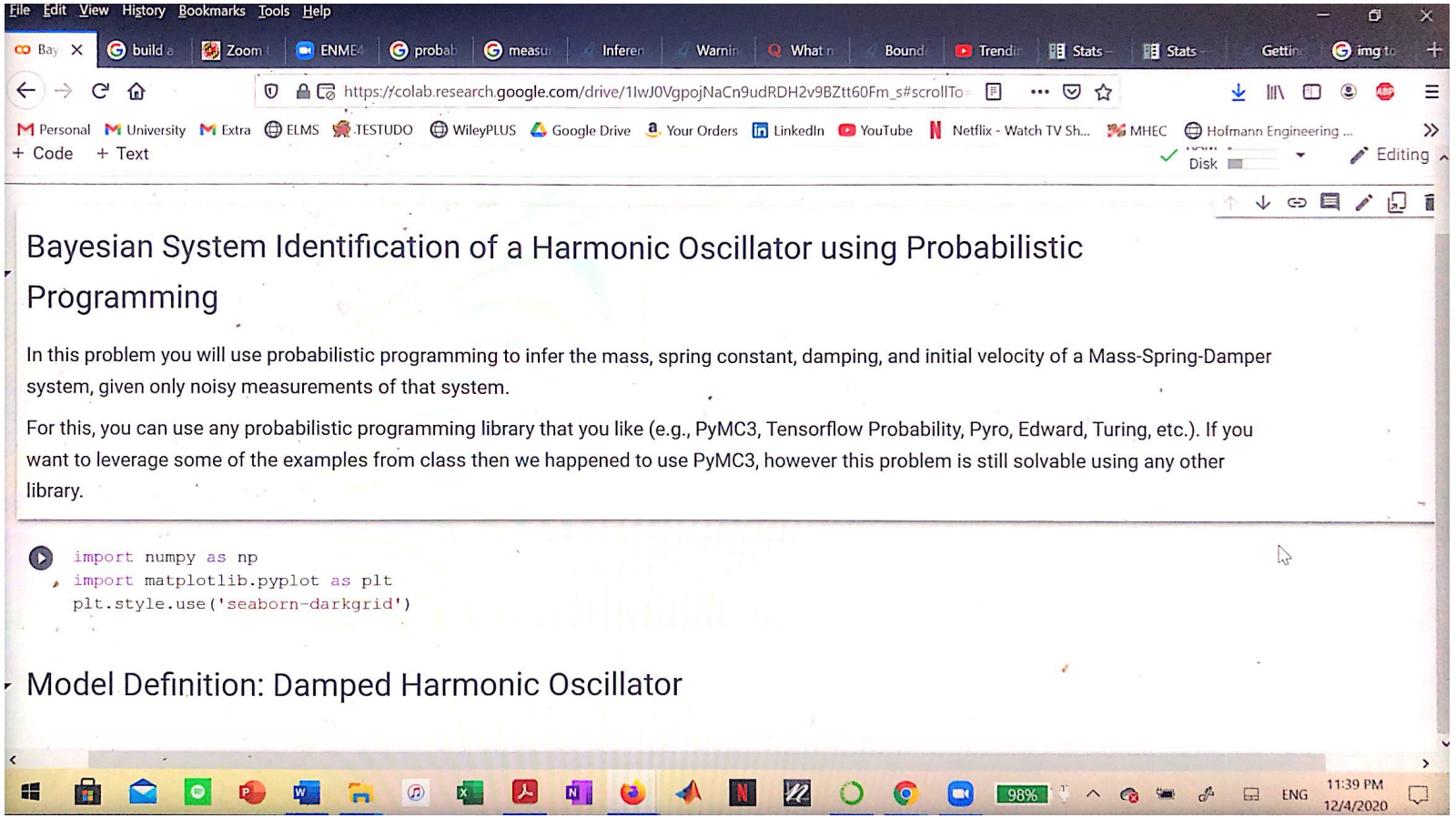
