Process Automation Demo – Automating Compilation of Daily QC Results

**Example:**

* Each day, a lab technician records QC (quality control) results in a spreadsheet or logs (maybe .csv, .txt, or even email reports).
* At the end of the week, someone has to pull all those daily files, compile them into one sheet, and check for missing/abnormal values.
* It’s boring, repetitive, and prone to human error.

“In this demo, I automate the aggregation of daily chemistry analyzer QC results into a single weekly summary, reducing error-prone manual work and instantly flagging failed QC parameters—critical for lab quality and compliance.”

***Clinical Chemistry Process Automation Demo***

**Project Overview**

This project automates the aggregation and quality control analysis of daily clinical chemistry QC (Quality Control) results using Westgard rules. It’s designed to demonstrate real-world lab automation and data validation practices required for high-compliance, high-throughput laboratory operations.

**Key Goals:**

* Save time by eliminating manual collation and review of daily QC results
* Instantly detect and summarize Westgard rule violations across multiple analytes
* Provide a weekly summary for rapid review, accreditation, and troubleshooting

**How It Works**

1. **Daily QC CSV Files**:  
   Each file represents one day’s QC results, including Test Name, Result, Mean, SD, Reference Range, and Westgard rule outcomes.
2. **Automation Script**:
   * Reads all daily QC files in a folder (e.g., daily\_qc\_westgard/)
   * Aggregates results for the week
   * Applies Westgard rules to each test (1-2s, 1-3s, 2-2s, R-4s, 4-1s, 10x, etc.)
   * Summarizes rule violations and flags “failures” requiring action
3. **Output**:
   * Compiled weekly CSV
   * Human-readable summary report, highlighting failed tests and trends

**Westgard Rules Used**

* **1-2s**: Result exceeds mean ± 2SD (warning, not always fail)
* **1-3s**: Result exceeds mean ± 3SD (fail)
* **2-2s**: Two consecutive results exceed mean ± 2SD on same side (fail)
* **R-4s**: One result > mean +2SD, next < mean –2SD (fail)
* **4-1s**: Four consecutive results exceed mean ± 1SD on same side (trend warning)
* **10x**: Ten consecutive results on one side of the mean (trend warning)

**Why This Matters**

* **Lab compliance:** Automating Westgard rule checks minimizes human error, supports CAP/CLIA/ISO15189 requirements, and keeps labs audit-ready.
* **Operational efficiency:** Reduces technician workload and ensures instant detection of QC issues that could impact patient results.
* **Portfolio value:** Demonstrates practical Python/data automation skills *and* deep domain knowledge.

**How to Run**

1. Place daily CSV QC files in the daily\_qc\_westgard/ folder.
2. Run the Python script provided.
3. Review the compiled weekly output and Westgard summary.

**Quick Start**

1. Clone this repo or download the code and example data.
2. Install Python 3 and pandas (pip install pandas).
3. Place your daily QC .csv files in the Daily\_QC\_Results/ folder (or change the folder name in the script).
4. Run the script:  
   python qc\_weekly\_summary.py
5. Check the generated files:
   * weekly\_qc\_summary.csv: Combined data
   * weekly\_qc\_report.txt: Human-readable Westgard summary

**To use a different data folder:**  
Edit the qc\_folder = "Daily\_QC\_Results" line at the top of the script to match your folder.

**Tech Stack:**

* Python 3
* pandas
* (Windows or Mac/Linux)

**Contact:**  
For feedback or collaboration: [allen.stalc@gmail.com]

**Example Input:**

Date,TestName,Result,Mean,SD,ReferenceLow,ReferenceHigh,WestgardRuleViolated,Pass,Comments

2024-05-20,Glucose,98,100,5,70,110,None,Pass,Within 2SD

2024-05-20,Sodium,149,140,3,135,145,1-2s,Warning,Exceeds +2SD but <3SD

...

**Example Output:**

* weekly\_qc\_summary.csv
* weekly\_qc\_report.txt (lists any Westgard failures, trends, and warnings by test and date)

**Credits**

* Designed and implemented by Allen Stalcup as part of a clinical data/process automation portfolio.