Assignment #4

This assignment is due on May 13th one hour before class via email to **christian.wallraven+AMS2019@gmail.com**.

Important: You need to name your file properly. If you do not adhere to this naming convention, I may not be able to properly grade you!!!

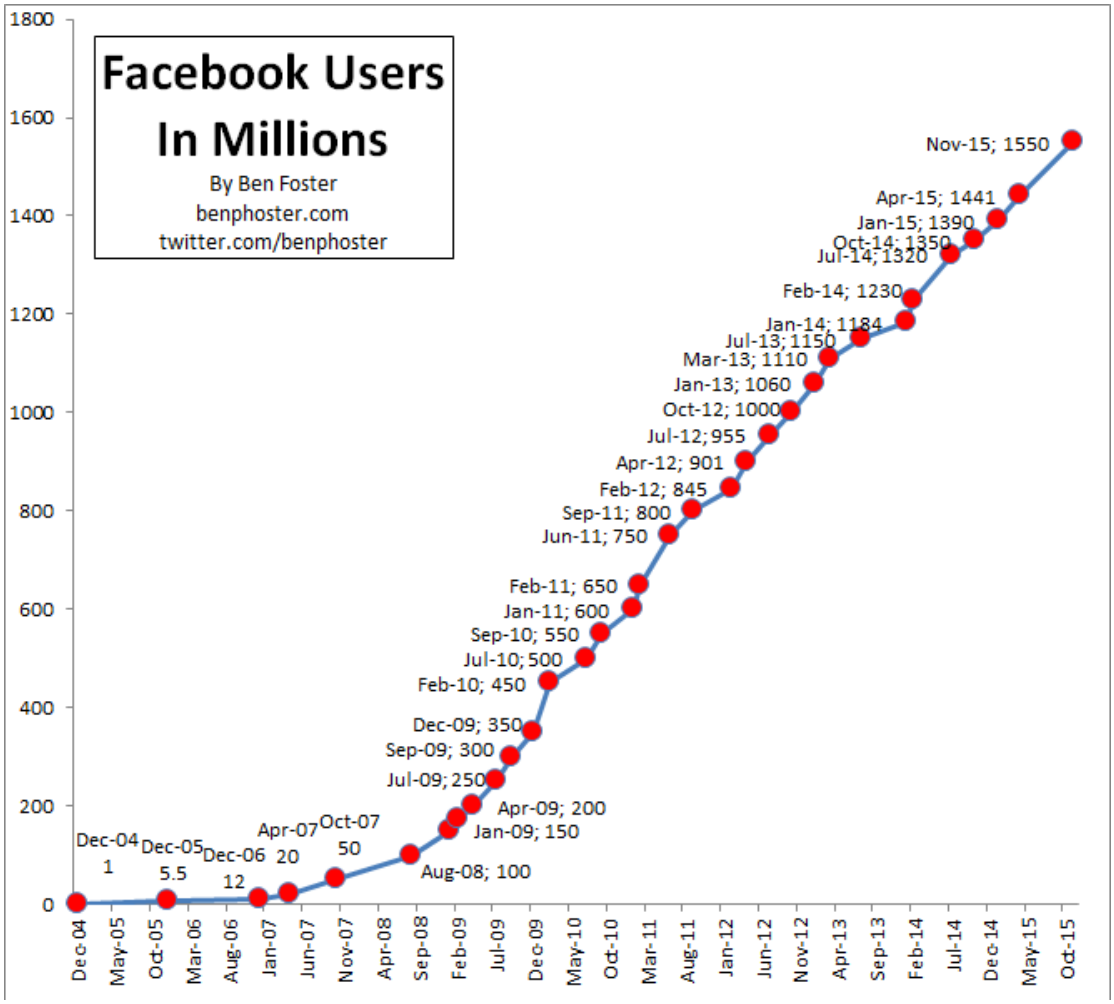
If you are done with the assignment, make one zip-file of the `assignment4` directory and call this zip-file `STUDENTID1_STUDENTID2_STUDENTID3_A4.zip` (e.g.: `2016010000_2017010001_A3.zip` for a team consisting of two students or `2016010000_2017010001_2017010002_A3.zip` for a three-student team). The order of the IDs does not matter, but the correctness of the IDs does! **Please double-check that the name of the file is correct!!**

Please make sure to comment the code, so that I can understand what it does. Uncommented code will reduce your points!

ALSO: I can also surf on the internet for code. Downloading and copying and pasting other peoples' code is plagiarism and will NOT be tolerated. If you work as a team, the code needs to contain all team members' names!!

This assignment has 3 parts that are shown below. Each part is on a separate page.

