

CHAPTER 14 FORM B

Name \_\_\_\_\_ Course Number: \_\_\_\_\_ Section Number: \_\_\_\_\_

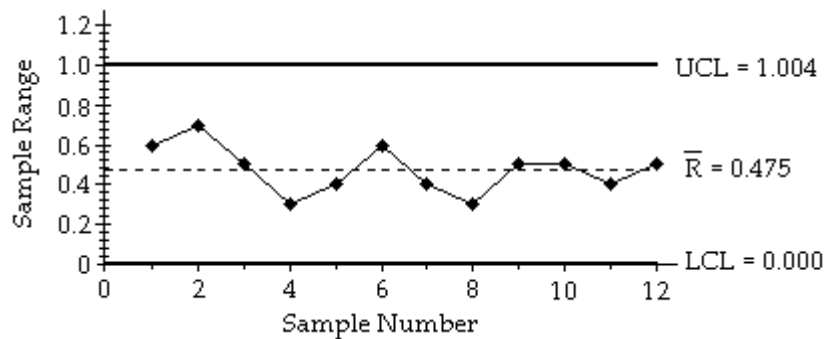
**Directions:** Answer the questions and solve the problems in the spaces provided, or attach paper. Use graph paper for control chart solutions, if preferred.

**Provide an appropriate response.**

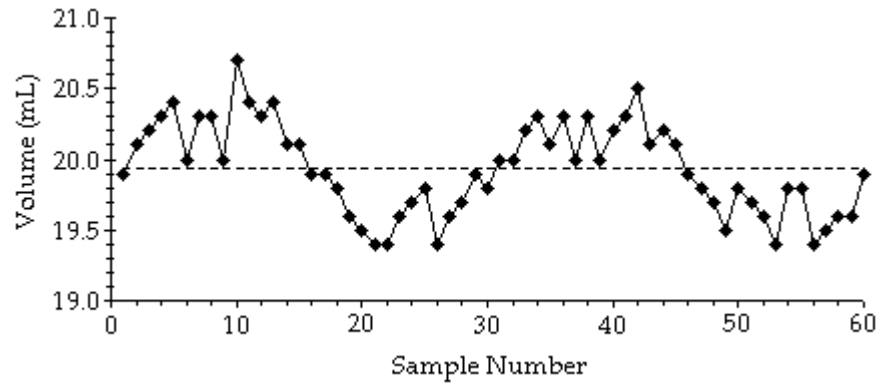
- 1) Describe what process data are. Why are process data important to businesses? What is a common goal of businesses using quality control?
  
  
  
  
  
  
  
  
  
  
- 2) Describe the three criteria used to determine if a control chart indicates a process which is not statistically stable.
  
  
  
  
  
  
  
  
  
  
- 3) Describe how the term Six Sigma relates to statistical process control.

**Examine the given run chart or control chart and determine whether the process is within statistical control. If it is not, identify which of the three out-of-statistical-control criteria apply.**

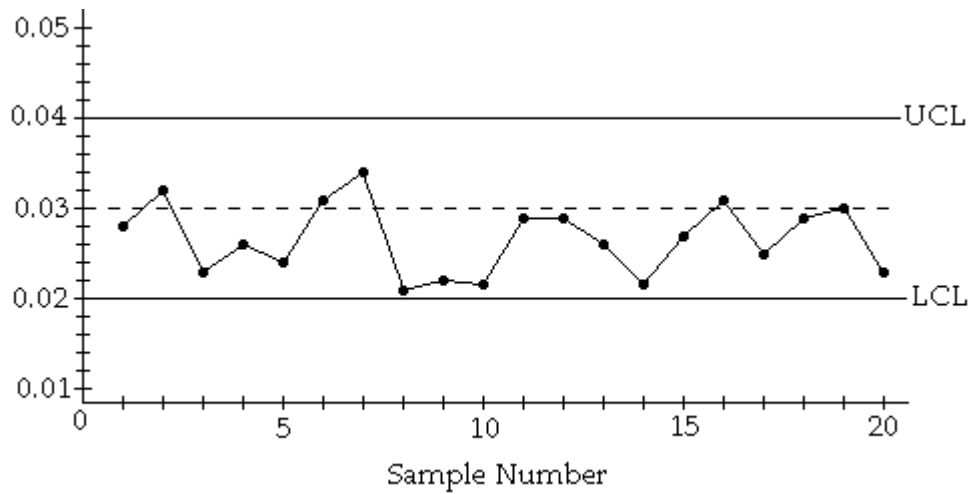
- 4) A control chart for R is shown below. Determine whether the process variation is within statistical control. If it is not, identify which of the three out-of-control criteria lead to rejection of statistically stable variation.



- 5) A run chart for individual values is shown below. Does there appear to be a pattern suggesting that the process is not within statistical control? If so, describe the pattern.



- 6) A run chart for individual values is shown below. Does there appear to be a pattern suggesting that the process is not within statistical control? If so, describe the pattern.



