

Problem Sheet #3

Problem 3.1: *computing time binned statistics for network flow records* (3+3+3+3+3 = 15 points)

In this assignment, you are going to extend the network flow processing program that you have written for the previous assignment. The following extensions should be implemented:

- a) In the previous assignment, the statistics of all flows matching a certain filter were aggregated into a single flow bin. Extend your program such that flows are counted into multiple timed flow bins. Every flow bin represents a certain time interval (in seconds). The start time of a flow is used to find the corresponding timed flow bin. Make sure that it is possible to iterate over all timed flow bins in ascending time order.
- b) Flows may cross multiple timed flow bins. Extend your solution such that flows are split proportionally in case they cross multiple timed flow bins.
- c) Take a statistic such as the octets of the flows in a (timed) flow bin and calculate the minimum (q0), the first quantile (q1), the median (q2), the third quantile (q3), and the maximum (q4). This should be done by implementing a class `Quantile` that takes a list of numbers (`Long`) and provides methods to obtain the quantiles. It should also provide access to the size of the list of numbers and the sum of the numbers.
- d) Extend your program so that it generates data files suitable for processing them with `gnuplot`. A sample data file might start as follows:

#	time	type	min	q1	median	q2	max	size	sum
1443137563		octs	2111	0	2111	0	2111	1	2111
1443137563		pkts	18	0	18	0	18	1	18
1443137563		rocts	21503	0	21503	0	21503	1	21503
1443137563		rpkts	31	0	31	0	31	1	31
1443137622		octs	60	0	60	0	60	1	60
1443137622		pkts	1	0	1	0	1	1	1
1443137622		rocts	0	0	0	0	0	1	0
1443137622		rpkts	0	0	0	0	0	1	0
- e) Use the `maven` build system to structure your project. Write unit tests for your classes to demonstrate that your classes are working as expected.

Hints:

- It may be useful to work with classes of the `java.time` package such as `java.time.Instant`, `java.time.Duration`, `java.time.OffsetDateTime`, and `java.time.format.DateTimeFormatter`.