

### Exercise Sheet 10

#### Exercise 36      Logistic Regression

The following table shows the number of American intercontinental ballistic missiles (ICBMs) in the years from 1960 to 1969:

year, $x$	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969
number, $y$	18	63	294	424	834	854	904	1054	1054	1054

Find a best fit curve for this data set using logistic regression ( $Y = 1060$ )! Draw the original data and sketch the curve  $y = \frac{1060}{1+e^{a+bx}}$ !

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#### Additional Exercise      Exponential Regression

Radioactive substances decay according to the law  $N(t) = N_0e^{-\lambda t}$ , where  $t$  is the time,  $\lambda$  a substance-specific decay parameter,  $N_0$  the number of atoms of the substance at the beginning and  $N(t)$  the number of remaining atoms at time point  $t$ . With the help of Geiger–Müller counter the following values  $n$  were measured for the number of  $\alpha$  particles that were emitted by a small amount of a radioactive substance up to different time points  $t$ :

$t$ (in s)	0	30	60	90	120	150	180	210	240
$n$	0	306	552	655	768	863	901	919	956

Each counted  $\alpha$  particle indicates that one atom of the radioactive substance decayed. Determine the half-life of the radioactive substance! What element is this substance?

Procedure: Find a best fit curve  $n = n_0(1 - e^{-a+bt})$ !

(Hint: You have to find a transformation that reduces the problem to the problem of finding a best fit line (regression line);  $n_0 = 1000$ .) Although the value for  $a$  may differ from zero with this approach,  $-b$  may be seen as an approximation of the decay parameter  $\lambda$ , from which the half-life can easily be determined. The half-life of a substance is the time after which only half of the originally present atoms remain.

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**Exercise 37** Frequent Itemset Mining

Please use the Apriori algorithm for solving this exercise!

- a) Find the frequent/maximal/closed item sets for the following transaction vector and  $s_{min} = 3$ :

1:	a	d	f						
2:	b	d							
3:	b	c							
4:	b	d	e						
5:	c	d	f						
6:	a	c	d	e					
7:	b	c	d						
8:	a	b	d						
9:	b	c	e	g					
10:	a	b	d						

- b) Find an example of a transaction database for which the number of maximal item sets goes down if the minimum support is reduced; or explain in some other way why it is possible that the number of maximal item sets can also become smaller if the minimum support is reduced.