# Exercise 2: Sampling

For this assignment, complete the dataset, and then answer the questions to the best of your ability.

(adapted from CH4 ex.12)  
A college has N=150 faculty members. The dean wants to conduct a faculty salary survey selecting   
systematic sample of n=20 faculty. The list of faculty members appears on page 147. I have begun an Excel file, included with this problem set, with the first 100 entries filled in.

**Dataset**

First, complete the dataset by adding the final 50 entries from page 147. The following coding was used:

Division: 1= Eng&Prof 2= Medicine 3= Lit&SocSci 4= Biol&Sci  
Sex: 1= Male 2=Female

**Questions**

Then, answer the following questions:  
1) What should be the sampling interval for this design? (1 pt)

The ratio of population to sample size for this dataset is 7.5. The sampling interval will be rounded down to 7 and I will continue counting and selecting each kth element from the random starting point until 20 elements are chosen.   
2) What are the possibilities for the first random start? (1 pt)

The probabilities for the first random start are 1, 2, 3, 4, 5, 6, and 7.   
3) Draw a sample of 20 faculty members (2pts)

Using the random start (RS) of 5, the elements selected for the n=20 sample through systematic selection are elements 5, 12, 19, 26, 33, 40, 47, 54, 61, 68, 75, 82, 89, 96, 103, 110, 117, 124, 131 and 138.

4) Estimate the mean salary for the faculty using your n=20 sample. (3 pts)

The mean salary for the faculty using the n=20 sample is $73,300.   
5) What is the variance for that mean? (3 pts)  
The variance for this mean estimate is approximately $671,590.

Next, the dean of the school of medicine suggested that their professors were not paid as well as the other divisions’ professors and wondered if you could draw a sample to see if that is true.  
6) Draw a stratified sample from the dataset, using a sample size n=10, for each of the four  
divisions. (2 pts)  
7) Show your estimated mean salary for each division. (4 pts)  
The estimated mean salary for each division is as follows. Staff from the English & Professor division have a mean salary of $71,400, staff from the medical division have the highest mean salary of $87,700, those from the English and Social Sciences division on average earn $72,300 while those in the biology/science division report average earnings of $78,200. Based on these sample estimates (later do statistical significance tests), we can confidently refute the claim that those in the medical division are getting paid less than staff in other divisions.

Finally, some of the female professors said the real issue wasn’t divisional but rather that women were not paid as much as their male counterparts. They asked you to check the data and see if they are correct.  
8) Draw a stratified sample size n=20 for both sexes (2 pts)  
9) Show your estimated mean salary by sex. (2 pts)

On average, male staff earn $80,100 while female staff only earn approximately $53,850 across divisions and staff rankings. At face value, this may suggest a disparity in pay based independently on gender, however a further look at the data shows that slightly more than half of the male staff are in the first ranking while only 23% of female staff are in this ranking. Still, after grouping the data by gender and rank, it seems that male staff systematically earn more than female staff at each rank category.

| no | Division | sex | rank | salary |
| --- | --- | --- | --- | --- |
| 1 | 1 | 1 | 3 | 88 |
| 109 | 1 | 1 | 2 | 121 |
| 45 | 1 | 1 | 3 | 43 |
| 18 | 1 | 1 | 1 | 91 |
| 75 | 1 | 1 | 2 | 71 |
| 113 | 1 | 1 | 1 | 72 |
| 67 | 1 | 2 | 3 | 44 |
| 60 | 1 | 1 | 3 | 58 |
| 103 | 1 | 1 | 1 | 114 |
| 34 | 1 | 1 | 2 | 64 |
| 81 | 2 | 2 | 3 | 42 |
| 43 | 2 | 2 | 3 | 32 |
| 57 | 2 | 1 | 3 | 64 |
| 115 | 2 | 1 | 2 | 167 |
| 105 | 2 | 1 | 1 | 112 |
| 4 | 2 | 1 | 1 | 133 |
| 87 | 2 | 1 | 3 | 83 |
| 55 | 2 | 1 | 3 | 84 |
| 59 | 2 | 2 | 1 | 87 |
| 77 | 2 | 2 | 2 | 59 |
| 142 | 3 | 2 | 3 | 46 |
| 71 | 3 | 1 | 1 | 91 |
| 25 | 3 | 1 | 1 | 61 |
| 99 | 3 | 1 | 2 | 50 |
| 9 | 3 | 2 | 3 | 39 |
| 122 | 3 | 1 | 1 | 79 |
| 40 | 3 | 1 | 2 | 60 |
| 12 | 3 | 1 | 1 | 62 |
| 6 | 3 | 1 | 1 | 113 |
| 47 | 3 | 1 | 1 | 92 |
| 89 | 4 | 1 | 1 | 78 |
| 118 | 4 | 1 | 1 | 107 |
| 41 | 4 | 2 | 1 | 73 |
| 79 | 4 | 1 | 1 | 83 |
| 52 | 4 | 1 | 1 | 49 |
| 32 | 4 | 1 | 1 | 103 |
| 98 | 4 | 1 | 1 | 85 |
| 135 | 4 | 2 | 3 | 36 |
| 10 | 4 | 1 | 1 | 74 |
| 37 | 4 | 1 | 1 | 85 |