Lecture #17

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8 Rules for Chart Interpretation

- Test 1: Extreme points
- Test 2: 2 out of 3 points in zone A or beyond
- Test 3: 4 out of 5 points in zone B or beyond
- Test 4: Runs above / below the centerline
- Test 5: Linear trend
- Test 6: Oscillatory trend
- Test 7: Avoidance of zone C
- Test 8: Run in zone C

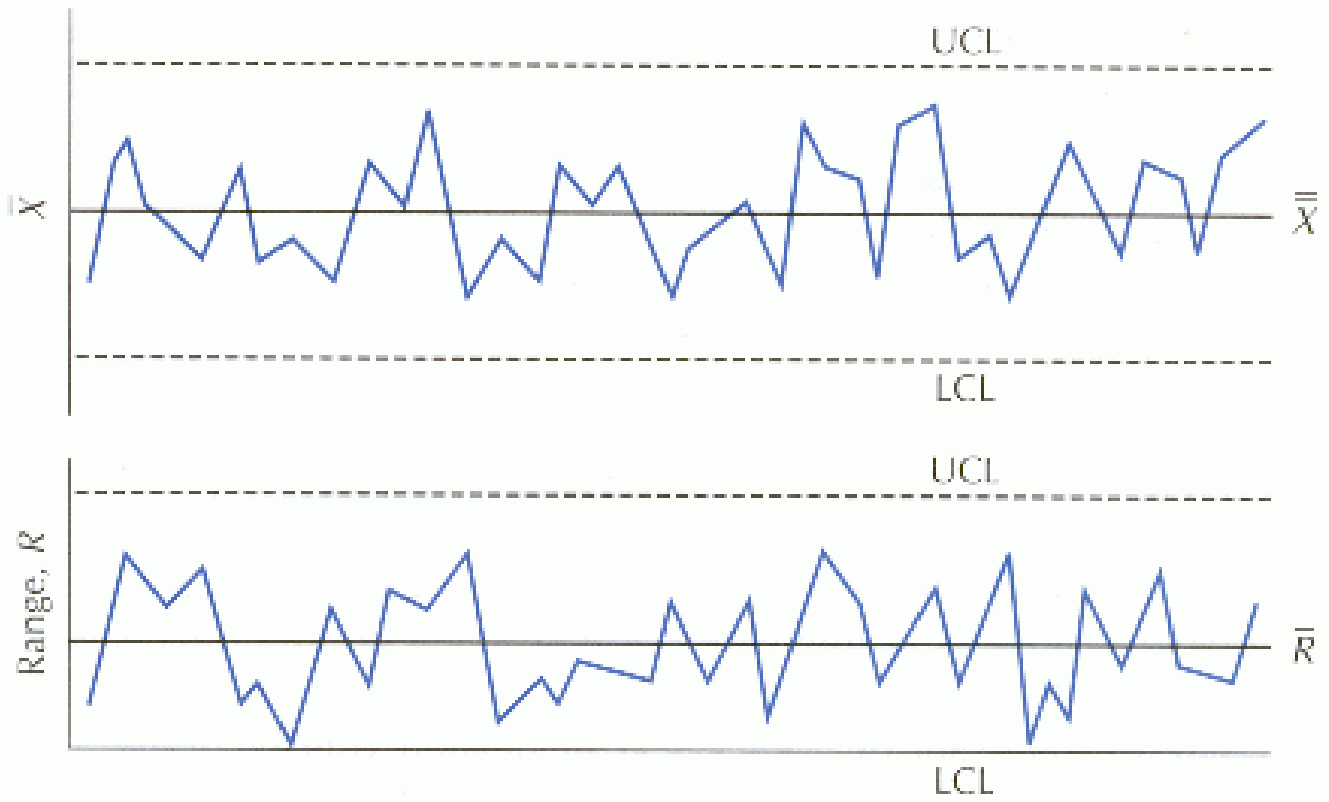


Figure 6.2 Appearance of a Process in Good Statistical Control

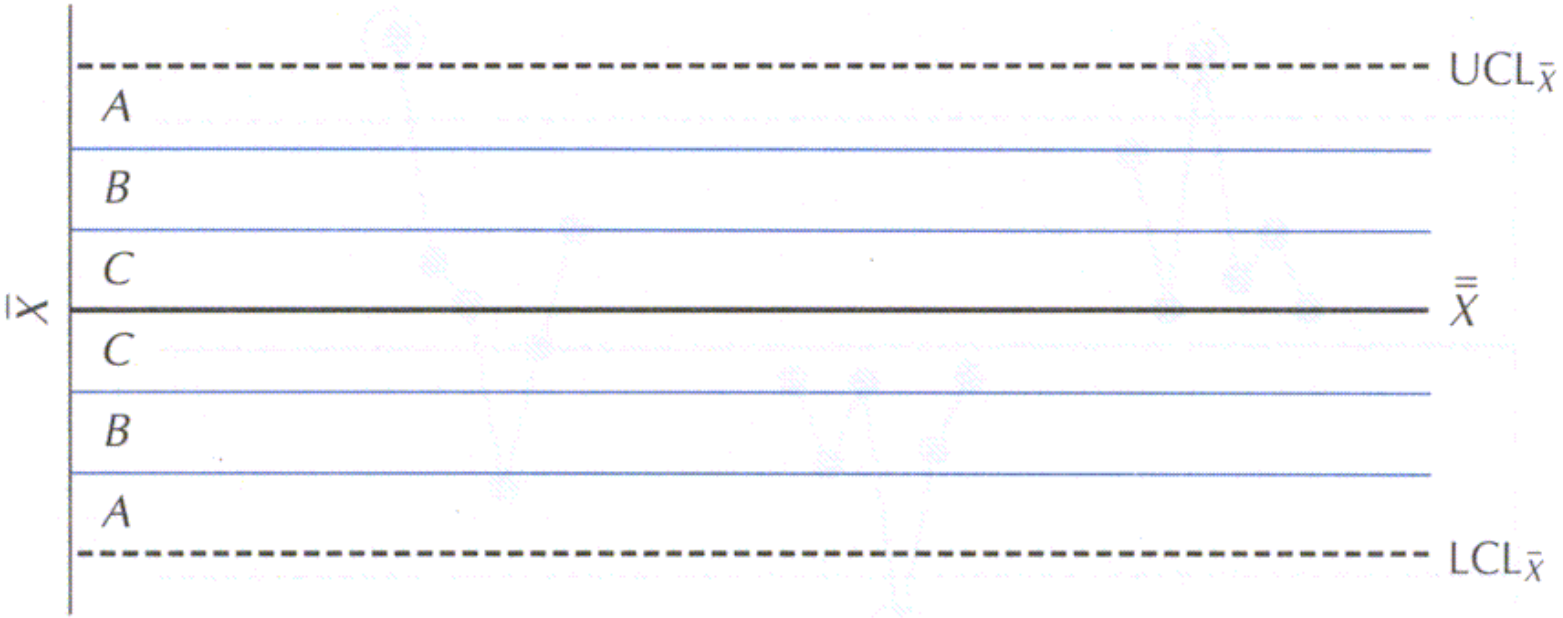
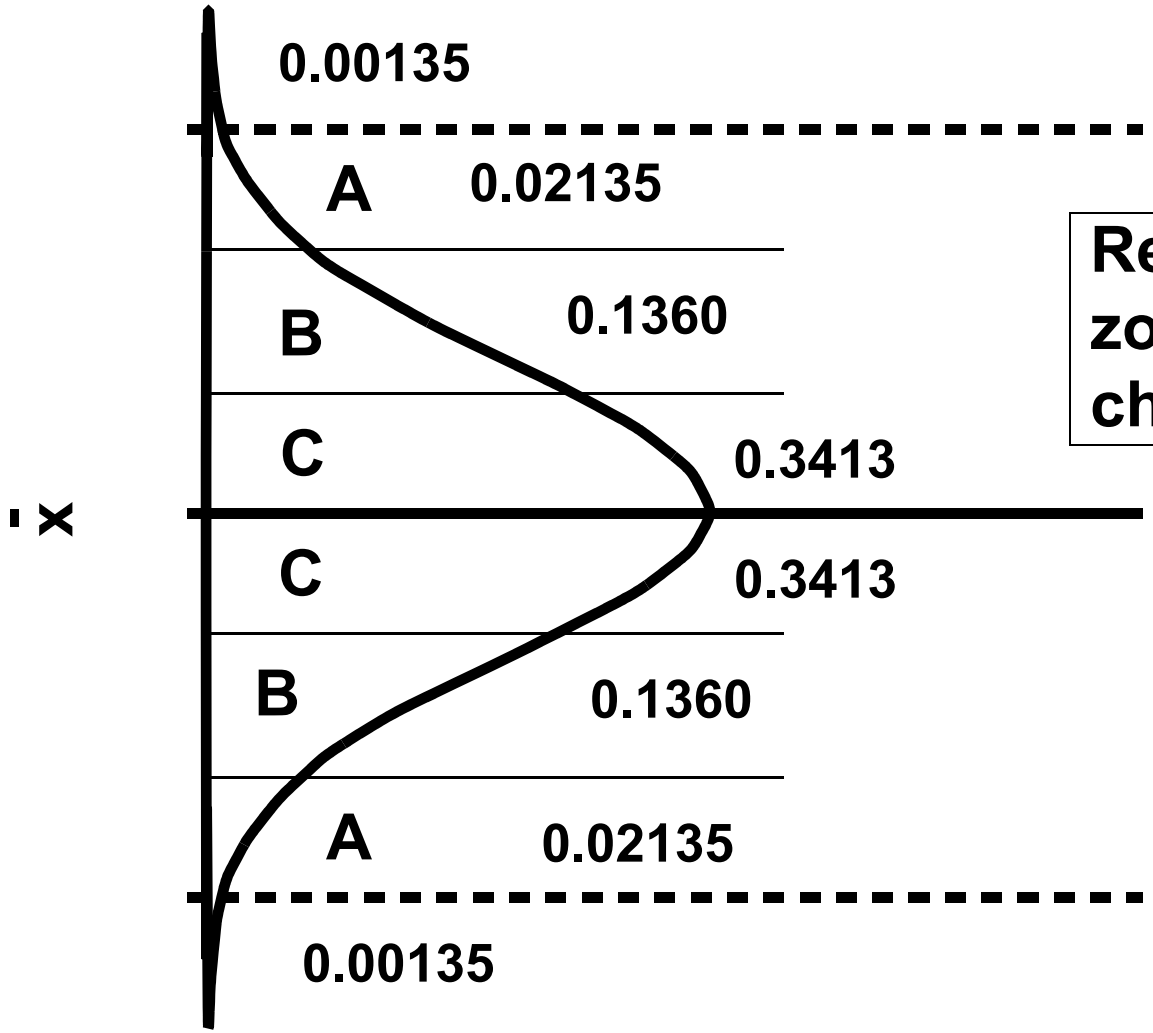
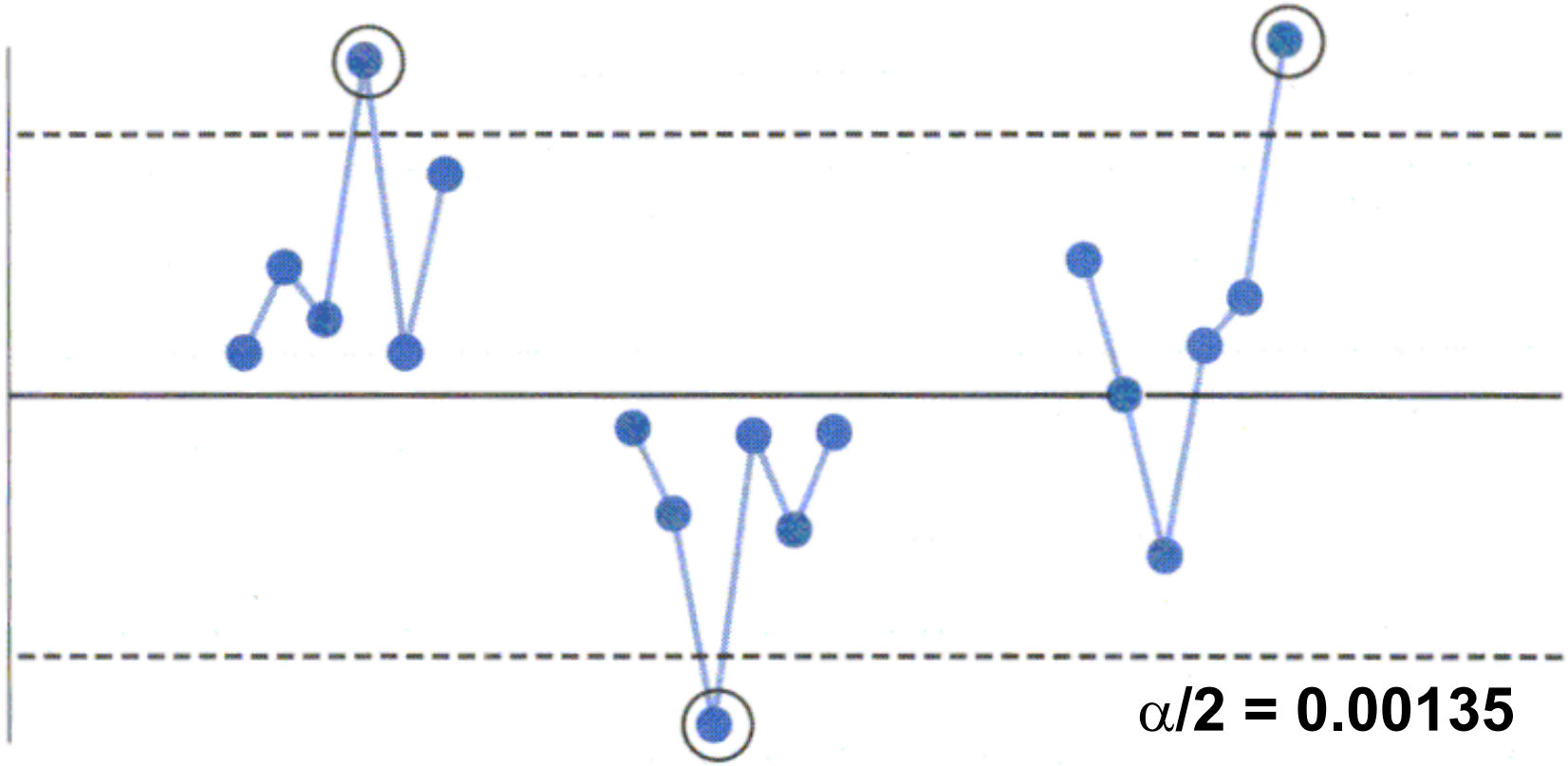


