HW03 Report

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Problem 1

```
clouds = read.table(file = "clouds.dat", header = TRUE)
n = length(clouds$Seeded)

# Difference in median precipitation
theta_hat = median(clouds$Seeded) - median(clouds$Unseeded)
theta_hat
```

```
## [1] 177.4
```

```
# Bootstrap to estimate the standard error
B = 1000
theta_hat_bootstrapped = rep(0, B)
for (i in 1 : B) {
  index = sample(1 : n, n, replace = TRUE)
  seeded_star = clouds$Seeded[index]
  unseeded_star = clouds$Unseeded[index]
  theta_hat_bootstrapped[i] = median(seeded_star) - median(unseeded_star)
}
theta_hat_se = var(theta_hat_bootstrapped) ^ 0.5
theta_hat_se
```

```
## [1] 37.30855
```

```
# 95% Normal confidence interval
cf_95 = c(theta_hat - 1.96 * theta_hat_se, theta_hat + 1.96 * theta_hat_se)
cf_95
```

```
## [1] 104.2752 250.5248
```

Problem 3

```
bigcity = read.table(file = "bigcity.dat", header = TRUE)
n = length(bigcity$x)

# Plug-in estimator
theta_hat = mean(bigcity$x) / mean(bigcity$u)
theta_hat
```

```
## [1] 1.239019
```

```
# Bootstrapping
B = 1000
theta_hat_bootstrapped = rep(0, B)
for (i in 1 : B) {
  index = sample(1 : n, n, replace = TRUE)
  x_star = bigcity$x[index]
  u_star = bigcity$u[index]
  theta_hat_bootstrapped[i] = mean(x_star) / mean(u_star)
}
theta_hat_se = var(theta_hat_bootstrapped) ^ 0.5
theta_hat_se
```

```
## [1] 0.03549368
```

```
# 95% bootstrap pivoral interval
pv_95 = c(2 * theta_hat - quantile(theta_hat_bootstrapped, 0.975), 2 * theta_hat - quantile(theta_hat_b
pv_95
```

```
##    97.5%     2.5%
## 1.163331 1.300251
```

Problem 7b

```
data = c(22, 23.9, 20.9, 23.8, 25, 24, 21.7, 23.8, 22.8, 23.1, 23.1, 23.5, 23, 23)
n = length(data)

beta = max(data)
beta
```

```
## [1] 25
```

```
alpha = n / (n * log(beta) - log(prod(data)))
alpha
```

```
## [1] 12.59487
```