Homework_2_451

2025-01-18

```r
#1:
mean_count <- 41.3
mean_area <- 36
total_area <- 535
variance_count <- 10.1
variance_area <- 3.4
cov_area_count <- 2.8
M <- 35
m <- 15

#Calculations
density <- mean_count / mean_area
N_hat <- density * total_area

term1 <- variance_count
term2 <- (density^2) * variance_area
term3 <- -2 * density * cov_area_count

variance_N <- ((M^2) * (1 - (m / M)) / m) * (term1 + term2 + term3)

# Confidence Interval
std_error <- sqrt(variance_N)
z <- 1.96
CI_1 <- N_hat + z * std_error
CI_2 <- N_hat - z * std_error

# Print Results
print(list(Abundance = N_hat, Variance = variance_N, CI_Upper = CI_1, CI_Lower = CI_2))
```

```
## $Abundance
## [1] 613.7639
##
## $Variance
## [1] 380.3501
##
## $CI_Upper
## [1] 651.9889
##
## $CI_Lower
## [1] 575.5389
```

```r
#2

nx <- 117
ny <- 125
m <- 102
```

```r
# Calculations
N_hat_beaver <- ((nx + 1) * (ny + 1)) / (m + 1) - 1
var_N_beaver <- ((nx + 1) * (ny + 1) * (nx - m) * (ny - m)) / ((m + 1)^2 * (m + 2))
beta_x <- nx / N_hat_beaver
beta_y <- ny / N_hat_beaver

# Print Results
print(list(Abundance = N_hat_beaver, Variance = var_N_beaver, Detection_Prob_Aerial = beta_x, Detection
```

```
## $Abundance
## [1] 143.3495
##
## $Variance
## [1] 4.649046
##
## $Detection_Prob_Aerial
## [1] 0.8161869
##
## $Detection_Prob_Ground
## [1] 0.8719946
```

```r
#3
eagle <- read.csv("eagles.csv")
mean_count <- mean(eagle$Count)
var_count <- var(eagle$Count)

total_area <- 400
plot_area <- 10
sampled_plots <- 19
M <- total_area / plot_area

# Calculations
N_hat_eagle <- M * mean_count
var_N_eagle <- (M^2) * (var_count / sampled_plots)

# Confidence Interval
std_error <- sqrt(var_N_eagle)
z <- 1.96
CI_upper_1 <- N_hat + z * std_error
CI_lower_1 <- N_hat - z * std_error

# Print Results
print(list(Abundance = N_hat_eagle, Variance = var_N_eagle, Confidence_Interval_Upper = CI_upper_1, Con
```

```
## $Abundance
## [1] 313.6842
##
## $Variance
## [1] 732.2869
##
## $Confidence_Interval_Upper
## [1] 666.8031
##
## $Confidence_Interval_Lower
```

```
## [1] 560.7247
```