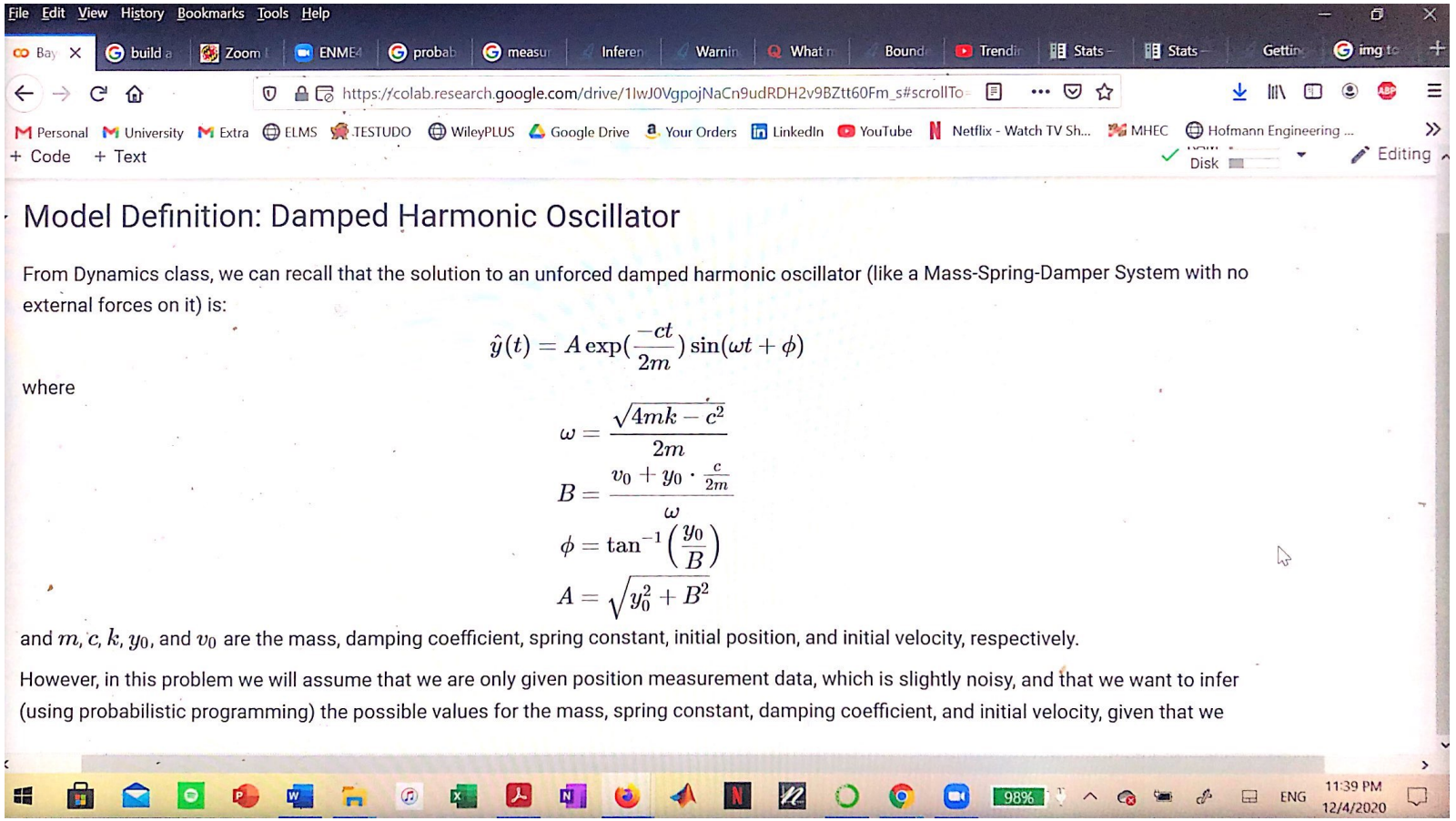
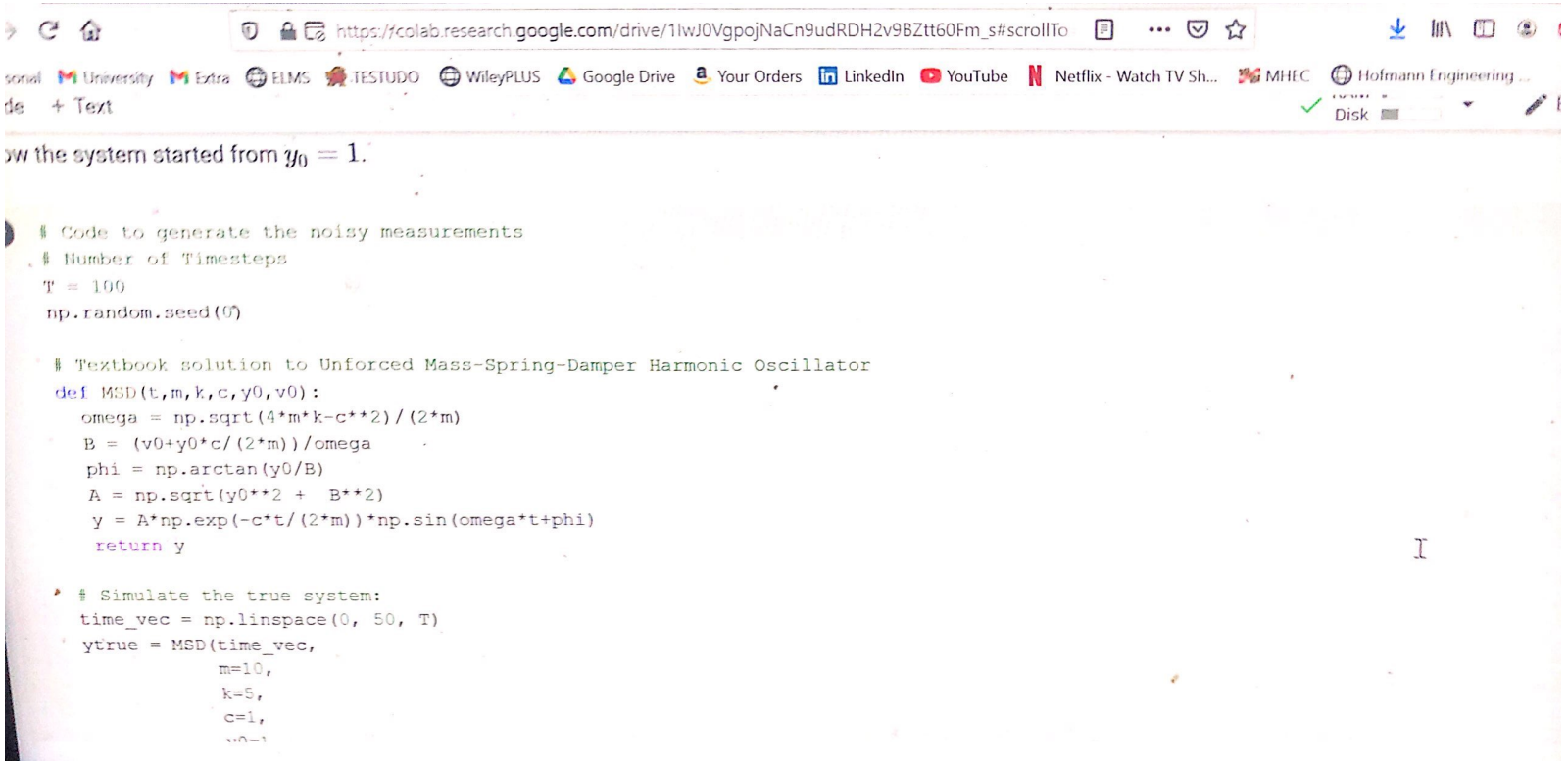
