Question 2

> The above data collects the mean flow (m^3/s) of the Fraser River (Canada) from 1912 to 1999

1.

Let the number of sample be:

$$n = 88$$

Let the data in time order be:

$$x_1 = 3\,360, \ \ x_2 = 2\,884, \ ..., \ x_i, \ ..., \ x_n = 3\,465, \quad i \in \{1, 2, ..., n\}$$

Then we have the mean:

$$\bar{x} = \frac{1}{n}\sum_{i=1}^{n} x_i = \frac{238\,719}{88} \approx 2\,712.716$$

Let the data in ascending order be:

$$x_{a_1} = 2\,012, \ \ x_{a_2} = 2\,027, \ ..., \ x_{a_{i_a}}, \ ..., \ x_{a_n} = 3\,715, \quad i_a \in \{1, 2, ..., n\}$$

Then we have the index of the median:

$$i_{a_m} = \frac{n+1}{2} = 44.5 = \frac{44+45}{2}$$

Then we have the median:

$$m = x_{a_{i_{a_m}}} = \frac{x_{a_{44}} + x_{a_{45}}}{2} = 2\,664.5$$

Answer

- $\bar{x} = \frac{238\,719}{88} \approx 2\,712.716$
- $m = 2\,664.5$

2.

Let the time be:

$$t_1 = 1\,912,\ t_2 = 1\,913,\ ...,t_i,\ t_n = 1\,999, \quad i \in \{1, 2, ..., n\}$$

Then we have the mean of t:

$$\bar{t} = \frac{1}{n}\sum_{i=1}^{n} t_i = \frac{172\,084}{88} \approx 1\,955.5$$

Then we have the covariance of t and x:

$$\sigma_{tx} = \frac{1}{n}\sum_{i=1}^{n} t_i x_i - \bar{t}\bar{x} = \frac{1\,103\,545}{880} \approx 1\,254.028 > 0$$

Then we can say that the mean flow is increasing in time.

Answer

- Increasing