

If  $\mu = 55$ ,  $\sigma_{4a} = 4$ ,  $\sigma_{4b} = 10$ ,  $\sigma_{4c} = 15$ , In this which is better

### Step 1: Understand the Meaning

- **Mean ( $\mu = 55$ )** → Average value is 55 in all three cases
- **Standard Deviation ( $\sigma$ )** → Measures spread or variability

Standard deviation tells us:

- How far values are from the mean
- How consistent the data is

Smaller  $\sigma$  = More consistent

Larger  $\sigma$  = More spread

### Step 2: Compare the Three Cases

Case	Mean ( $\mu$ )	Standard Deviation ( $\sigma$ )	Spread	Quality
A	55	4	Very small	<input checked="" type="checkbox"/> Best
B	55	10	Moderate	<input type="checkbox"/> Average
C	55	15	Very large	<input checked="" type="checkbox"/> Poor

### Step 3: Graphical Explanation (Concept)

If we draw three normal curves with mean = 55:

$$\sigma = 4$$

- Narrow and tall curve

- Data tightly clustered near 55
- High consistency

$\sigma = 10$

- Medium width curve
- Moderate variation

$\sigma = 15$

- Wide and flat curve
- Large variation
- Unstable system

Smaller  $\sigma$  gives better control.

#### **Step 4: Business Interpretation (Manufacturing Example)**

Suppose a factory produces medicine tablets with:

Target weight = 55 mg

**Case A:  $\sigma = 4$**

- Most tablets between 51–59 mg
- Almost all tablets acceptable
- Low wastage
- High quality control

**Case B:  $\sigma = 10$**

- Tablets between 45–65 mg
- Some tablets too heavy/light
- Moderate wastage

**Case C:  $\sigma = 15$**

- Tablets between 40–70 mg
- Many defective
- Customer complaints
- High financial loss

So  $\sigma = 4$  is best.

## **Step 5: Using Empirical Rule**

For Normal Distribution:

### **When $\sigma = 4$**

- 68% between 51 and 59
- 95% between 47 and 63
- Very controlled range

### **When $\sigma = 15$**

- 68% between 40 and 70
- 95% between 25 and 85
- Very wide range

Wide range = Poor consistency.

## **Step 6: When Would Larger $\sigma$ Be Better?**

Only in rare cases like:

- Measuring diversity
- Studying income inequality
- Risk analysis

But in quality control and performance measurement:

Smaller  $\sigma$  is always better.

## **Final Exam Answer**

Since all three distributions have the same mean ( $\mu = 55$ ), the one with the smallest standard deviation is better.

[boxed{\sigma = 4 \text{ is best}}]

Because:

- It has lowest variability
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- Values are closely concentrated around mean
- It ensures better consistency and quality

### Comparison of Standard Deviations ( $\mu = 55$ )

**Height**