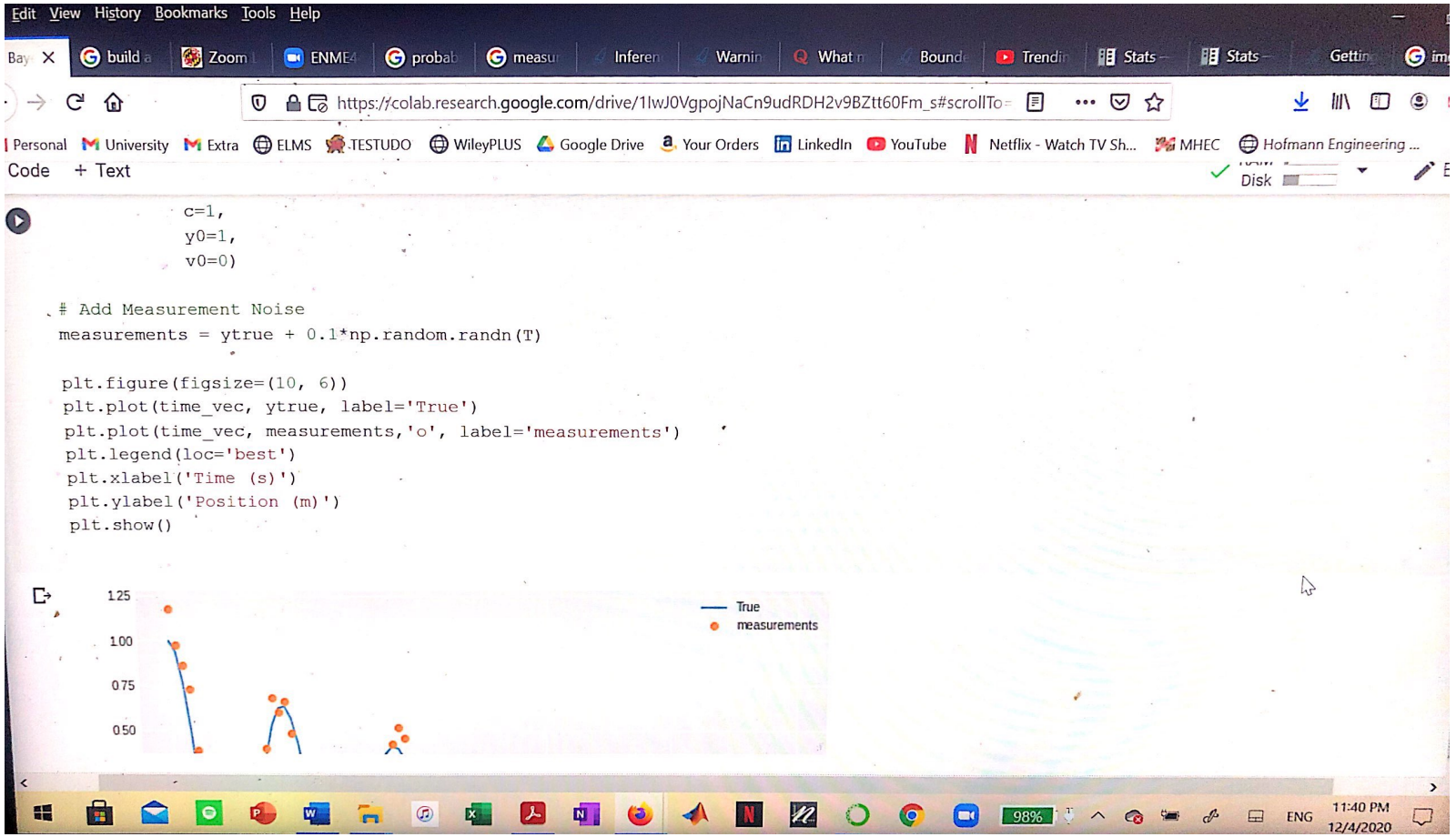
