HW 4

1. (6 points)

Modified from Lohr Exercise 3.3 Consider a population with 6 students and suppose we know the test scores of the students.

```
student1 <- 66; student2 <- 59; student3 <- 70
student4 <- 83; student5 <- 82; student6 <- 71
all_students <- c(student1, student2, student3, student4, student5, student6)
```

    a. Find the population mean y_U and population variance S^2.

    b. Assume you plan to take a simple random sample of size 4. Calculate $V(\bar{y})$ using the following equation

$$V(\bar{y}) = \frac{S^2}{n}\left(1 - \frac{n}{N}\right)$$

Recall the variance of an estimator of population mean is

    c. Now let stratum 1 consist of students 1 - 3 and stratum 2 consist of students 4 - 6. Assume you can take 2 samples from each stratum. Find $V(\bar{y}_{str})$ and compare it to that from SRS.

2. (6 points)

Modified from Lohr Exercise 3.6 Suppose that a city has 90,000 dwelling units, of which 35,000 are houses, 45,000 are apartments, and 10,000 are condominium.

    a. You believe that the mean electricity usage is about twice as much for houses as for apartments or condominiums, and that the standard deviation is proportional to the mean so that $S_{house} = 2S_{apartment} = 2S_{condo}$. How would you allocate a stratified sample of 900 observations if you wanted to estimate the mean electricity consumption for all dwelling units in the city?

    b. Now suppose that you take a stratified random sample with proportional allocation and want to estimate the overall proportion of households in which energy conservation is practiced. If 45% of house dwellers, 25% of apartment dwellers, and 3% of condo residents in the sample practice energy conservation, with is p for the population?