Figure 6.3 Control Chart Zones to Aid Chart Interpretation

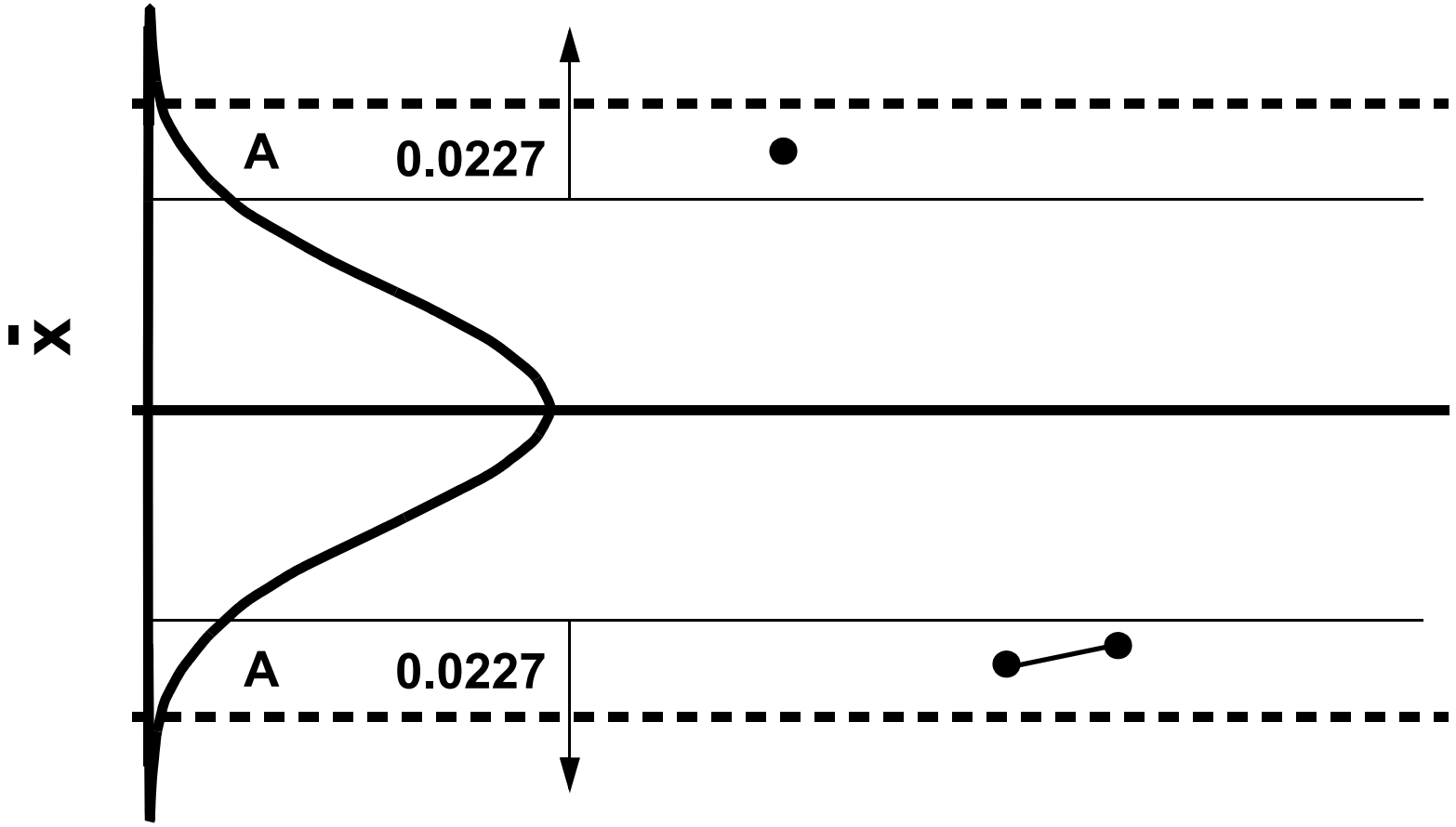


Remember: No zones on the R chart

Test 1 examples - Extreme Points



Test 2: 2 out of 3 Points in Zone A or Beyond



Basis for Test 2

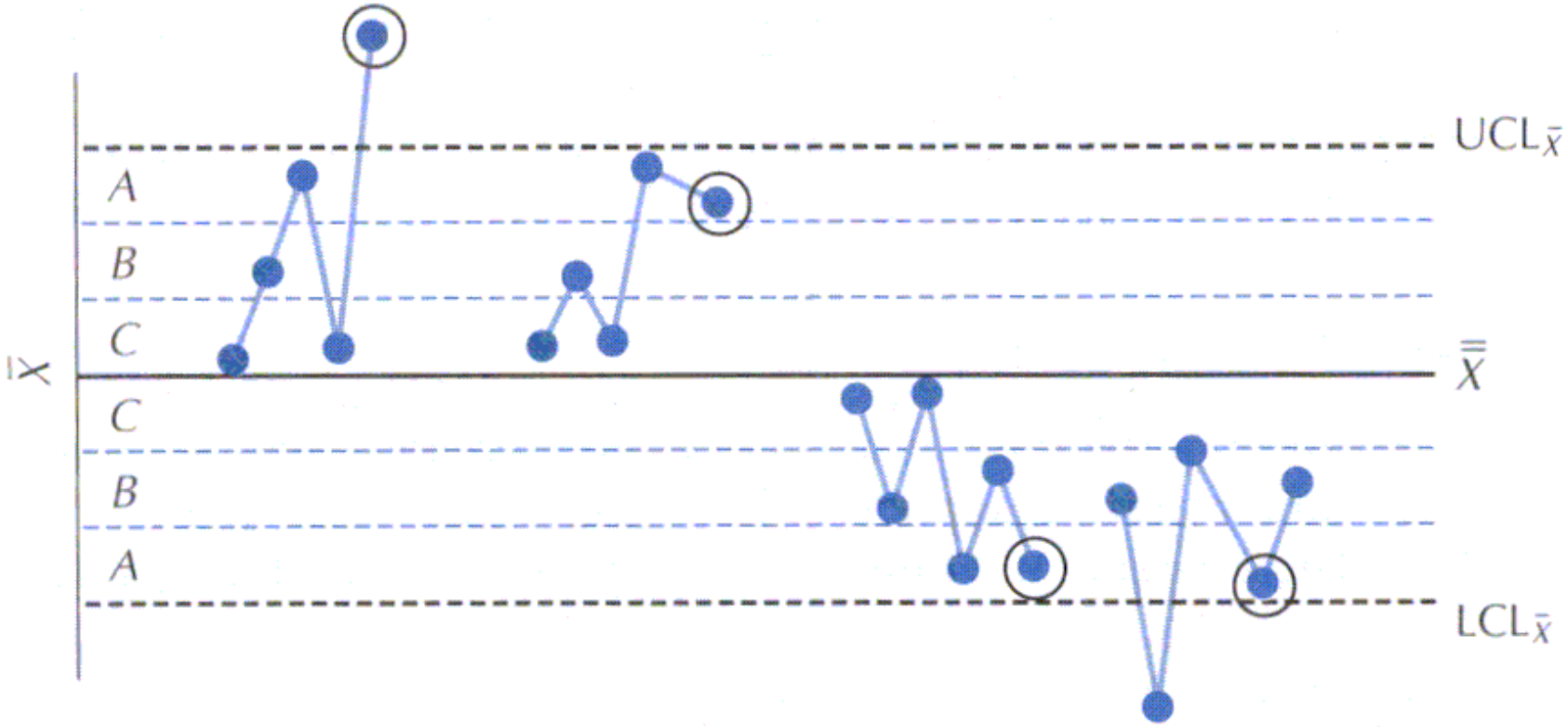
Prob (A Point in Zone A or Beyond) = .0227

Prob (Two Points in a Row in Zone A or Beyond)
= (0.0227) * (0.0227) = 0.00052