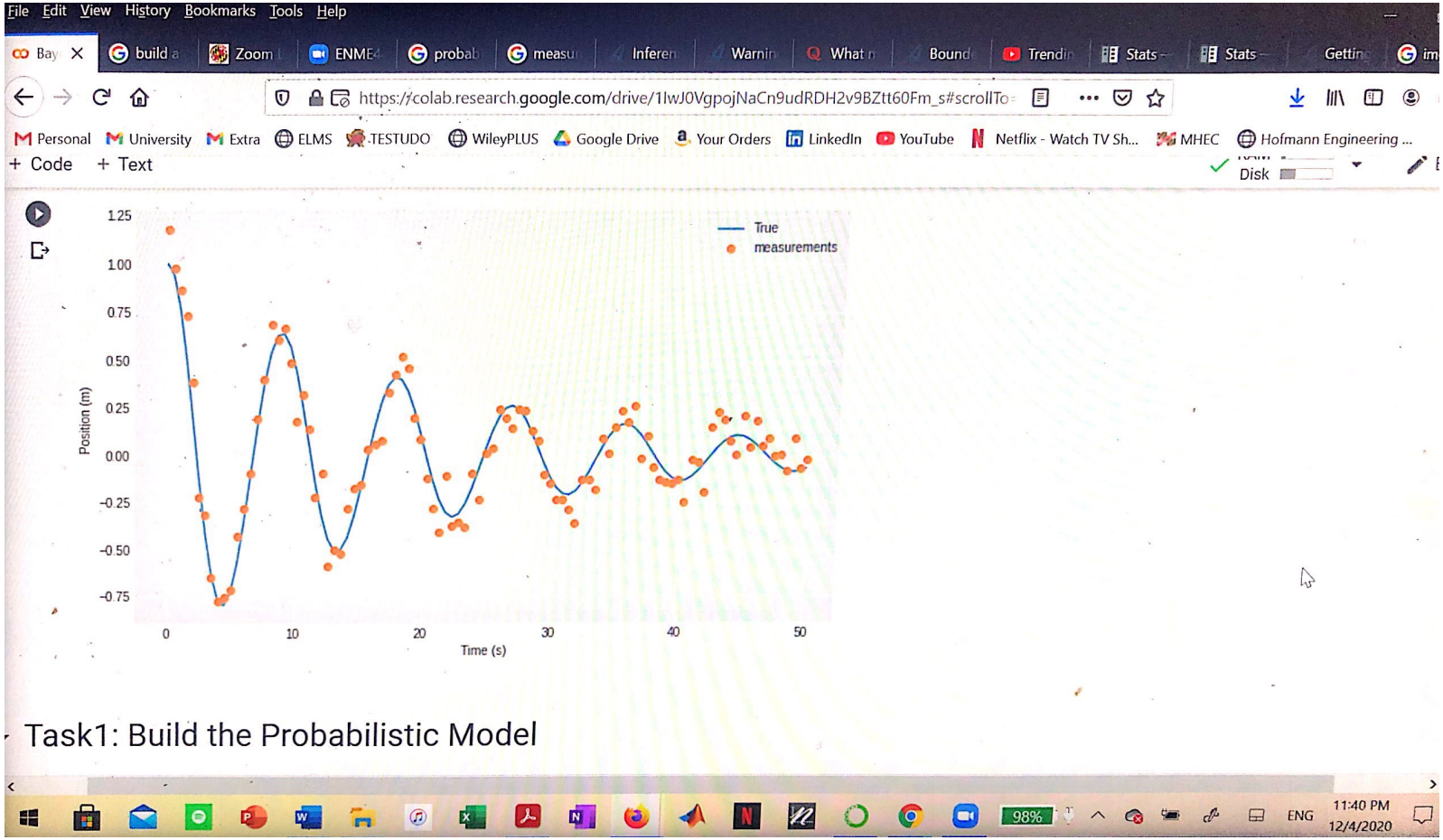
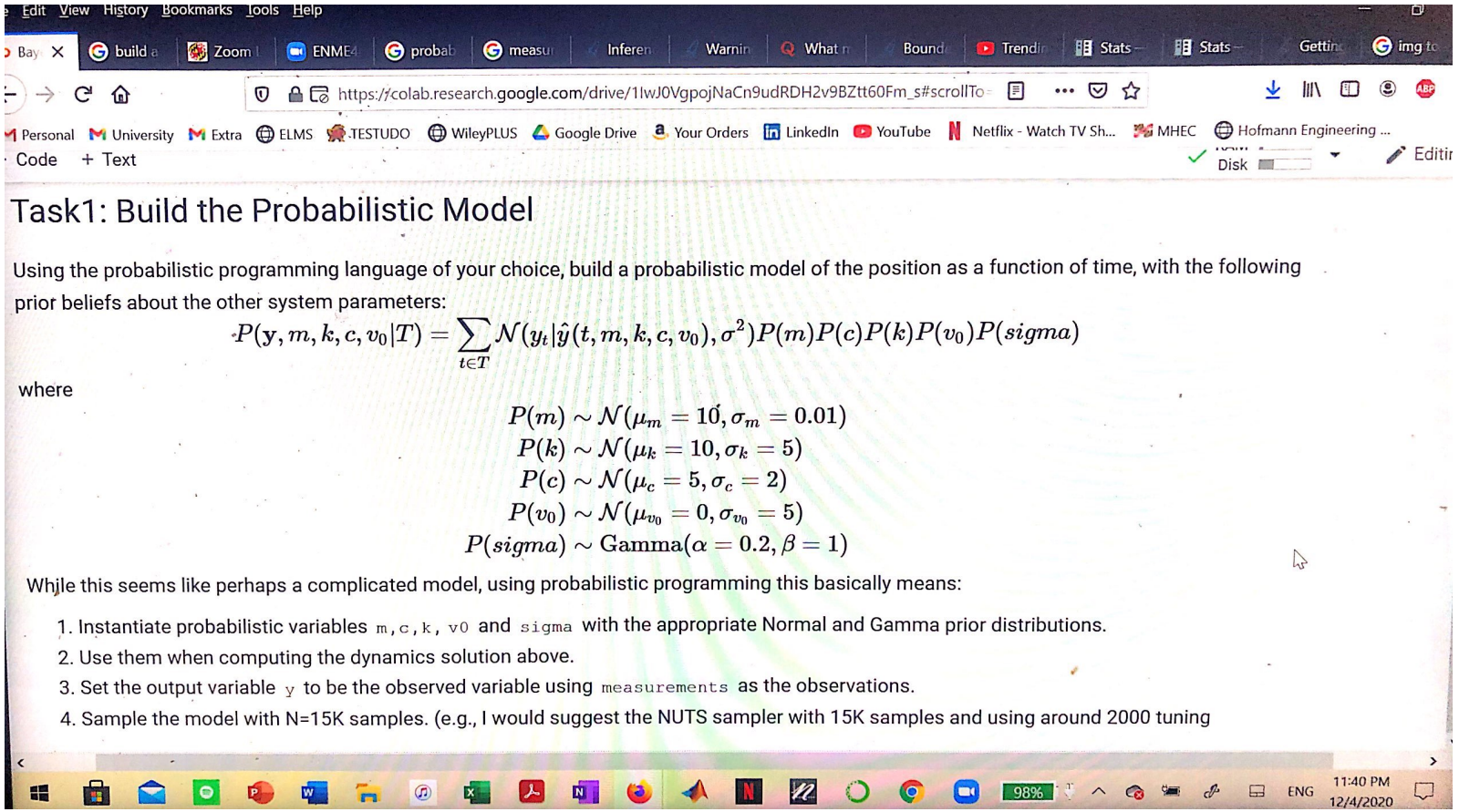


