10.2 Quality

Name: _____ Class: _____ Date: _____ **Total: 14 marks**

KEY WORDS control chart • Pareto analysis

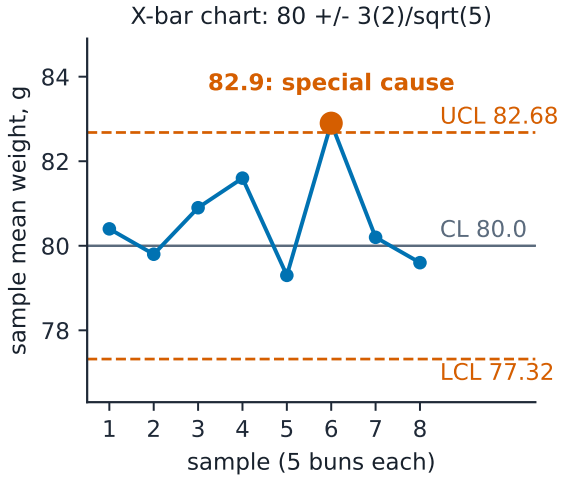
Objective

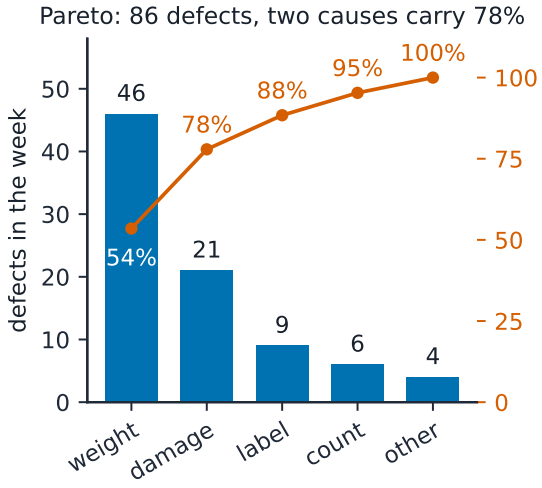
Set control limits, read a chart's signals, and rank defects with a Pareto and the cost of quality.

1 Key knowledge and worked examples

■ Limits and signals

X-bar limits $\mu \pm 3\sigma/\sqrt{n}$ (or $\pm A_2\bar{R}$); $\bar{R} = d_2\sigma$; R-chart UCL $= D_4\bar{R}$. A point beyond a limit or eight on one side is a special cause.





Beyond the limits is a signal; inside them, hands off

■ Worked example. The 80 g bun

$80 \pm 3 \times 2/\sqrt{5} = 80 \pm 2.68$ ✓; sample 6 at 82.9 is beyond. Pareto 46 + 21 of 86 = 77.9% ✓.

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2 Practice

2.1 Jam jars: process mean 250 g, sd 3 g, samples of 4. The X-bar limits. [3]

2.2 For $n = 4$, $d_2 = 2.059$ and $D_4 = 2.282$. The average range and the R-chart upper limit. [3]

2.3 Defects this week: cracked 38, under-filled 27, label 15, lid 12, other 8. The Pareto ranking, the total, and the share of the top two. [4]

2.4 Cost of quality: prevention 900, appraisal 1,500, internal failure 4,200, external failure 6,400 on sales of 80,000. The total, the failure share, and the share of sales. [4]

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Solutions

2.1

- $3\sigma/\sqrt{n} = 3 \times 3/2 = 4.5$ g.
- Limits 245.5 and 254.5 g.

2.2

- $\bar{R} = 2.059 \times 3 = 6.18$ g.
- $UCL_R = 2.282 \times 6.18 = 14.1$ g.

2.3

- Order as given: 38, 27, 15, 12, 8; total 100.
- Top two $65/100 = 65\%$ - cracking and filling are the vital few.

2.4

- Total $900 + 1{,}500 + 4{,}200 + 6{,}400 = 13{,}000$.
- Failure $10{,}600/13{,}000 = 81.5\%$; of sales $13{,}000/80{,}000 = 16.3\%$.

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