Kiel University
Christian-Albrechts-Universität zu Kiel
Faculty of Engineering

DEPARTMENT OF
COMPUTER SCIENCE

Process Analytics

Prof. Dr. Agnes Koschmider
Dominik Janssen

Advanced Process Mining

Summer term 2020

Exercise sheet 8

Event Log Quality

Exercise 1: Noise vs. Outlier

Explain the difference between noise and outlier using an example.

Solution

Outliers are anomalies recorded in the process. The outlier behaviour diverges from the expected process. Whereas noise is wrongly recorded data that does not necessarily hint toward an anomaly in the process execution.

In an online shopping scenario, an outlier could be a customer getting billed before the placement of her order is complete. Noise would be if the logging system was flawed and recorded the time of activities wrong because it did not account for daylight saving time. Outliers are interesting anomalies in the process itself whereas noise is an issue with the correctness of the data.

Exercise 2: Types of Outliers

a) Explain briefly the key aspects of a contextual outlier.

b) Design a (short) event log that contains a contextual outlier. Explain why the outlier is contextual.

Solution

a) A contextual outlier is an observation that is not to be expected in the underlying context.

b) In the following event log, case ID 1 presents a contextual outlier. If the package is determined to go to the US, road-transportation is not a valid mode of transport.

Case ID	Timestamp	Activity
1	01.06.20	Print US shipping label
1	01.06.20	File tax declaration
1	01.06.20	Load package on truck
2	05.06.20	Print EU shipping label
2	05.06.20	Load package on truck
3	06.06.20	Print US shipping label
3	06.06.20	File tax declaration
3	06.06.20	Load package on air-plane

Exercise 3: Event Log Imperfections

a) Inspect the following event log and identify possible event log imperfections. If possible correct them.

Case ID	Timestamp	Activity
1	01.06.20 - 18:00:42	receive order
1	01.06.20 - 18:20:01	locate appropriate warehouse
2	01.06.20 - 18:33:32	recieve order
1	01.06.20 - 19:17:17	take goods out of storage
1	01.06.20 - 23:17:19	package goods
1	01.06.20 - 00:44:53	ship package
2	06.02.20 - 06:20:01	decline order
3	02.06.20 - 06:21:00	receive order
2	02.06.20 - 06:25:11	inform customer
4	02.06.20 - 06:50:42	order received
3	02.06.20 - 07:00:02	locate appropriate warehouse
4	02.06.20 - 07:25:01	decline order
4	02.06.20 - 08:24:18	inform customer
3	02.06.20 - 09:17:13	take goods out of storage
3	02.06.20 - 12:12:19	place goods in parcel
3	02.06.20 - 12:12:43	weigh package
3	02.06.20 - 12:13:13	seal package
3	02.06.20 - 12:13:32	hand over package
3	02.06.20 - 13:41:32	ship package

b) What might be wrong when assuming that all event log imperfections have been caused by logging errors?

Solution

a) **Incorrect data: timestamp** In case 1 a wrong timestamp is used. The shipping of the package takes place hours before the order was received. Most likely the date was recorded wrong.

The correct time stamp for the *ship package* activity should be `02.06.20 - 00:44:53`.

Imprecise data: timestamp The rejection of the order in case 2 according to the event log was executed four months before the customer has placed the order. Possibly the month and date got mixed up.

The correct time stamp should be `02.06.20 - 06:20:01`.

Irrelevant data: event The packaging activity in case 3 is logged in much deeper detail than the other cases. In this case the events *place goods in parcel*, *weigh package*, *seal package*, *hand over package* represent distinct process steps in a level too granular.

They can be summarised into the single process step *package goods*.

Imprecise data: event attributes In case 4 the activity label *order received* is used instead of *receive order*. The semantic meaning of the activity is the same, yet the names are distinct.

The different descriptions should be unified.

Incorrect data: activity name The first activity of case 2 *recieve order* is written incorrectly. This activity therefore does not accurately reflect the process step that generated the log entry.

The correct spelling is *receive order*.

The corrected event log looks as follows:

Case ID	Timestamp	Activity
1	01.06.20 - 18:00:42	receive order
1	01.06.20 - 18:20:01	locate appropriate warehouse
2	01.06.20 - 18:33:32	**receive** order
1	01.06.20 - 19:17:17	take goods out of storage
1	01.06.20 - 23:17:19	package goods
1	**02.06.20** - 00:44:53	ship package
2	**02.06.20** - 06:20:01	decline order
3	02.06.20 - 06:21:00	receive order
2	02.06.20 - 06:25:11	inform customer
4	02.06.20 - 06:50:42	**receive order**
3	02.06.20 - 07:00:02	locate appropriate warehouse
4	02.06.20 - 07:25:01	decline order
4	02.06.20 - 08:24:18	inform customer
3	02.06.20 - 09:17:13	take goods out of storage
3	02.06.20 - 12:13:32	**package goods**
3	02.06.20 - 13:41:32	ship package

b) If all anomalies or imperfections are assumed to be logging errors that need correction flaws in the process can be overseen and remain unnoticed.

Exercise 4: Eventually-Follows Graph

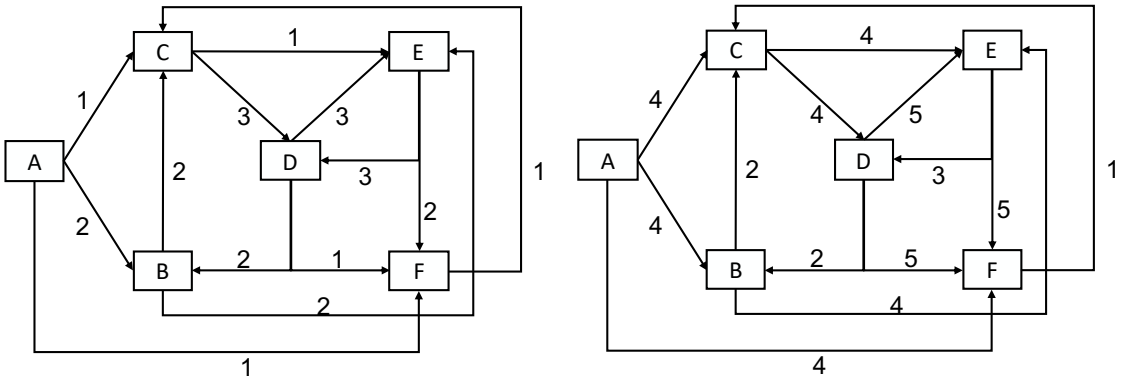
$L_1 = [\langle ABCDEDEF \rangle, \langle ACDBEF \rangle, \langle ABCEDEDF \rangle, \langle AFCDBE \rangle]$

a) Draw both a directly-follows graph and an eventually-follows graph based on the event log above.

b) Try to identify outliers in both graphs and explain which one is better suited to identify outliers.

Solution

a)



b) The eventually-follows graph is suited better to identify outliers. Rare occurrences of activities still affects the edge count of the EFG and increases it, but the regular more frequent behaviour is amplified by the EFG.