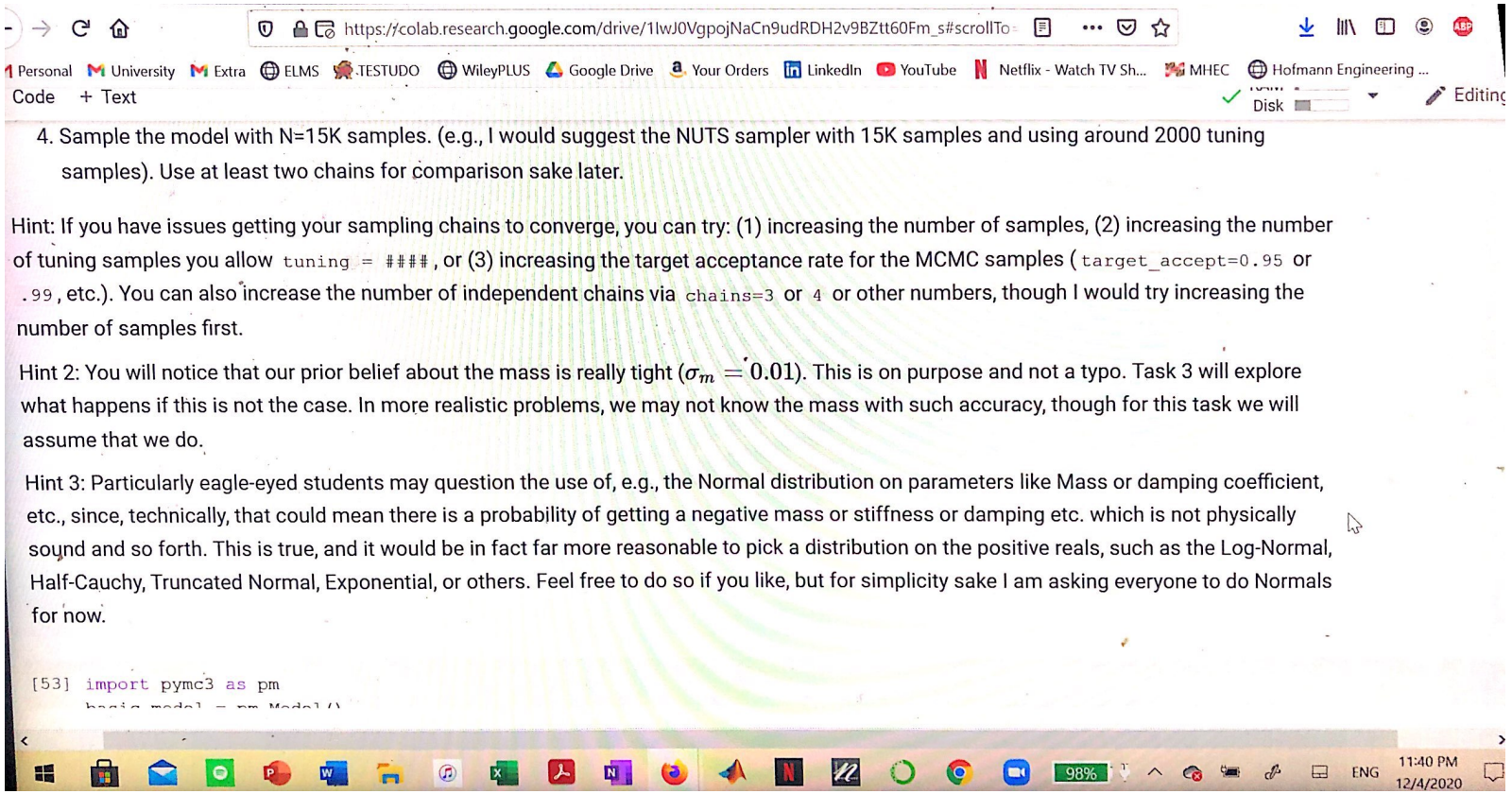


