Statistical Process Control (SPC) Charts

**Definition**

Statistical process control (SPC) is a methodology for monitoring a process, demonstrating the process variation, and determining if common or special causes are present. The goal is to allow continual process improvement by monitoring the process and determining if redesign of the process or removal of special causes is needed to improve performance.

**Learning Objective**

The objective of this homework assignment is to assist in understanding the statistical foundations of data analysis, common and special causes, and statistical process control.

**Problem**

The leadership of an airline wants to improve the delivery of luggage from arriving airplanes to the baggage claim. This is important, since the airline charges $25 for each piece of luggage and promises to have the first bag from the flight delivered in 30 minutes or less. Some customers have recently complained that it is taking longer than 30 minutes.

An investigation into the issue has determined that no formal process for consistent data collection exists. The Director of Operations for the Airline in a particular airport has asked the Manager of Baggage Operations for the Airline in that airport to begin collecting data regarding every flight immediately, to simultaneously implement statistical process control, and to improve the process as needed to meet customer expectations. On 8/4/2012, the Manager of Baggage Operations established a formal process for collecting the data on each of the Airline’s two concourses.

**Assignment**

Complete the following actions, using the Excel file “Optional Problem Data Student File” for the actions involve Excel:

1. Prepare an SPC chart in Excel for each concourse using the data collected during the period 8/4 to 8/13 (data provided below).
2. Paste each SPC chart into a separate slide in a PowerPoint presentation (select the graph in Excel, right click and select Copy, go to PowerPoint slide, go to Home tab, click on the down arrow below Paste in the upper left of toolbar, select Paste Special, select “Picture (Enhanced Metafile)”, and then select OK.
3. On each PowerPoint slide (one for each concourse) annotate each data point on the control chart with a C (common cause variation) or an S (special cause variation).
4. Specify whether the process associated with each concourse is or is not in control on each slide;
5. Specify whether the process associated with each concourse is or is not capable on each slide;
6. Explain the managerial implications of the data for each concourse. State clearly how you would address the situation on Concourse A and the situation on Concourse B – include these notes on additional slide(s) in your PowerPoint presentation;
7. Submit your PowerPoint presentation and Excel spreadsheet.

**Notes:**

You should use the Excel file titled “Optional Problem Student File” to help you calculate the UCL, LCL, and center line and to prepare your control charts. Just copy and paste the data from this document into the Excel template.

Use the following Shewhart special cause identification rules (Pyzdek, 2003, p. 428) to determine if the data exhibits special cause variation:

1. One point above the UCL or below the LCL;
2. Six consecutive points increase or decrease;
3. Fourteen consecutive points alternate up and down;
4. Nine consecutive points on the same side of the center line (Pyzdek, 2003, p. 428);.

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| --- | --- | --- | --- | --- |
| **Date** | **Flight** | **Concourse** | **Data Point** | **Time** |
| 8/4/2012 | 7901 | A | 1 | 30.00 |
| 8/4/2012 | 1004 | A | 2 | 26.00 |
| 8/4/2012 | 9654 | A | 3 | 28.00 |
| 8/4/2012 | 2626 | A | 4 | 27.00 |
| 8/4/2012 | 1798 | A | 5 | 26.00 |
| 8/5/2012 | 7901 | A | 6 | 20.00 |
| 8/5/2012 | 1004 | A | 7 | 21.00 |
| 8/5/2012 | 9654 | A | 8 | 30.00 |
| 8/5/2012 | 2626 | A | 9 | 32.00 |
| 8/5/2012 | 1798 | A | 10 | 31.00 |
| 8/6/2012 | 7901 | A | 11 | 28.00 |
| 8/6/2012 | 1004 | A | 12 | 29.00 |
| 8/6/2012 | 9654 | A | 13 | 33.00 |
| 8/6/2012 | 2626 | A | 14 | 21.00 |
| 8/6/2012 | 1798 | A | 15 | 20.00 |
| 8/7/2012 | 7901 | A | 16 | 22.00 |
| 8/7/2012 | 1004 | A | 17 | 27.00 |
| 8/7/2012 | 9654 | A | 18 | 29.00 |
| 8/7/2012 | 2626 | A | 19 | 25.00 |
| 8/7/2012 | 1798 | A | 20 | 30.00 |
| 8/8/2012 | 7901 | A | 21 | 31.00 |
| 8/8/2012 | 1004 | A | 22 | 29.00 |
| 8/8/2012 | 9654 | A | 23 | 28.00 |
| 8/8/2012 | 2626 | A | 24 | 24.00 |
| 8/8/2012 | 1798 | A | 25 | 27.00 |
| 8/9/2012 | 7901 | A | 26 | 29.00 |
| 8/9/2012 | 1004 | A | 27 | 28.00 |
| 8/9/2012 | 9654 | A | 28 | 25.00 |
| 8/9/2012 | 2626 | A | 29 | 26.00 |
| 8/9/2012 | 1798 | A | 30 | 24.00 |
| 8/10/2012 | 7901 | A | 31 | 31.00 |
| 8/10/2012 | 1004 | A | 32 | 29.00 |
| 8/10/2012 | 9654 | A | 33 | 28.00 |
| 8/10/2012 | 2626 | A | 34 | 24.00 |
| 8/10/2012 | 1798 | A | 35 | 32.00 |
| 8/11/2012 | 7901 | A | 36 | 29.00 |
| 8/11/2012 | 1004 | A | 37 | 29.00 |
| 8/11/2012 | 9654 | A | 38 | 25.00 |
| 8/11/2012 | 2626 | A | 39 | 25.00 |
| 8/11/2012 | 1798 | A | 40 | 24.00 |
| 8/12/2012 | 7901 | A | 41 | 31.00 |
| 8/12/2012 | 1004 | A | 42 | 30.00 |
| 8/12/2012 | 9654 | A | 43 | 30.00 |
| 8/12/2012 | 2626 | A | 44 | 30.00 |
| 8/12/2012 | 1798 | A | 45 | 24.00 |
| 8/13/2012 | 7901 | A | 46 | 19.00 |
| 8/13/2012 | 1004 | A | 47 | 18.00 |
| 8/13/2012 | 9654 | A | 48 | 19.00 |
| 8/13/2012 | 2626 | A | 49 | 25.00 |
| 8/13/2012 | 1798 | A | 50 | 24.00 |

