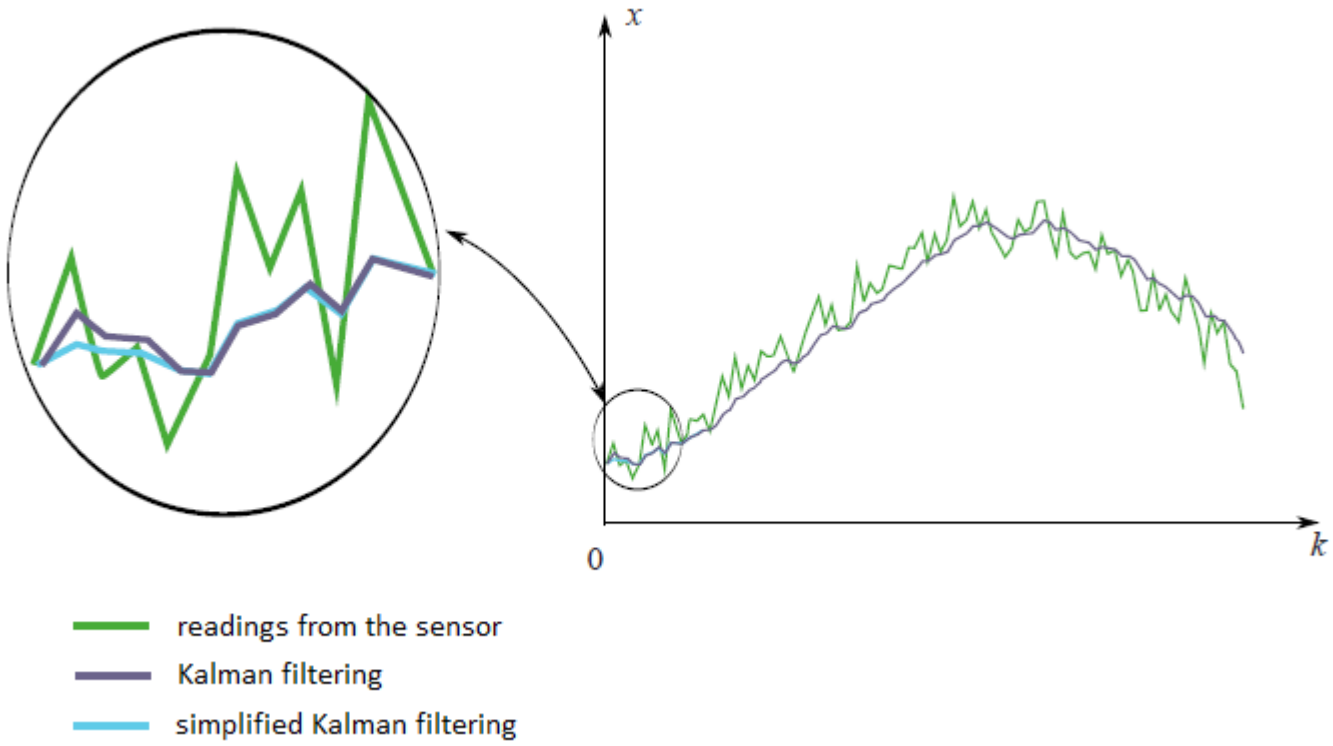
Home assignment #2-1

Home assignment 2-1: Create simplified recursive filter and compare its results with 1D Kalman filter

- **Generate noisy 1D data,**
- **Demonstrate 1D Linear Kalman Filter estimation on data,**
- **Create simplified recursive filter and compare its results with 1D Kalman filter**
- **Play with different values for filter initialization (xOpt and eOpt) to prove the Filter convergence**

$$x_{k+1}^{opt} = K_{stab} \cdot z_{k+1} + (1 - K_{stab}) \cdot x_k^{opt}$$



Home assignment #2-2

Home assignment 2-2: Kalman Filter - Estimation of the traveled distance

The task is to predict the traveled distance based on the linear accelerometer measurement.
Update the predicted value using the distance measurements of the GPS sensor.

Take your smartphone and jog (outdoors) for 150 meters approx. with an approximate speed.
Record the measurements of the linear accelerator and GPS sensors
The linear accelerator will return the acceleration along x, y, and z.
The GPS will return the longitude and latitude

Apply Kalman filter to predict the traveled distance and plot the graphs of the measured distance (in meters) and the predicted distance (in meters)

Hint: Since we have already the data collected, you can compute the estimated standard deviation of the process model (std_acc) and the measurement model (std_meas).

