2. An e-commerce platform wants to analyze the delivery times of its shipments tounderstand the variability in order fulfillment and optimize its logistics operations. Data: Let's consider the delivery times (in days) for a sample of 50 shipments:

3, 5, 2, 4, 6, 2, 3, 4, 2, 5, 7, 2, 3, 4, 2, 4, 2, 3, 5, 6, 3, 2, 1, 4, 2, 4, 5, 3, 2, 7, 2, 3, 4, 5, 1, 6, 2, 4, 3, 5, 3, 2, 4, 2, 6, 3, 2, 4, 5, 3

Questions:

a. Range: What is the range of the delivery times?

b. Variance: What is the variance of the delivery times?

c. Standard Deviation: What is the standard deviation of the deliverytimes?

**Delivery‑time data (50 shipments)**

3, 5, 2, 4, 6, 2, 3, 4, 2, 5, 7, 2, 3, 4, 2, 4, 2, 3, 5, 6, 3, 2, 1, 4, 2, 4, 5, 3, 2, 7, 2, 3, 4, 5, 1, 6, 2, 4, 3, 5, 3, 2, 4, 2, 6, 3, 2, 4, 5, 3

| **Day** | **Frequency** |
| --- | --- |
| 1 | 2 |
| 2 | 14 |
| 3 | 11 |
| 4 | 10 |
| 5 | 7 |
| 6 | 4 |
| 7 | 2 |

*Total* = 176 days,  *Mean* = 3.52 days.

**a. Range**

Range =max(x)−min(x)

=7−1

=6 days

**b. Variance**

**Population variance** (the data are treated as the whole shipment set)

=734/50−3.52^2

=14.68−12.3904

=2.2896

*σ^*2 ≈ 2.29 days^2​

**Sample variance** (if the 50 observations are only a sample of a larger population)

S^2 = ∑x^2−(∑x) ^2/n/n−1

=734−176^2/50/49

=114.48/49=2.3365

*S^*2 ≈ 2.34 days^2​

**c. Standard Deviation**

Population σ = ≈1.51 days

Sample *s* = ​ ≈ 1.53 days