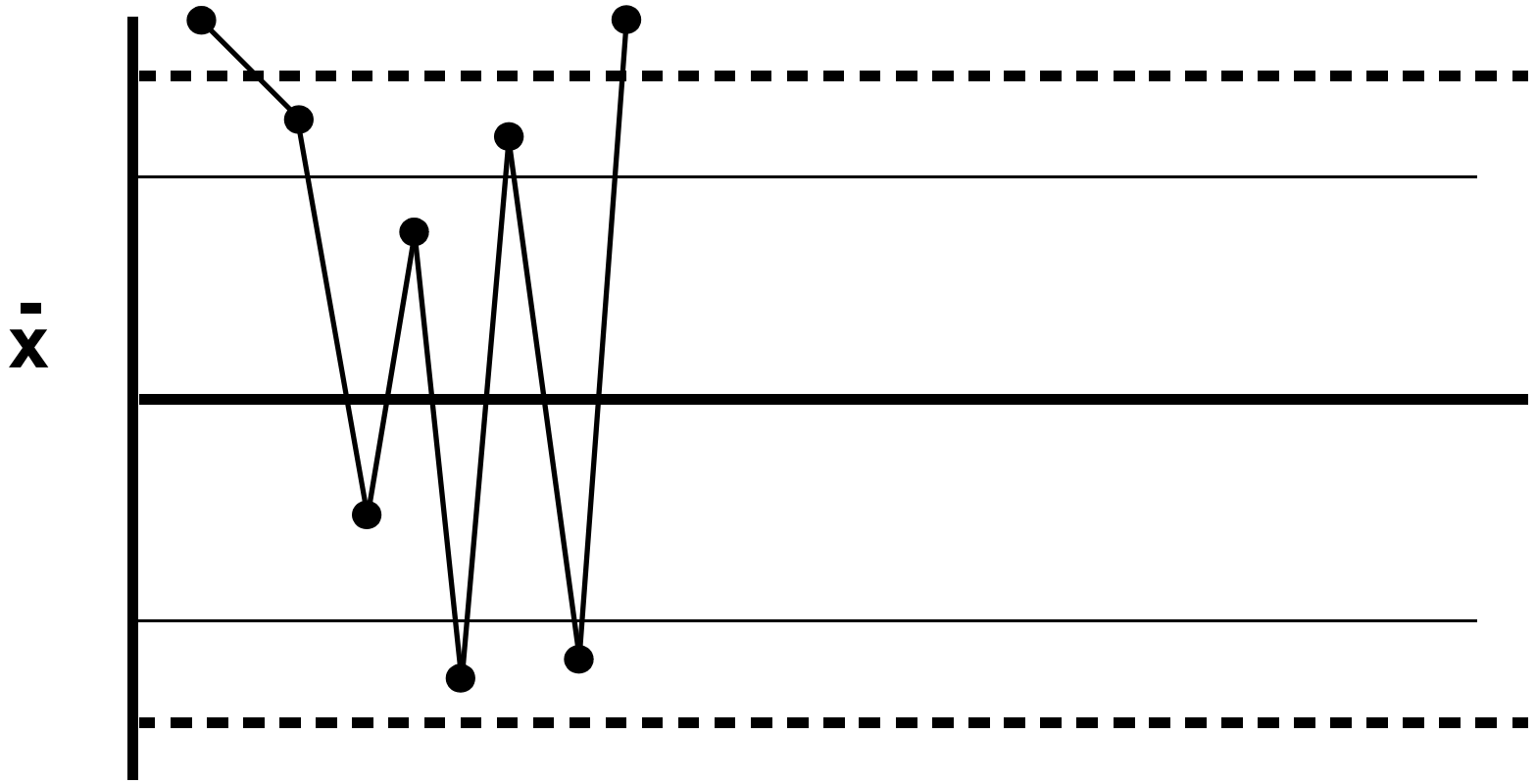
Very small relative to $\alpha/2 = 0.00135$
-- 2 points in a row in zone A is too restrictive

What about 2 out 3 in zone A or beyond? Two ways for this to occur: (A -- not A -- A) OR (not A -- A -- A)
$= 2 * (0.0227)^2 * (0.9773) = 0.0010$ -- close to $\alpha/2$

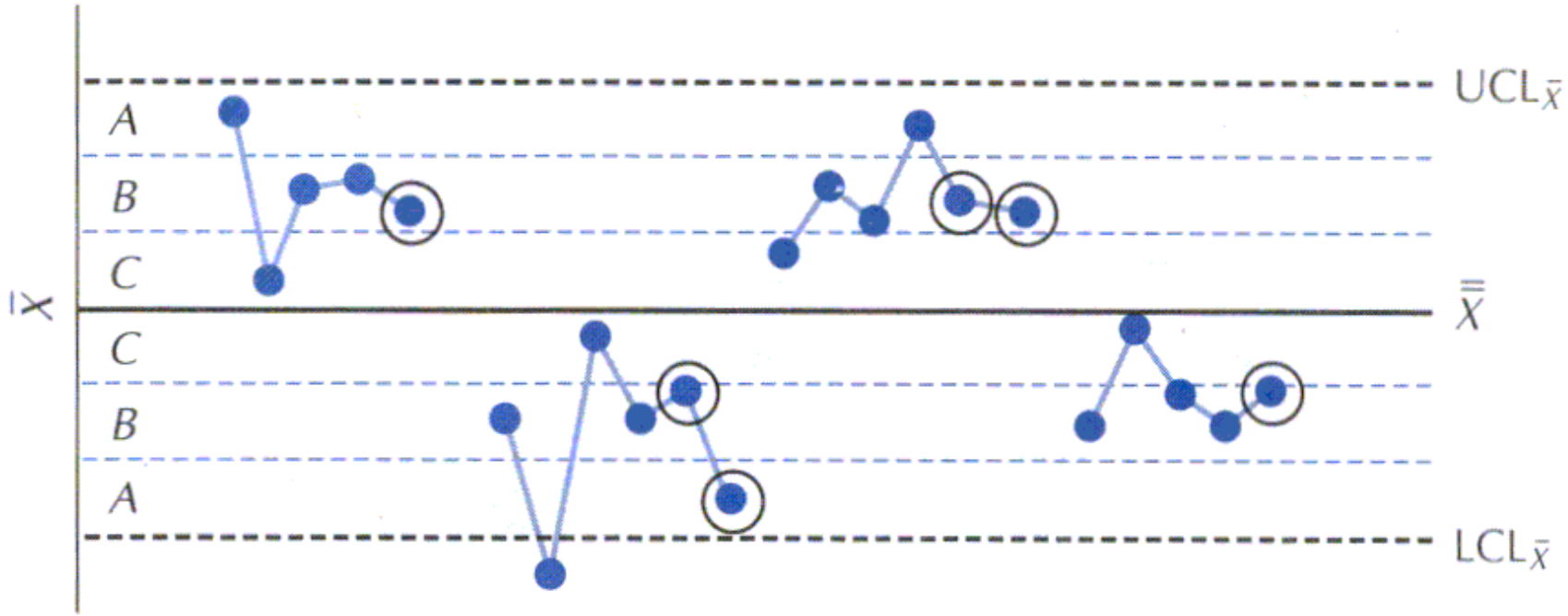
Test 2 examples - 2 out of 3 Points in Zone A or Beyond



