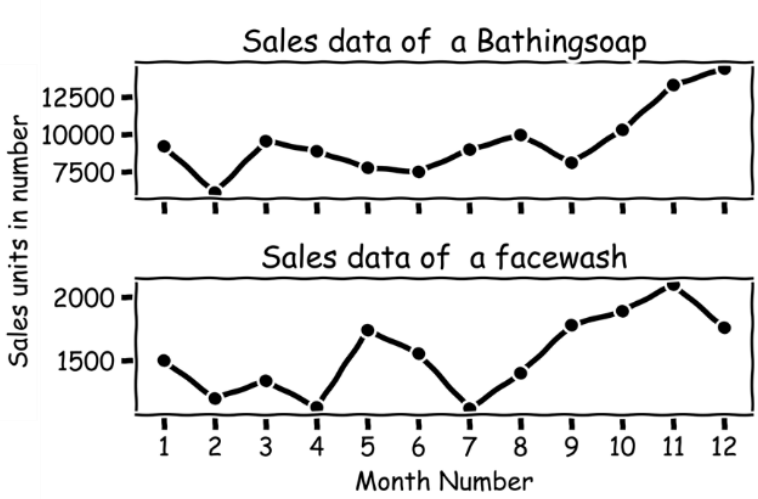
Lab 05
Data Visualization II

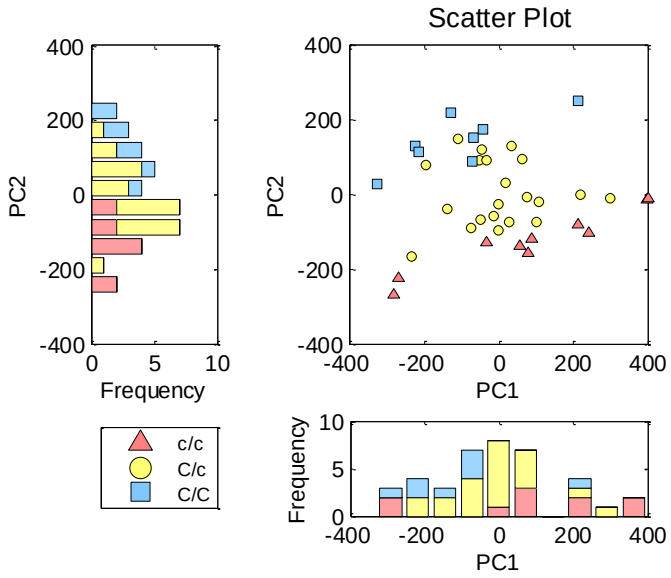
A. Basic Plotting (10 points)

Get sale unit of bathingsoap and facewash in sales_data.csv and show it using the subplots. The figure should be in the xkcd style and look like the figure below.



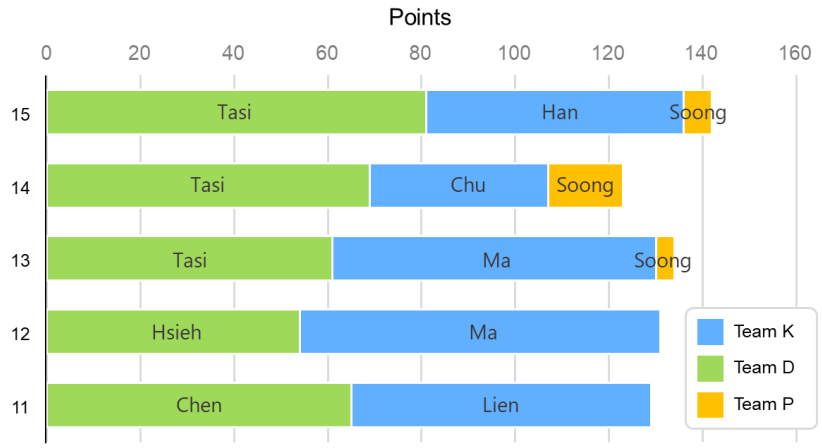
B. Histogram and Subplots (25 points)

Load the dataset in "Scatter.xslx". The dataset contains the PC1, PC2, and genotype of some specimen. The genotype 0, 1, and 2 denote the type 'c/c', 'C/c', and 'C/C', respectively. Prepare a figure composed of 3 subplots: (a) PC1-PC2 scatter plot, (b) PC1 histogram, and (c) PC2 histogram. The bin number in the histogram is 10. Use different colors to distinguish different genotypes. Provide the legend at the bottom-left corner. The result should look like the figure below.