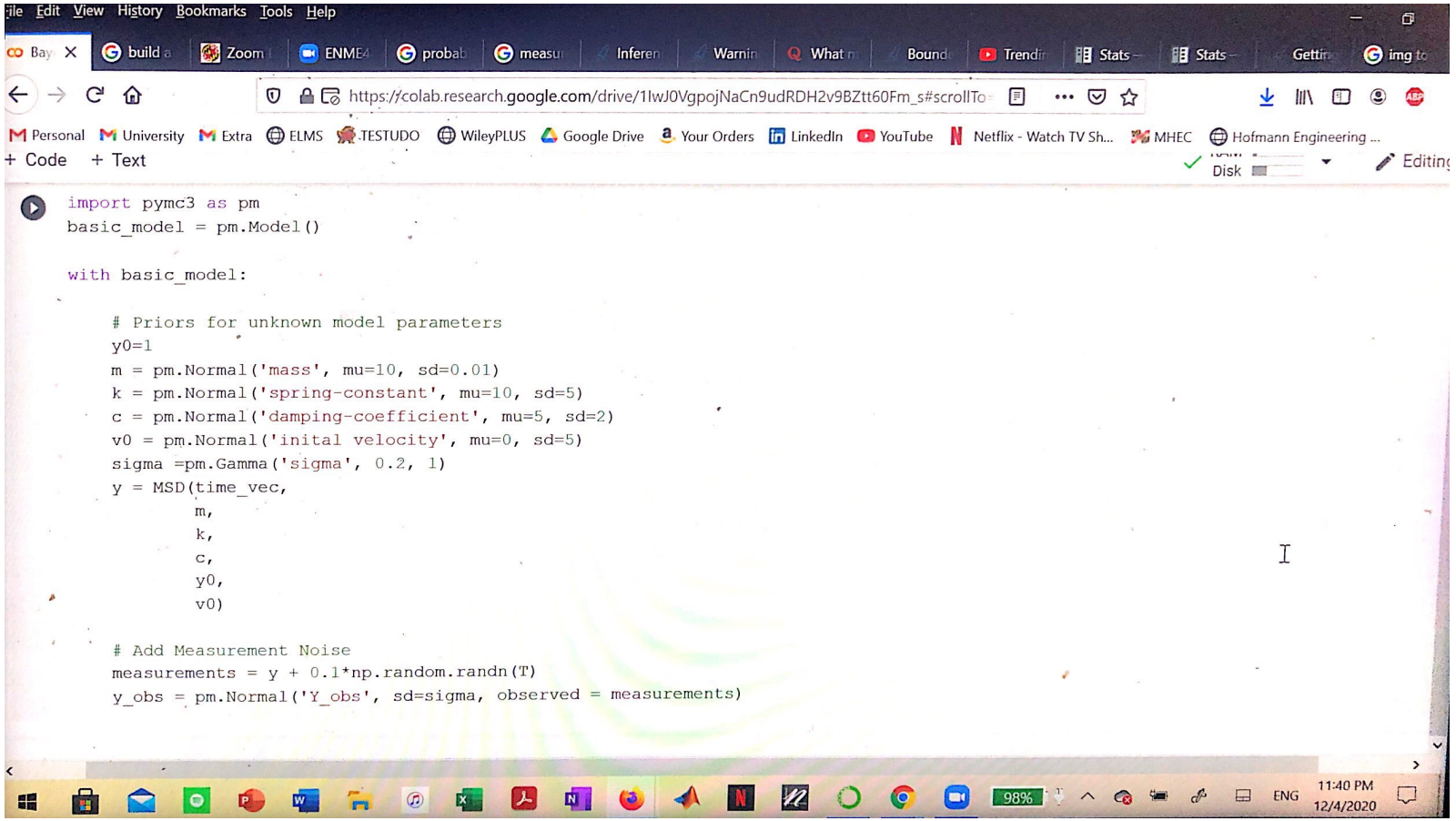