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| --- | --- | --- | --- | --- |
| **Date** | **Flight** | **Concourse** | **Data Point** | **Time** |
| 8/4/2012 | 8870 | B | 1 | 30.00 |
| 8/4/2012 | 2178 | B | 2 | 26.00 |
| 8/4/2012 | 8600 | B | 3 | 28.00 |
| 8/4/2012 | 3504 | B | 4 | 27.00 |
| 8/4/2012 | 1452 | B | 5 | 26.00 |
| 8/5/2012 | 8870 | B | 6 | 20.00 |
| 8/5/2012 | 2178 | B | 7 | 21.00 |
| 8/5/2012 | 8600 | B | 8 | 22.00 |
| 8/5/2012 | 3504 | B | 9 | 26.00 |
| 8/5/2012 | 1452 | B | 10 | 27.00 |
| 8/6/2012 | 8870 | B | 11 | 28.00 |
| 8/6/2012 | 2178 | B | 12 | 29.00 |
| 8/6/2012 | 8600 | B | 13 | 25.00 |
| 8/6/2012 | 3504 | B | 14 | 21.00 |
| 8/6/2012 | 1452 | B | 15 | 20.00 |
| 8/7/2012 | 8870 | B | 16 | 22.00 |
| 8/7/2012 | 2178 | B | 17 | 27.00 |
| 8/7/2012 | 8600 | B | 18 | 29.00 |
| 8/7/2012 | 3504 | B | 19 | 28.00 |
| 8/7/2012 | 1452 | B | 20 | 30.00 |
| 8/8/2012 | 8870 | B | 21 | 27.00 |
| 8/8/2012 | 2178 | B | 22 | 30.00 |
| 8/8/2012 | 8600 | B | 23 | 28.00 |
| 8/8/2012 | 3504 | B | 24 | 29.00 |
| 8/8/2012 | 1452 | B | 25 | 23.00 |
| 8/9/2012 | 8870 | B | 26 | 29.00 |
| 8/9/2012 | 2178 | B | 27 | 20.00 |
| 8/9/2012 | 8600 | B | 28 | 25.00 |
| 8/9/2012 | 3504 | B | 29 | 21.00 |
| 8/9/2012 | 1452 | B | 30 | 24.00 |
| 8/10/2012 | 8870 | B | 31 | 23.00 |
| 8/10/2012 | 2178 | B | 32 | 29.00 |
| 8/10/2012 | 8600 | B | 33 | 28.00 |
| 8/10/2012 | 3504 | B | 34 | 24.00 |
| 8/10/2012 | 1452 | B | 35 | 29.00 |
| 8/11/2012 | 8870 | B | 36 | 29.00 |
| 8/11/2012 | 2178 | B | 37 | 29.00 |
| 8/11/2012 | 8600 | B | 38 | 25.00 |
| 8/11/2012 | 3504 | B | 39 | 25.00 |
| 8/11/2012 | 1452 | B | 40 | 24.00 |
| 8/12/2012 | 8870 | B | 41 | 19.00 |
| 8/12/2012 | 2178 | B | 42 | 30.00 |
| 8/12/2012 | 8600 | B | 43 | 30.00 |
| 8/12/2012 | 3504 | B | 44 | 30.00 |
| 8/12/2012 | 1452 | B | 45 | 24.00 |
| 8/13/2012 | 8870 | B | 46 | 19.00 |
| 8/13/2012 | 2178 | B | 47 | 29.00 |
| 8/13/2012 | 8600 | B | 48 | 19.00 |
| 8/13/2012 | 3504 | B | 49 | 25.00 |
| 8/13/2012 | 1452 | B | 50 | 27.00 |

Reference

Pyzdek, T. (2003). The Six Sigma Handbook. McGraw Hill, New York, New York.