C. Bar Chart and Text (25 points)

The Score.csv file contains the history statistics of an arcade game competition. The data includes the participating teams of each round, their total score and their team leader. Plot the data with a horizontal stacked bar chart. Use different colors to distinguish different teams and put the leader's name in the middle of the bar. The result should look like the figure below.

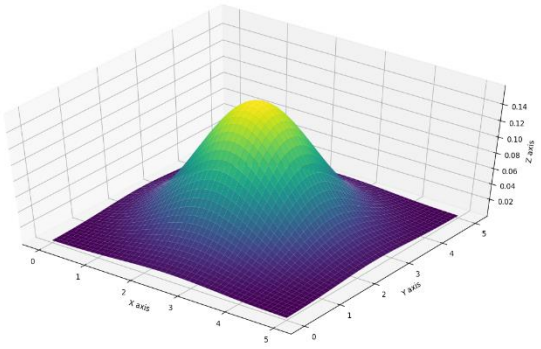


D. 3D Plots and Advanced Styling (15 points + 10 points bonus)

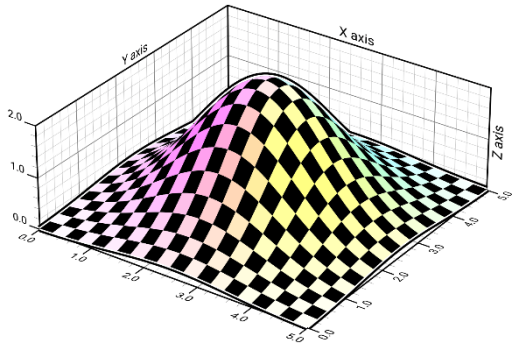
In probability theory and statistics multivariate Gaussian distribution is a generalization of the one-dimensional normal distribution to higher dimensions. In the 2-dimensional nonsingular case, the probability density function of a vector $[XY]'$ is:

$$f(x,y) = \frac{1}{2\pi\sigma_X\sigma_Y\sqrt{1-\rho^2}}\exp\left(-\frac{1}{2(1-\rho^2)}\left[\frac{(x-\mu_X)^2}{{\sigma_X}^2} + \frac{(y-\mu_Y)^2}{{\sigma_Y}^2} - \frac{2\rho(x-\mu_X)(y-\mu_Y)}{\sigma_X\sigma_Y}\right]\right)$$

Plot a 3D Gaussian Distribution with $\mu_X = \mu_Y = 2.5$ and $\sigma_X = \sigma_Y = 1$ in a 3D graph. Your result should look like the figure below.



10 points



Another 10 points for this styling

(Figure from: https://github.com/rougier/scientific-visualization-book)

E. Reading and Programming - Animations (25 points + 10 points bonus)

Although Matplotlib library is usually used to plot graphs of functions or figures, it can also be used as an animation tool. The plotted graphs when added with animations gives a more powerful visualization and helps the presenter to catch a larger number of audiences. Read the documentation regarding the animation API at https://matplotlib.org/3.3.0/api/animation_api.html then complete the following exercise.

In this exercise, you are going to simulate the *double pendulum* with matplotlib. If you haven't heard of it, do not worry, matplotlib provides an animation example as well as its source code at https://matplotlib.org/3.3.0/gallery/animation/double_pendulum.html. However, if you look at the animation provided, you will find that it is difficult to identify the trace where the second pendulum's tip moves. Therefore, your task is to plot the trace following these steps:

1) Plot the trace in the animation. (15 points)
2) Keep the trace in a fixed length. (10 points)
3) Adjust the transparency on the tail. (10 points bonus)