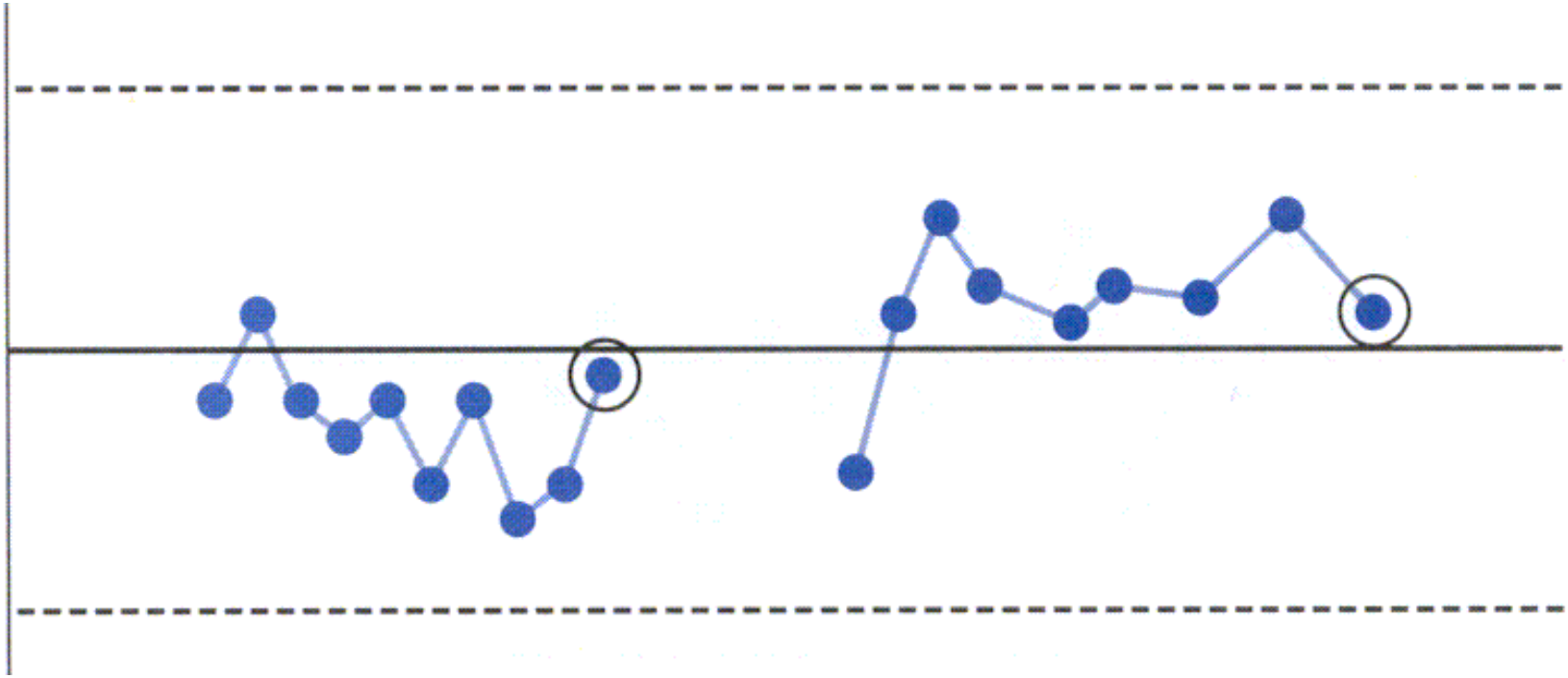
Additional Comments on Test 2



Test 3 examples - 4 out of 5 Points in Zone B or Beyond



Test 4 examples - Runs Above or Below the Centerline

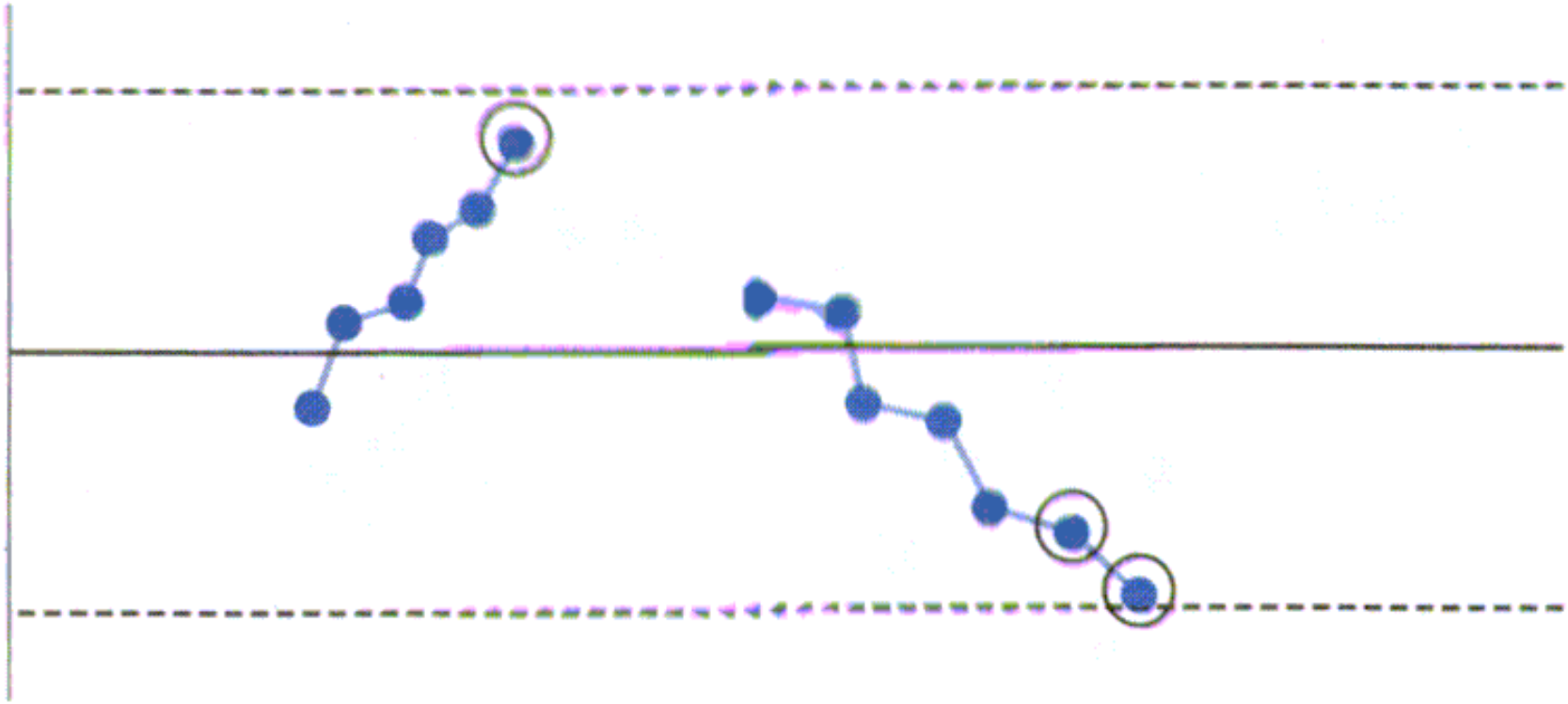


Probability Above / Below CL = 0.5

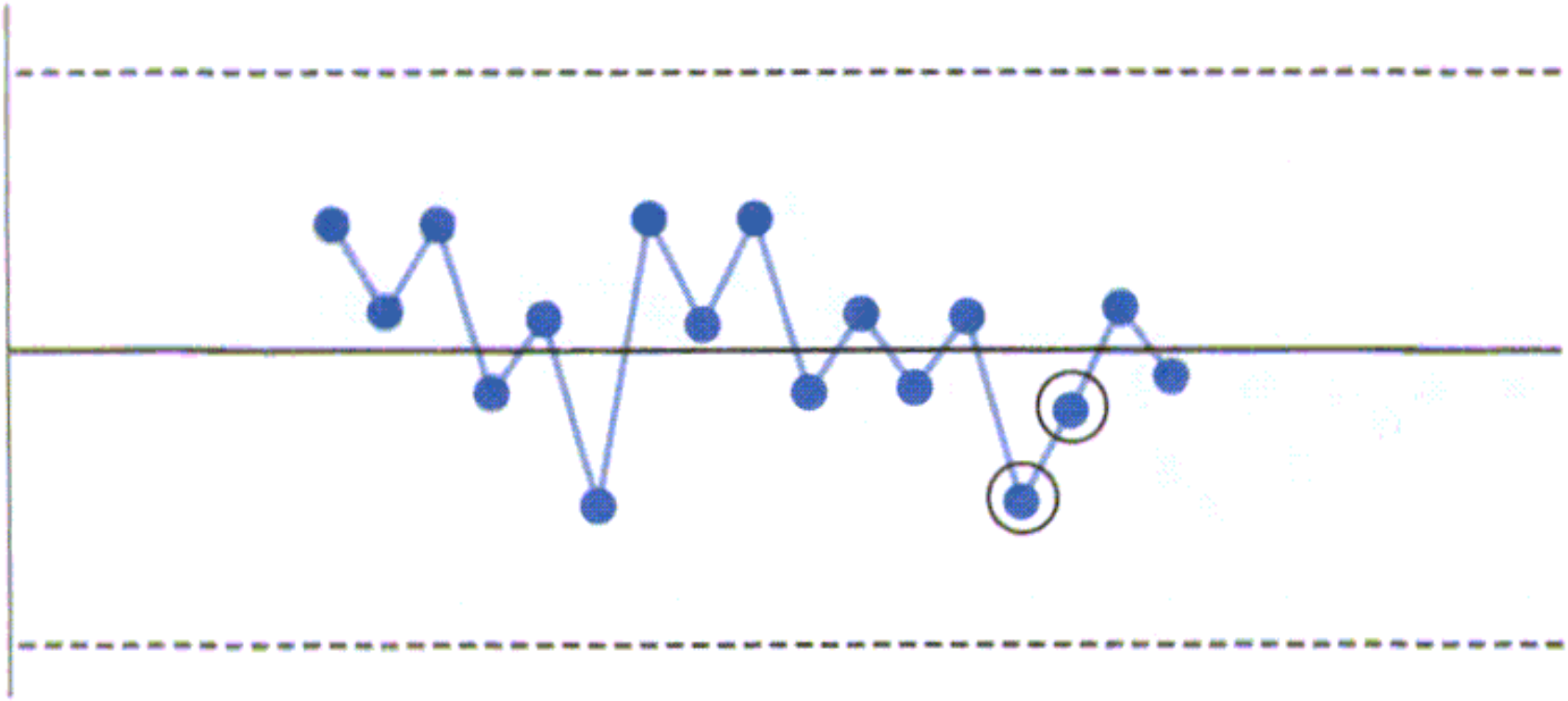
Prob (8 in a row above) = $(0.5)^8$ = 0.0039

FYI... $(0.5)^9$ = 0.00195 $(0.5)^{10}$ = 0.000977

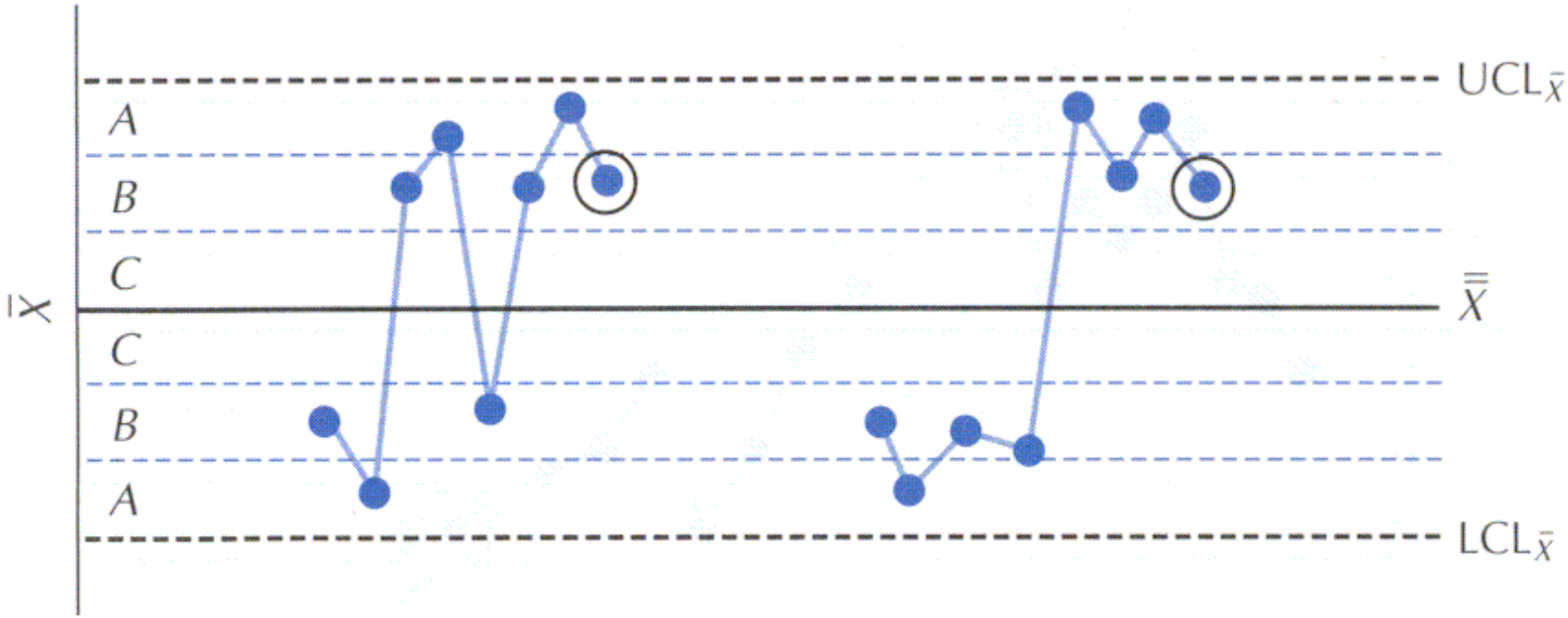
Test 5 examples - Linear (Upward / Downward) Trend