Part1 Line fitting - prediction (20 points):



Here is a graph showing the number of facebook users in millions. As you can see, the curve had a huge boost in 2007/2008 and now seems to be on an almost linear trend. For now, we will only concentrate **on this later trend**!

Take all datapoints from August 2008 until November 2015 and put them in an array called `members`. Take all timepoints in months (with August 2008 being month 0) and put them in an array called `months`.

In a script called `facebook.m`, **fit this data with a line**, using the **closed-form solution** derived in **class!!! I do NOT want to see the BACKSLASH or POLYFIT! I do NOT want to see a VANDERMONDE matrix!**

Plot the measured data points, along with the fitted line into the same plot.

Using your regression line as a predictor model, when will facebook have as many users as humans living on earth (assume 8 billion)? Plot this point into the plot above (extending the x-axis accordingly)!

Make sure to insert all observations and interpretations as comments into your script!

Part2 Curve fitting 1 (20 points):

Let us try to fit polynomials to the sin-function.

In a script called `fitSin.m`, generate datapoints `x=[-pi:0.1:pi]` and corresponding y-values for the sin-function.

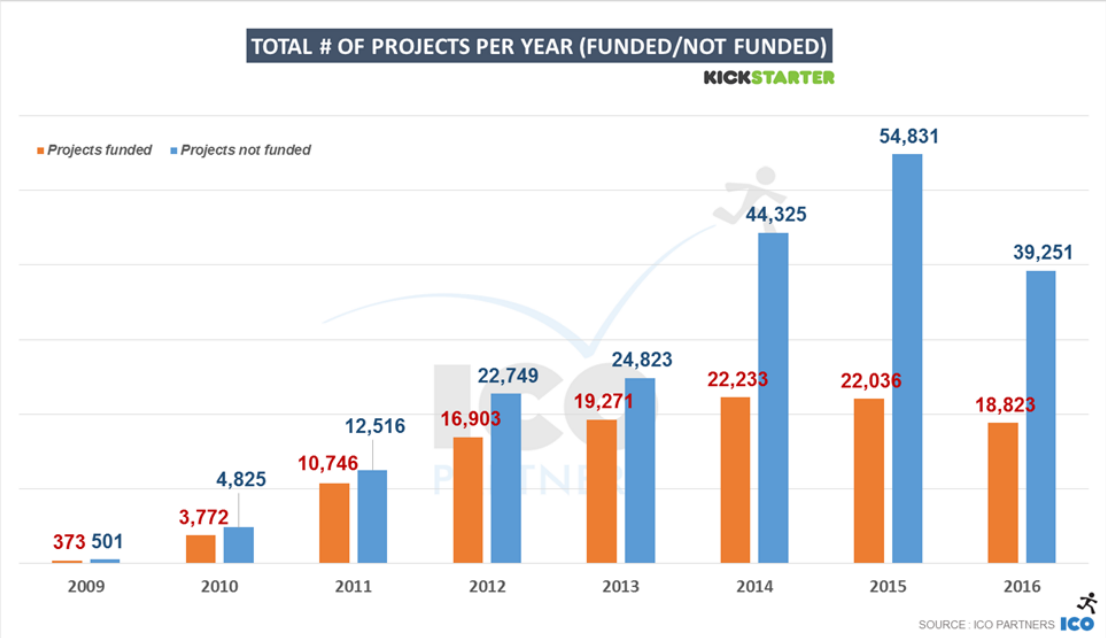
Fit the data in a least-squares sense with polynomials of degrees 0 through 10. I want you to **use the VANDERMONDE matrix** for this – take a look at the lecture slides again, please.

Make one figure with two subplots. The first subplot contains the original sin-function and all fits. The second subplot has a plot of the **norm of the residuals** as a function of the polynomial degree.

Now take a look at the coefficients of the polynomials. What can you say? Let us say, that I only give you 11 chances to fit a polynomial to the sin-function – how can you use your observation to produce a much better fit than with the 11 fits you just did??

Insert all observations as comments into `fitSin.m`

Part3 Curve fitting 2 (20 points):



Here is a graph showing the number of funded and non-funded projects on Kickstarter from 2009 to 2016.

Enter the two datasets into two variables funded and nonfunded.

In a script called `kickstarter.m`, enter the two datasets into two variables called funded and nonfunded. Then **fit this data with polynomials from degree 2 until 7**, using the **Vandermonde** method shown in class.

Which of the models do you think fits the data best for each of the two datasets (**remember the compromise between fit quality and generalizability!!!**)? Do the degrees differ? Why would they? Why would they not?

Plot the measured data points, along with your **best-fit model** into the same plot.

Using your model as a predictor model, how many projects will be funded and non-funded in 2020? Plot these points as well into the same plot.

Make sure to insert all observations and interpretations as comments into your script!