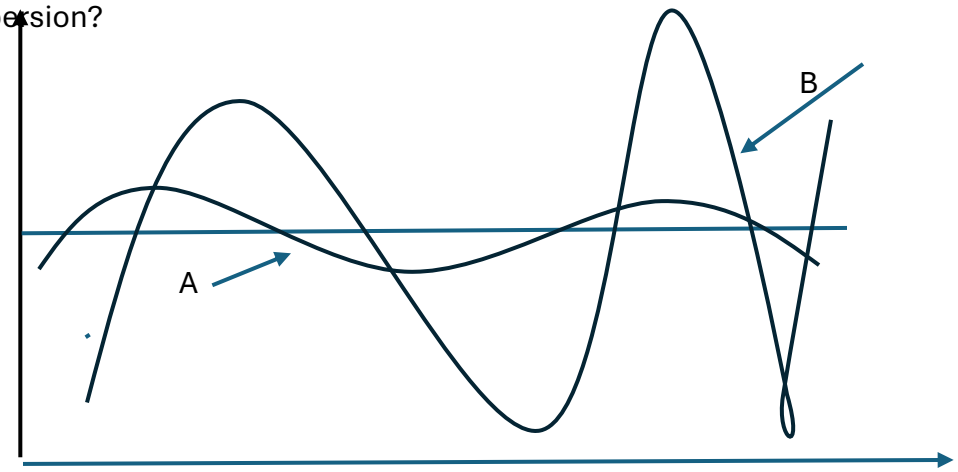
Chapter 4: measures of dispersions

1) what is dispersion?



2) What are those measures

IQV (Index of Qualitative Variables), Variance (S^2), and standard deviation (st.d. or S)

$$S^2 = \frac{\sum(X_i - \bar{X})^2}{N-1} \qquad 0 \leq S^2 \leq +\infty$$

$$S = \sqrt{\frac{\sum(X_i - \bar{X})^2}{N-1}} \qquad 0 \leq S \leq +\infty$$

3) Example

Compute the variance and st.d. for the following sample,

7, 42, 89, 13, 56, 91, 24, 68, 3, 77, 35, 60

$$\bar{X} = \frac{\sum X_i}{N} = \frac{7 + 42 + 89 + 13 + 56 + 91 + 24 + 68 + 3 + 77 + 35 + 60}{12} = 47.1$$

$$S^2 = \frac{\sum (X_i - \bar{X})^2}{N - 1} = 971$$

$$S^2 = \frac{(7 - 47.1)^2 + (42 - 47.1)^2 + (89 - 47.1)^2 + (13 - 47.1)^2 + (56 - 47.1)^2 + (91 - 47.1)^2 + (24 - 47.1)^2 + (68 - 47.1)^2 + (3 - 47.1)^2 + (77 - 47.1)^2 + (35 - 47.1)^2 + (60 - 47.1)^2}{11}$$

$$S = \sqrt{\frac{\sum (X_i - \bar{X})^2}{N - 1}} = 31.2$$

4)

$$IQV = \frac{K(100^2 - \sum Pct^2)}{100^2(K-1)}$$

K = number of categories

Pct = percentages of cases in each category

Race	Fayetteville AR 2010 (%)	Fayetteville AR 2020 (%)
White (NH)	81	74
Black	6	6
Hispanics	6	9
Asians	3	3
Others	4	8
IQV	41.8%	54.2%

$$IQV = \frac{K(100^2 - \sum Pct^2)}{100^2(K-1)}$$

$$IQV = \frac{5(100^2 - (81^2 + 6^2 + 6^2 + 3^2 + 4^2))}{100^2 \times (5-1)} = 71.8\%$$

$$IQV = \frac{5(100^2 - (74^2 + 6^2 + 9^2 + 3^2 + 8^2))}{100^2 \times (5-1)} = 54.2\%$$

$0 \leq IQV \leq 1 \; or \; 100\%$

When IQV goes towards 0, the distribution of cases across different categories become more skewed, when IQV moves towards 1 or 100%, the distribution of cases across different categories become more even.