Test 6 examples - Oscillatory Trend



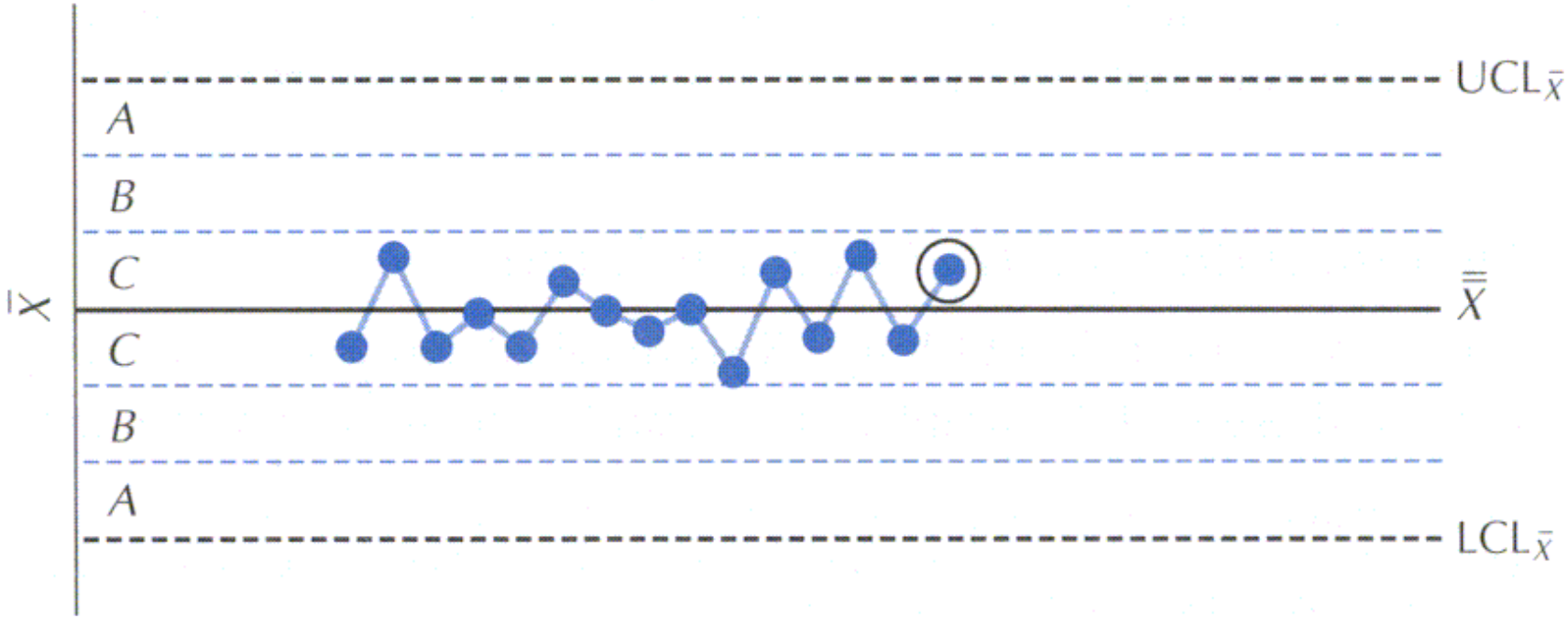
Test 7 examples - Avoiding Zone C



Prob (one point outside zone C) = 1-0.68 = 0.32

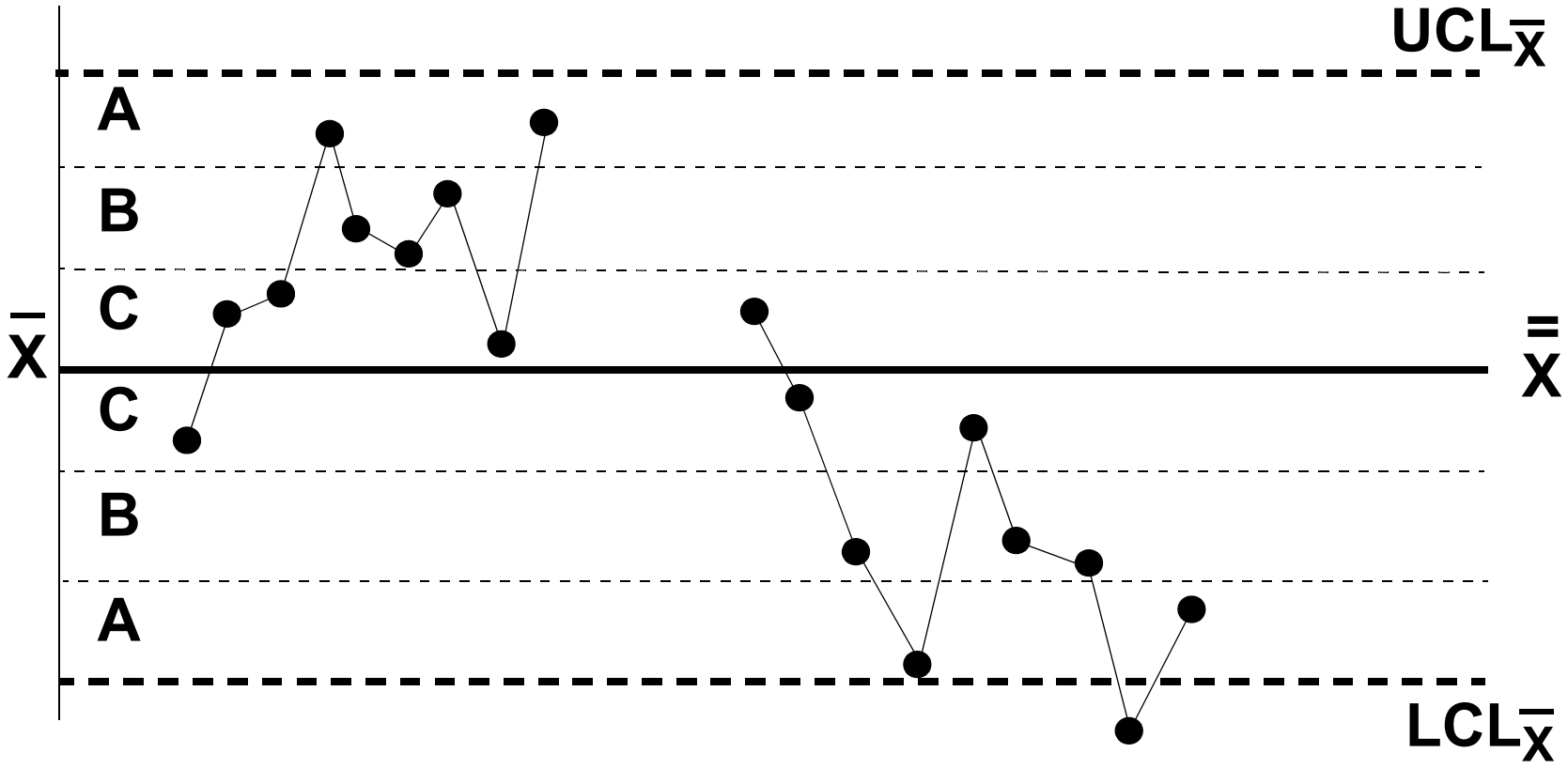
$(0.32)^8$ = 0.00011 -- very small

Test 8 examples - Run in Zone C



Prob (being in zone C) = 0.68

Prob (15 in a row in zone C) = $(0.68)^{15}$ = 0.0031



Example - Simultaneous Application of More Than One Test for Out-of-Control Conditions