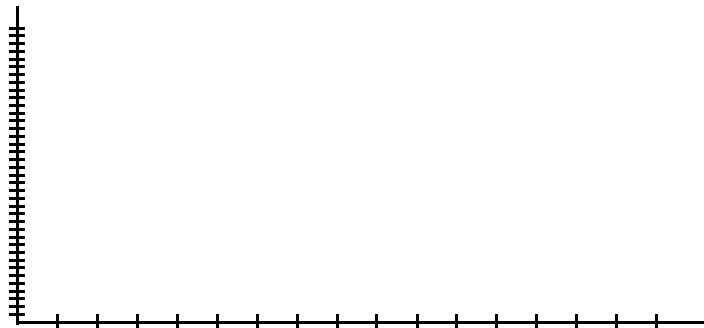
Construct an R chart and determine whether the process variation is within statistical control.

**Control Chart Constants**

n	$\bar{x}$		s		R	
	A <sub>2</sub>	A <sub>3</sub>	B <sub>3</sub>	B <sub>4</sub>	D <sub>3</sub>	D <sub>4</sub>
2	1.880	2.659	0.000	3.267	0.000	3.267
3	1.023	1.954	0.000	2.568	0.000	2.574
4	0.729	1.628	0.000	2.266	0.000	2.282
5	0.577	1.427	0.000	2.089	0.000	2.114
6	0.483	1.287	0.030	1.970	0.000	2.004
7	0.419	1.182	0.118	1.882	0.076	1.924
8	0.373	1.099	0.185	1.815	0.136	1.864
9	0.337	1.032	0.239	1.761	0.184	1.816
10	0.308	0.975	0.284	1.716	0.223	1.777

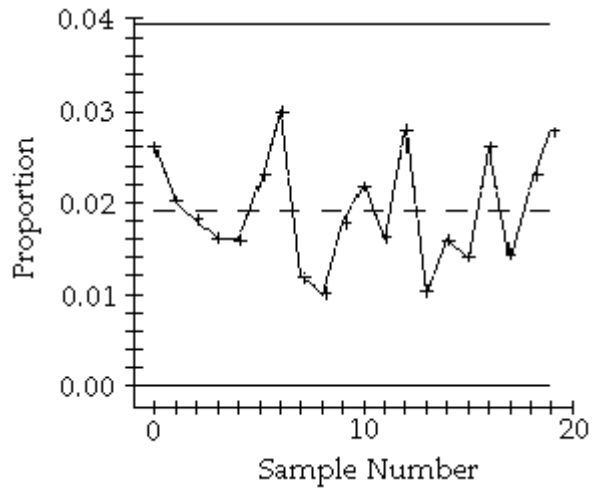
7) A machine is supposed to fill boxes to a weight of 50 pounds. Every 30 minutes a sample of four boxes is tested; the results are given below.

Sample	Box Weight (lb)				$\bar{x}$	Range
1	49	38	39	45	42.75	11
2	52	51	43	61	51.75	18
3	56	60	32	52	50.00	28
4	44	59	46	49	49.50	15
5	51	61	48	45	51.25	16
6	45	50	46	48	47.25	5
7	52	51	45	55	50.75	10
8	40	50	53	48	47.75	13
9	48	67	60	51	56.50	19
10	43	50	50	47	47.50	7
11	48	30	38	39	38.75	18
12	50	46	48	53	49.25	7
13	50	58	56	64	57.00	14
14	47	52	47	49	48.75	5
15	52	57	58	52	54.75	6

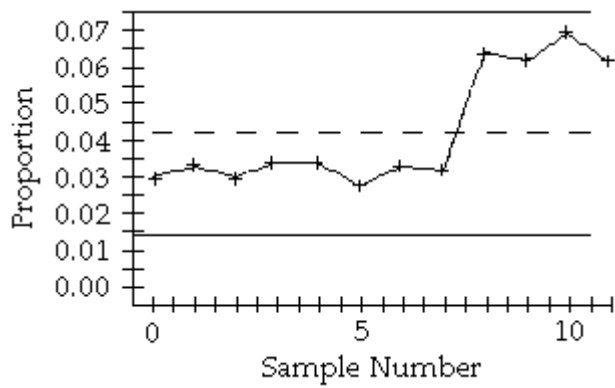


Examine the given run chart or control chart and determine whether the process is within statistical control. If it is not, identify which of the three out-of-statistical-control criteria apply.

8)



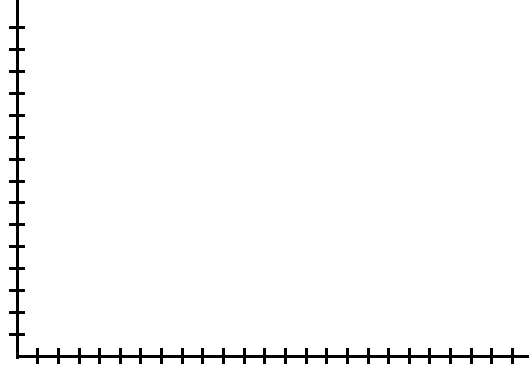
9)



Use the given process data to construct a control chart for p.