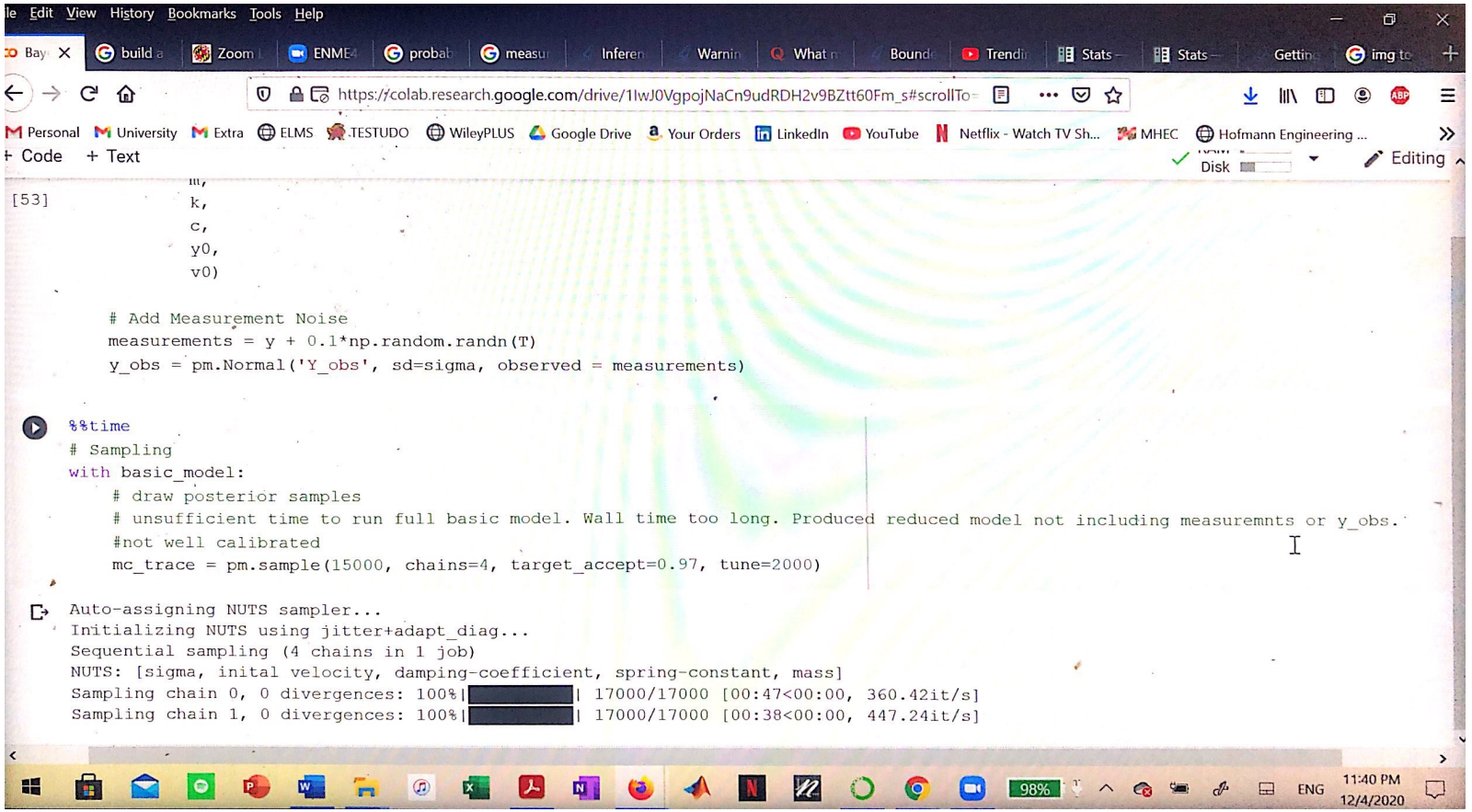


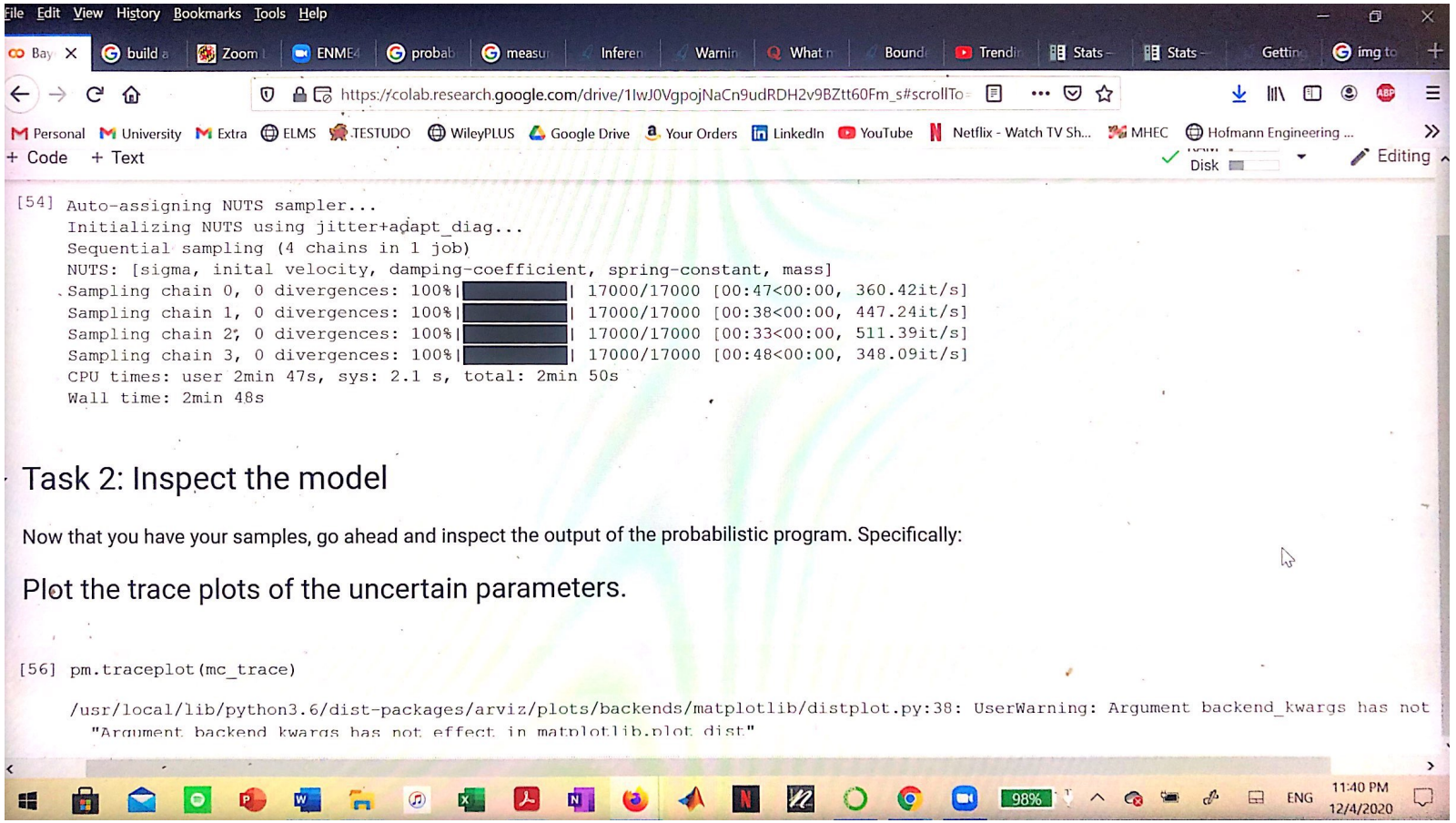