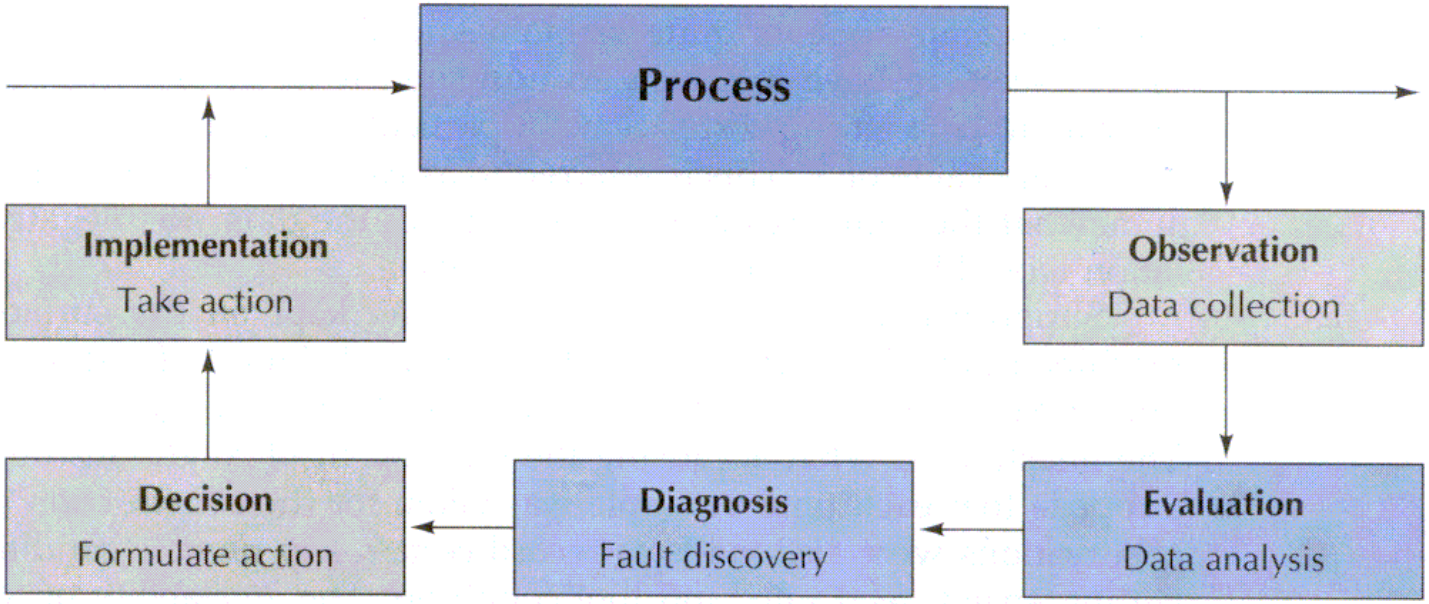


Figure 6.16 Classical Control System View of SPC Implementation

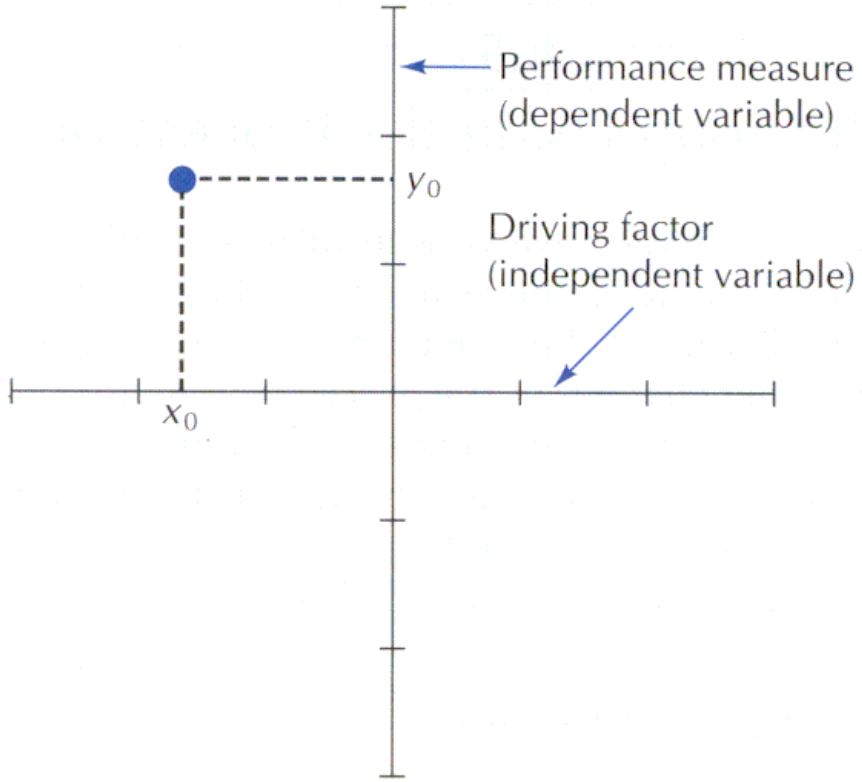


Figure 6.17 General Structure for a Scatter Diagram

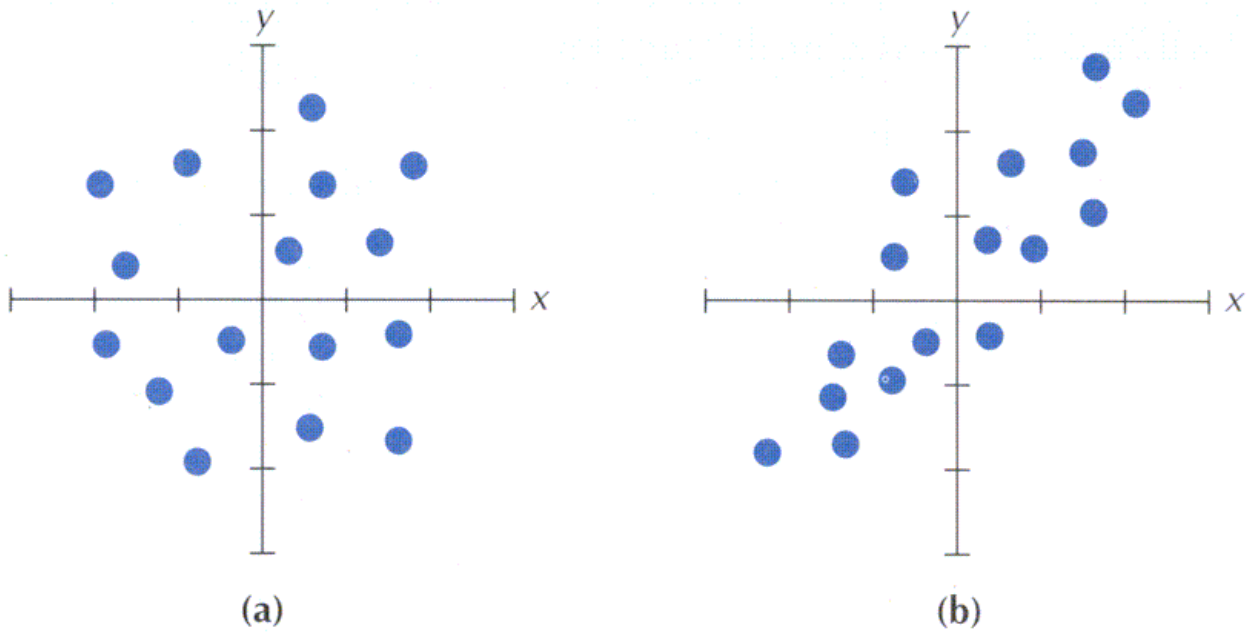


Figure 6.18 Examples of No Correlation (a) and Positive Correlation (b)