- 10) A manufacturer monitors the level of defects in the television sets that it produces. Each week, 200 television sets are randomly selected and tested and the number of defects is recorded. The results for 12 consecutive weeks are shown below.

4 7 5 6 8 3 12 4 4 5 6 2



- 11) **Solve the problem.**

Solve the p chart. Calculate the centerline value, UCL, and LCL for a manufacturing process, whose sampling detects the following defects among 20 batches of 10,000 products per sample. Data are shown below.

9, 10, 15, 8, 11, 7, 8, 9, 10, 12, 16, 7, 7, 8, 9, 12, 9, 6, 10, 11

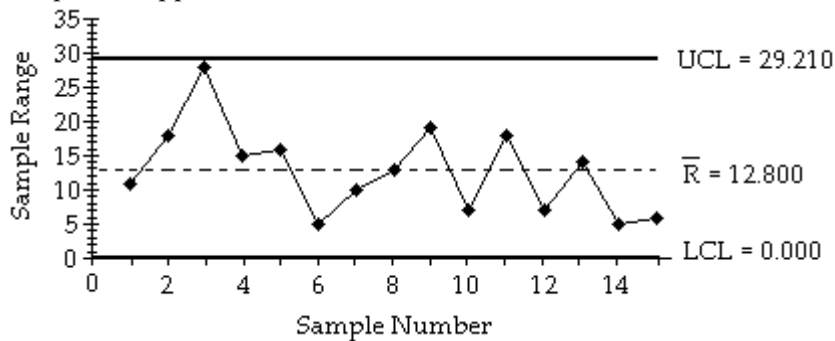
- 12) **Solve the problem.**

Solve the np chart, which is similar to the p chart, except that actual numbers of defects rather than proportions of defects are plotted on the vertical axis. For the data given in #11 above, calculate the centerline value, UCL, and LCL.

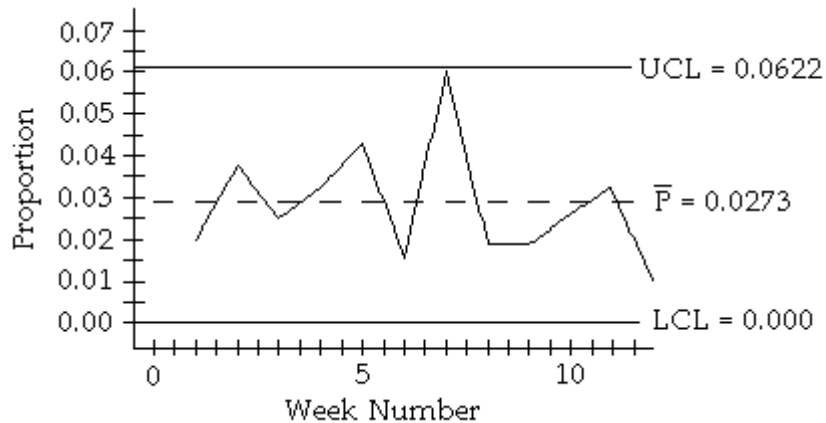
# Answer Key

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- 1) Process data are data arranged according to some time sequence. They are measurements of a characteristic of goods or services that result from some combination of equipment, people, materials, methods, and conditions. Process data are important to businesses because important characteristics of process data can change over time, and businesses are interested in ensuring quality by controlling these important characteristics. Businesses using quality control are interested in reducing variability in characteristics of their product.
- 2) 1) There is a pattern, trend, or cycle that is obviously not random. 2) There is a point lying outside the region between the upper or lower control limits. 3) There are eight consecutive points all above or all below the centerline. Additional criteria mentioned include: six consecutive points all increasing or all decreasing; fourteen consecutive points all alternating between up and down; two out of three consecutive points beyond control limits that are 2 standard deviations away from the centerline; four out of five consecutive points beyond control limits that are 1 standard deviation away from the centerline.
- 3) Answers will vary. Possible answer: Six Sigma represents reduced variation in a manufacturing process, which is the goal of statistical process control.
- 4) Process variation appears to be in statistical control.
- 5) Process appears to be out of statistical control. There is a cyclical pattern.
- 6) Process appears to be out of statistical control. There are 8 consecutive points below the centerline, beginning around sample 8.
- 7) The process appears to be within statistical control.



- 8) Process appears to be within statistical control.
- 9) Process appears to be out of statistical control. There is an upward shift. There are eight consecutive points below the centerline.
- 10)



- 11) Centerline value = 0.00097; UCL = 0.00190; LCL = 0.000036

## Answer Key

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- 12) Centerline value = 9.7; UCL = 19.04; LCL = 0.36. [Students should discover that each np measure is n times its p counterpart.]