power))

#create line graph
graph <- ggplot(power_data, aes(x = mu_a, y = power, colour = alpha, group = alpha)) +
  geom_point() +
  geom_line() +
  scale_y_continuous("Power", breaks=seq(0,1,.25)) +
  labs(x = "True Mean", y = "Power", title = "Relationship")

graph
```