Statistical Analysis of Fraser River Flow Data (1912-1999)

1 Analysis of Mean and Median Flow

1.1 Sample Size

Let the number of samples be:

$$n = 88 \tag{1}$$

Let the data in time order be:

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

1.2 Mean Calculation

The mean flow is given by:

$$\bar{x} = \frac{1}{n} \sum_{i=1}^{n} x_i = \frac{238,719}{88} \approx 2,712.716 \tag{3}$$

1.3 Median Calculation

Ordering the data in ascending order:

$$x_{a_1} = 2,012, \quad x_{a_2} = 2,027, \ ..., \ x_{a_{i_a}}, \ ..., \ x_{a_n} = 3,715, \quad i_a \in \{1, 2, ..., n\} \tag{4}$$

The index of the median is computed as:

$$i_{a_m} = \frac{n+1}{2} = 44.5 = \frac{44+45}{2} \tag{5}$$

Thus, the median flow is:

$$m = x_{a_{i_{a_m}}} = \frac{x_{a_{44}} + x_{a_{45}}}{2} = 2,664.5 \tag{6}$$

Summary of Results:

- Mean Flow: $\bar{x} = 2,712.716$
- Median Flow: $m = 2,664.5$

2 Trend Analysis over Time

2.1 Mean Year Calculation

Let the time sequence be:

$$t_1 = 1912, \ t_2 = 1913, \ ..., t_i, \ t_n = 1999, \quad i \in \{1, 2, ..., n\} \tag{7}$$

The mean year is computed as:

$$\bar{t} = \frac{1}{n} \sum_{i=1}^{n} t_i = \frac{172,084}{88} \approx 1955.5 \tag{8}$$

2.2 Covariance Calculation

The covariance between time and flow is given by:

$$\sigma_{tx} = \frac{1}{n}\sum_{i=1}^{n} t_i x_i - \bar{t}\bar{x} = \frac{1,103,545}{880} \approx 1,254.028 > 0 \tag{9}$$

Since $\sigma_{tx} > 0$, we conclude that the mean flow has been increasing over time.

Conclusion: The mean flow of the Fraser River shows an increasing trend over the period from 1912 to 1999.