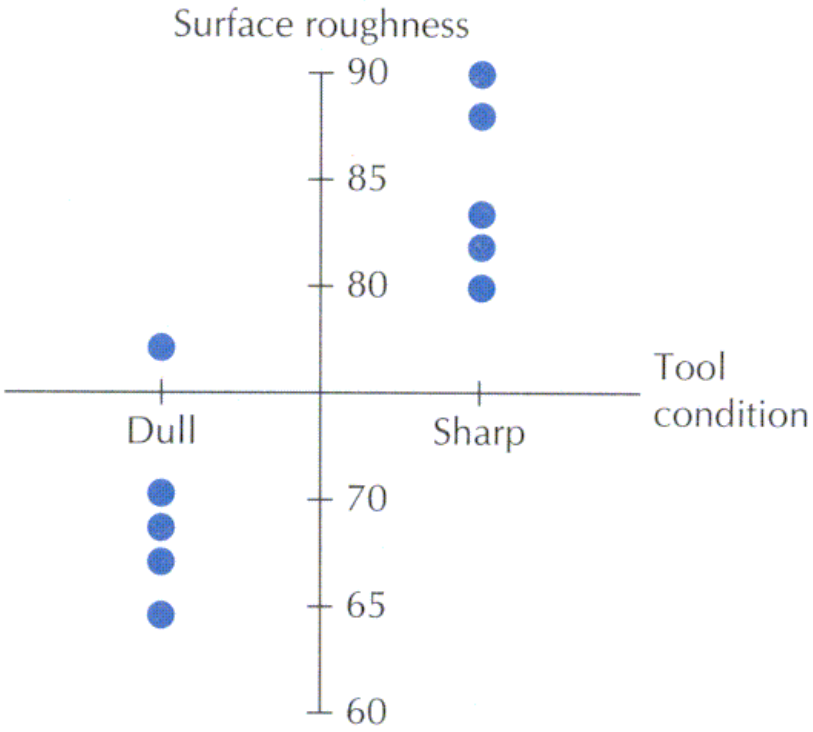


Figure 6.19 Scatter Diagram for Surface Roughness Versus Tool Condition

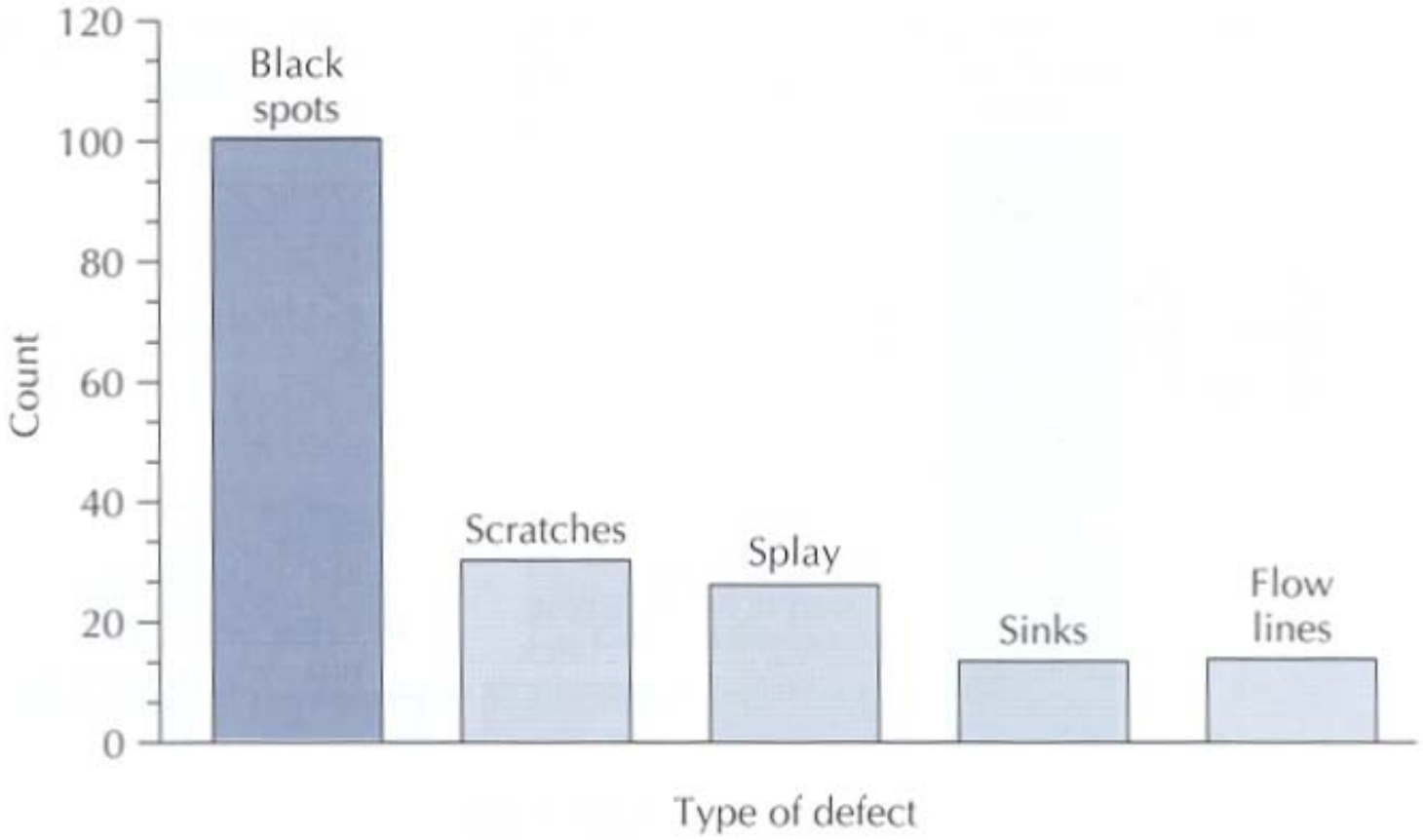


Figure 6.20 Pareto Diagram of Molding Defects

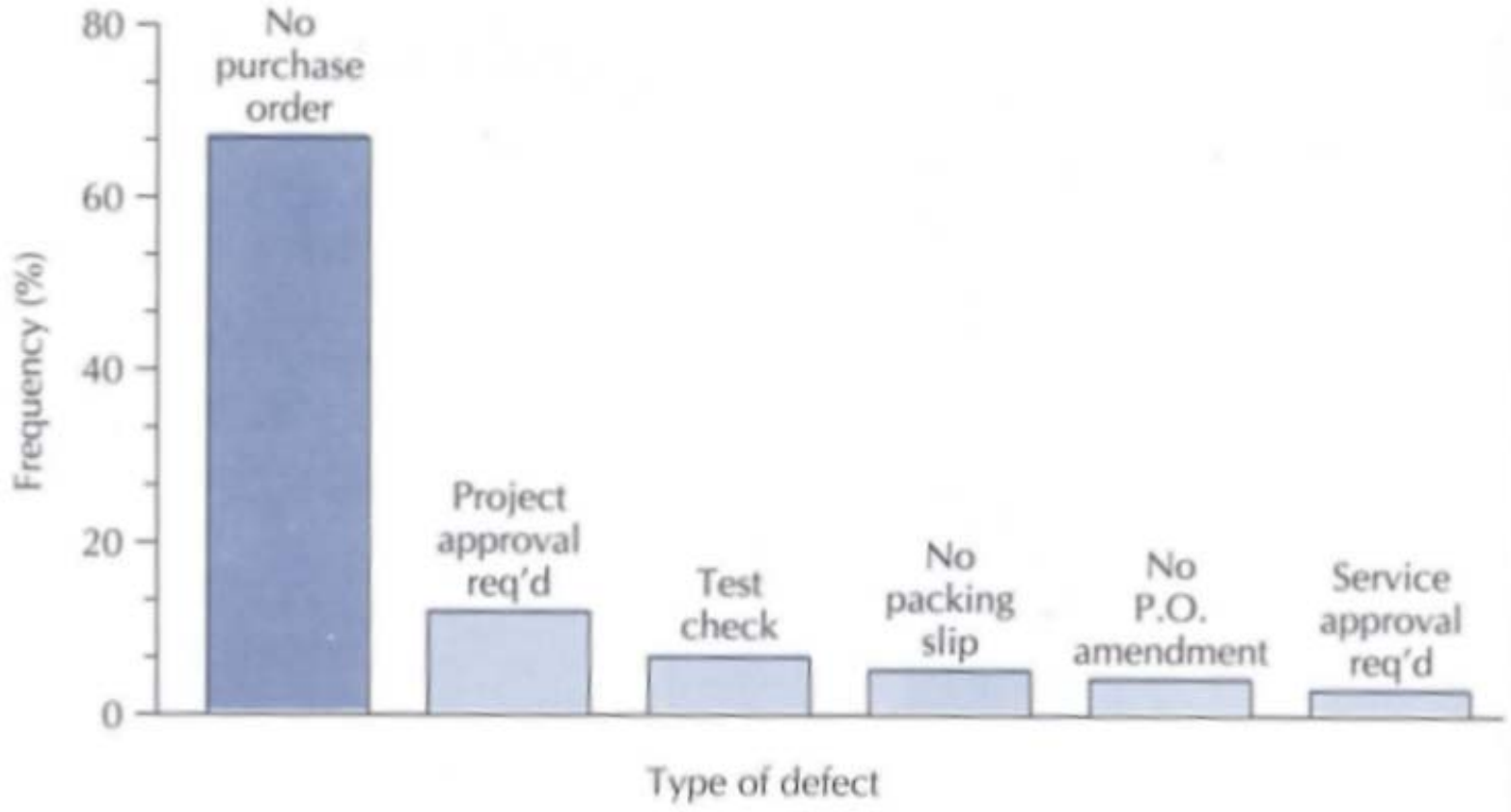


