**Exercise 1**

The management of a specialized software development company considers the key to success in a highly competitive market is the timely scheduling of applications assigned to it by its clients (primarily commercial firms and freelancers).
In order to determine the quality manager of the company, whether the programming department was operating effectively, he recorded, for a period of 15 months, the difference between the time the software application was completed and the time originally planned by the programming department. For this purpose, he used a random sample of 5 applications per month. The results are presented in the table below. In order to make the data comparable, it is assumed that the implementation time of the applications is approximately the same (otherwise percentage differences should be used). What are the conclusions drawn with the help of Statistical Process Control for the planning department of the company?

|  |  |
| --- | --- |
| Sample number | Divergence between the realand in the time allottedapplication (hours) |
| 1 | 9,2 | 12,7 | 10,4 | 11,7 | 13,2 |
| 2 | 12,9 | 11,4 | 9,0 | 24,1 | 8,8 |
| 3 | 7,1 | 31,0 | 6,9 | 8,6 | 15,5 |
| 4 | 9,2 | 10,1 | 11,2 | 8,5 | 10,3 |
| 5 | 10,8 | 8,6 | 14,0 | 11,6 | 9,4 |
| 6 | 9,8 | 7,7 | 32,3 | 10,0 | 11,1 |
| 7 | 10,4 | 11,0 | 9,4 | 11,4 | 10,9 |
| 8 | 9,6 | 11,6 | 11,2 | 12,7 | 10,4 |
| 9 | 11,0 | 7,3 | 26,6 | 11,5 | 11,7 |
| 10 | 8,5 | 14,0 | 7,3 | 30,5 | 8,6 |
| 11 | 9,8 | 9,9 | 10,3 | 7,8 | 32,5 |
| 12 | 11,8 | 10,4 | 8,0 | 9,2 | 9,0 |
| 13 | 8,1 | 10,7 | 7,9 | 14,4 | 12,8 |
| 14 | 12,5 | 8,4 | 9,5 | 10,3 | 11,5 |
| 15 | 9,7 | 7,0 | 10,1 | 11,6 | 8,9 |

**Exercise 2**

One courier company assigned its quality control department to draw conclusions as to whether the parcel delivery process throughout the country was properly performed. Whenever the process deviates from its purpose, for whatever reason, it is considered a failure (eg delayed receipt of the parcel by the company employee, errors in completing forms, delay in delivery, etc.). The quality control department randomly selects and examines 50 deliveries per hour across the country. The following table shows the number of failures for a continuous period of 3 days (the courier operates on a continuous basis 8 hours per day).

Determine if the parcel delivery process is under statistical control.

|  |  |  |  |
| --- | --- | --- | --- |
| **Sample**  | **number of failures** | **Sample** | **number of failures**  |
| 1 | 12 | 13 | 22 |
| 2 | 8 | 14 | 18 |
| 3 | 11 | 15 | 13 |
| 4 | 9 | 16 | 9 |
| 5 | 19 | 17 | 4 |
| 6 | 24 | 18 | 7 |
| 7 | 13 | 19 | 12 |
| 8 | 11 | 20 | 13 |
| 9 | 12 | 21 | 19 |
| 10 | 5 | 22 | 17 |
| 11 | 10 | 23 | 10 |
| 12 | 10 | 24 | 8 |

**Exercise 3**

A Production manager for a tire company has inspected the number of defective tires in five random samples with 20 tires in each sample. The table below shows the number of defective tires in each sample of 20 tires. Calculate the control limits.

|  |  |
| --- | --- |
| **Sample** | **Number of Defective Tires** |
| 1 | 3 |
| 2 | 2 |
| 3 | 1 |
| 4 | 2 |
| 5 | 2 |
| **Total** | **9** |

**Exercise 4**

The number of weekly customer complaints are monitored in a large hotel using a
c-chart. Develop three sigma control limits using the data table below.

|  |  |
| --- | --- |
| **Week** | **Number of Complaints** |
| 1 | 3 |
| 2 | 2 |
| 3 | 3 |
| 4 | 1 |
| 5 | 3 |
| 6 | 3 |
| 7 | 2 |
| 8 | 1 |
| 9 | 3 |
| 10 | 1 |
| Total | **22** |

**Exercise 5**

Three bottling machines are being evaluated for possible use at the Fizz plant. The machines must be capable of meeting the design specification of 15.8-16.2 oz. with at least a process capability index of 1.0. The table below shows the information gathered from production runs on each machine. Are they all acceptable?

|  |  |
| --- | --- |
| **Machine** | **σ** |
| A | 0.05 |
| B | 0.1 |
| C | 0.2 |

**Exercise 6**

Α chocolate industry has collected 2000 letters of complaint, the processing of which is as follows:

|  |  |  |
| --- | --- | --- |
| **Code** | **Description** | **Frequency** |
| A | Torn packaging | 740 |
| B | Battered product | 640 |
| C | End of life limit | 160 |
| D | Spoiled product | 300 |
| E | Foreign bodies in the product | 120 |
| F | Other | 20 |
|  | **Total** | **2.000** |

1. Construct the Pareto chart for the categories of complaints.
2. An important category of complaints is B (battered product). A further investigation into the category B complaints was made for the factory of origin of the battered products. The results are given in Table below.

|  |  |
| --- | --- |
| **Plant** | **Frequency** |
| Plant1 | 64 |
| Plant2 | 396 |
| Plant3 | 58 |
| Plant4 | 84 |
| Plant5 | 38 |
| **Total** | **640** |

1. Construct the Pareto chart for the plans.