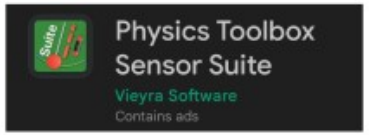
Submission

Submit your Colab file including a link to your data (upload your data to your (Drive, Dropbox, ...) account and share link)
Each student should submit the solution for his own data (working on the same dataset is not allowed)

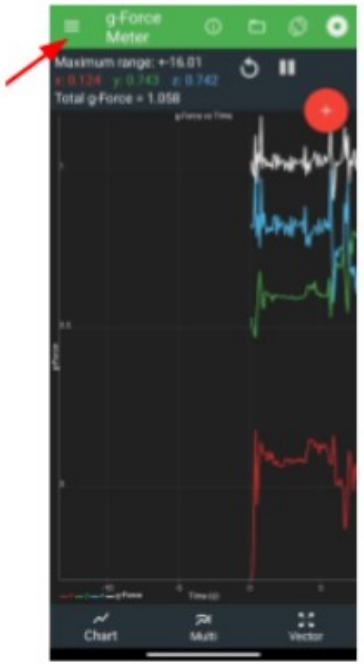
Home assignment #2-2

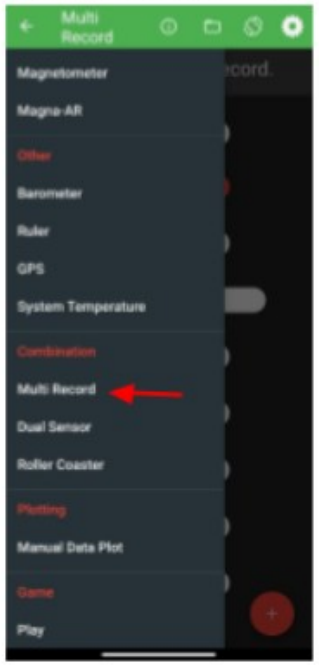
Collect Data:

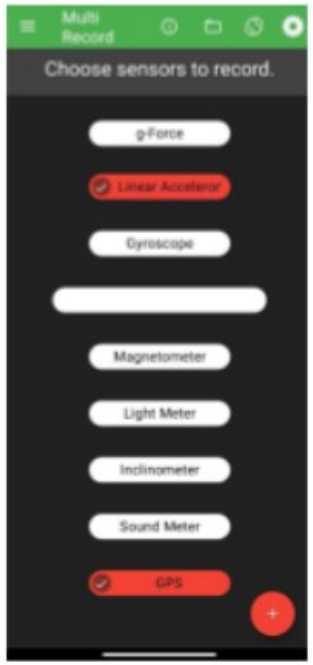
To do the task you need to download this app (Physics Toolbox Sensor Suite)



Open the App -> settings -> Multi Record mode -> select Linear Accelerator and GPS







Once you press on the  button the app will start recording your motion.

Move the required distance and press the Stop button 

The data will be save in csv file

time	ax	ay	az	Latitude	Longitude	Speed (m/s)
0.063546	0	0	0	0	0	0
0.064164	0	0	0	55.74802347	48.74196349	1.30999994
0.113742	0	0	0	55.74802347	48.74196349	1.30999994
0.114748	0	0	0	55.74802347	48.74196349	1.30999994
0.135187	0	0	0	55.74802347	48.74196349	1.30999994
0.136721	0	0	0	55.74802347	48.74196349	1.30999994
0.137454	0	0	0	55.74802347	48.74196349	1.30999994
0.138057	0	0	0	55.74802347	48.74196349	1.30999994
0.194265	0	0	0	55.74802347	48.74196349	1.30999994
0.19569	0	0	0	55.74802347	48.74196349	1.30999994
0.21537	0	0	0	55.74802347	48.74196349	1.30999994
0.216886	-0.8024	0.3143	-1.6314	55.74802347	48.74196349	1.30999994
0.218211	-0.8024	0.3143	-1.6314	55.74802347	48.74196349	1.30999994
0.219032	-0.8024	0.3143	-1.6314	55.74802347	48.74196349	1.30999994
0.264493	-0.8024	0.3143	-1.6314	55.74802347	48.74196349	1.30999994
0.268254	-0.8024	0.3143	-1.6314	55.74802347	48.74196349	1.30999994
0.295369	-0.8024	0.3143	-1.6314	55.74802347	48.74196349	1.30999994

Where ax, ay, az are the measured accelerations. Latitude and Longitude are from the GPS sensor. Consider the first non-zero values of Latitude and Longitude as your reference point (starting point).