Figure 6.21 Pareto Diagram of Defects Occurring in an Accounts Payable Department

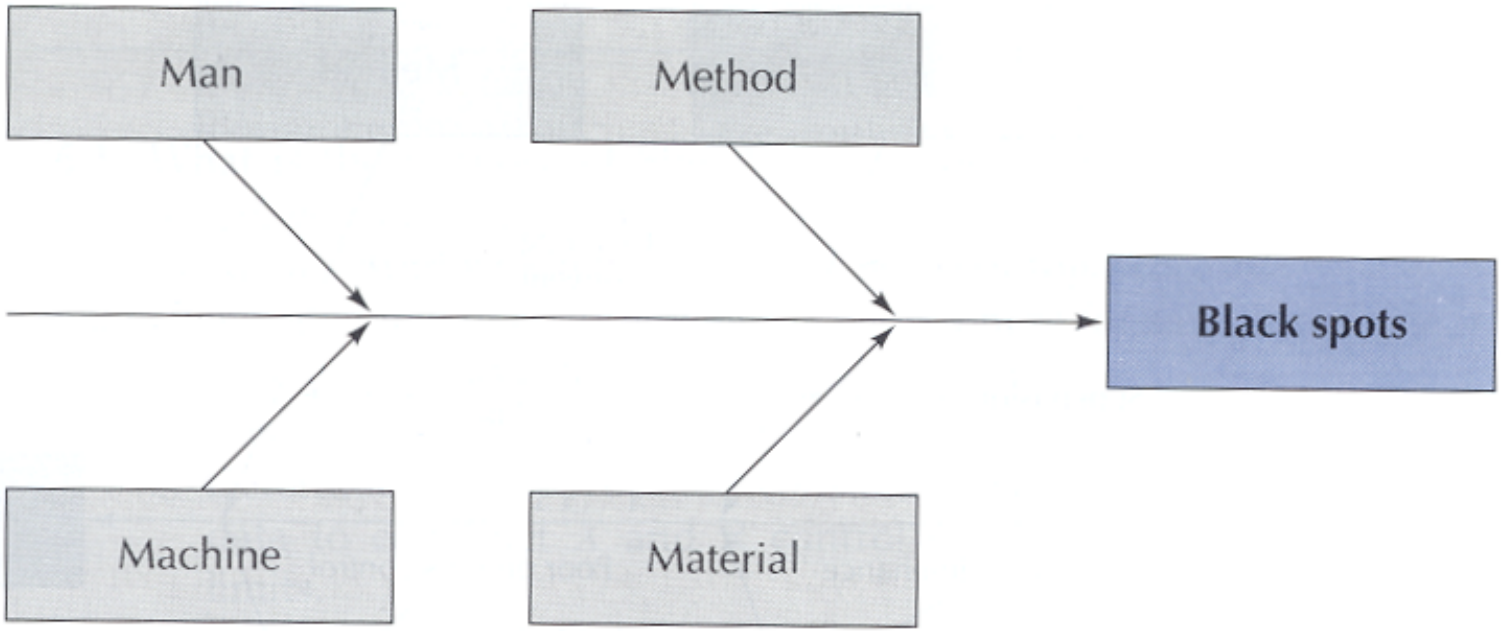


Figure 6.22 Structure of the Cause-and-Effect Diagram

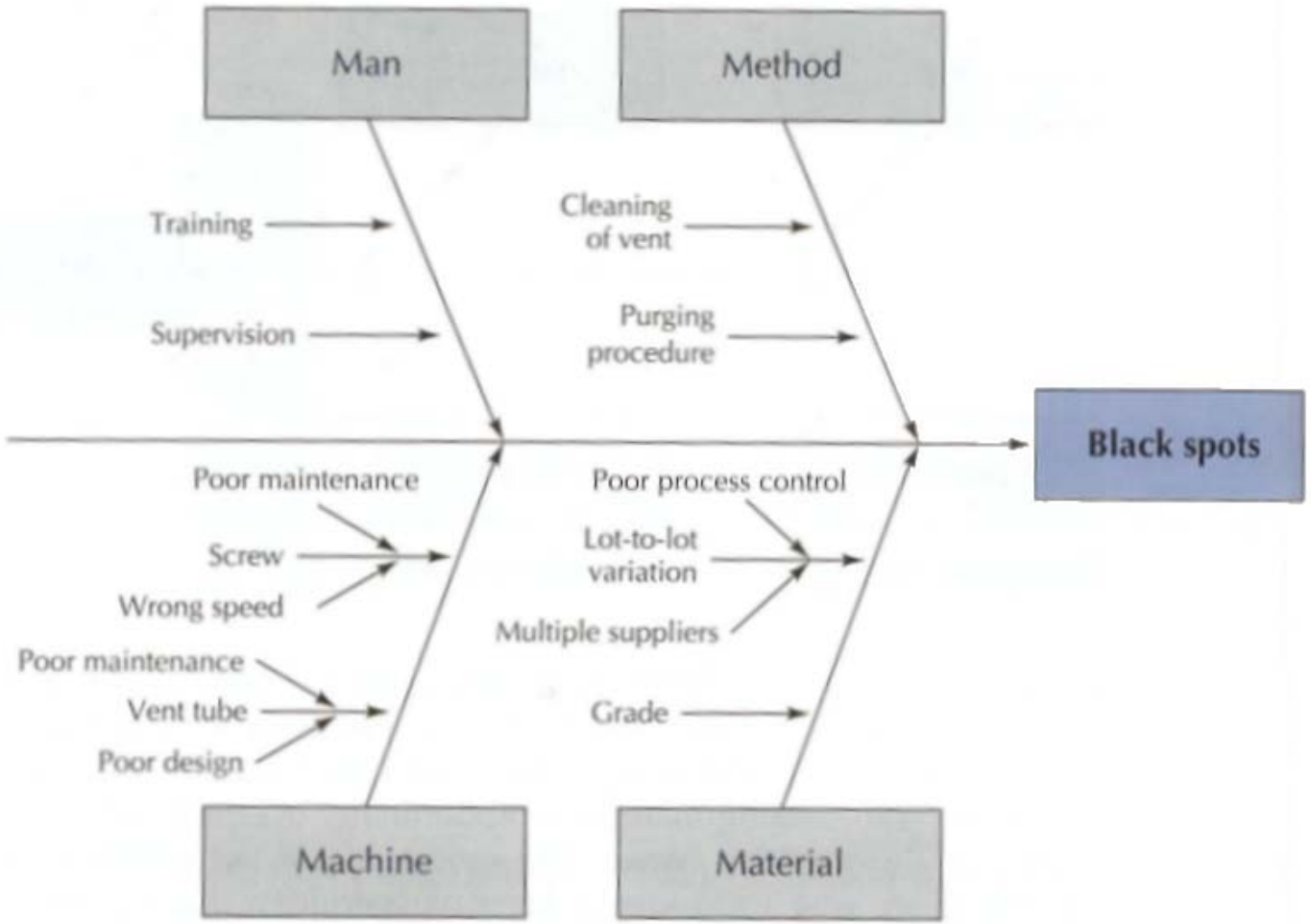


Figure 6.23 Fully Developed Cause-and-Effect Diagram for the Black-Spot Symptom