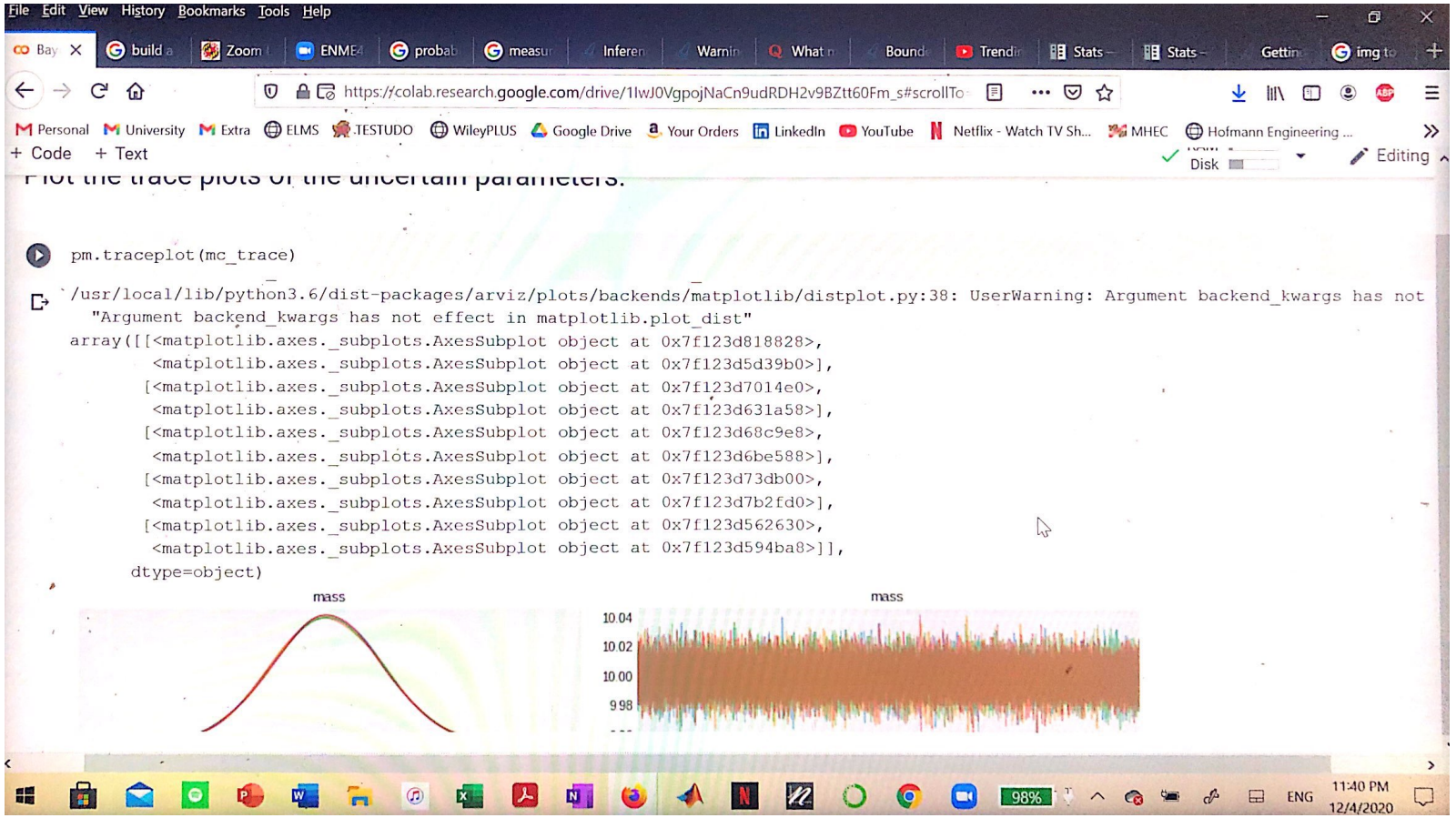


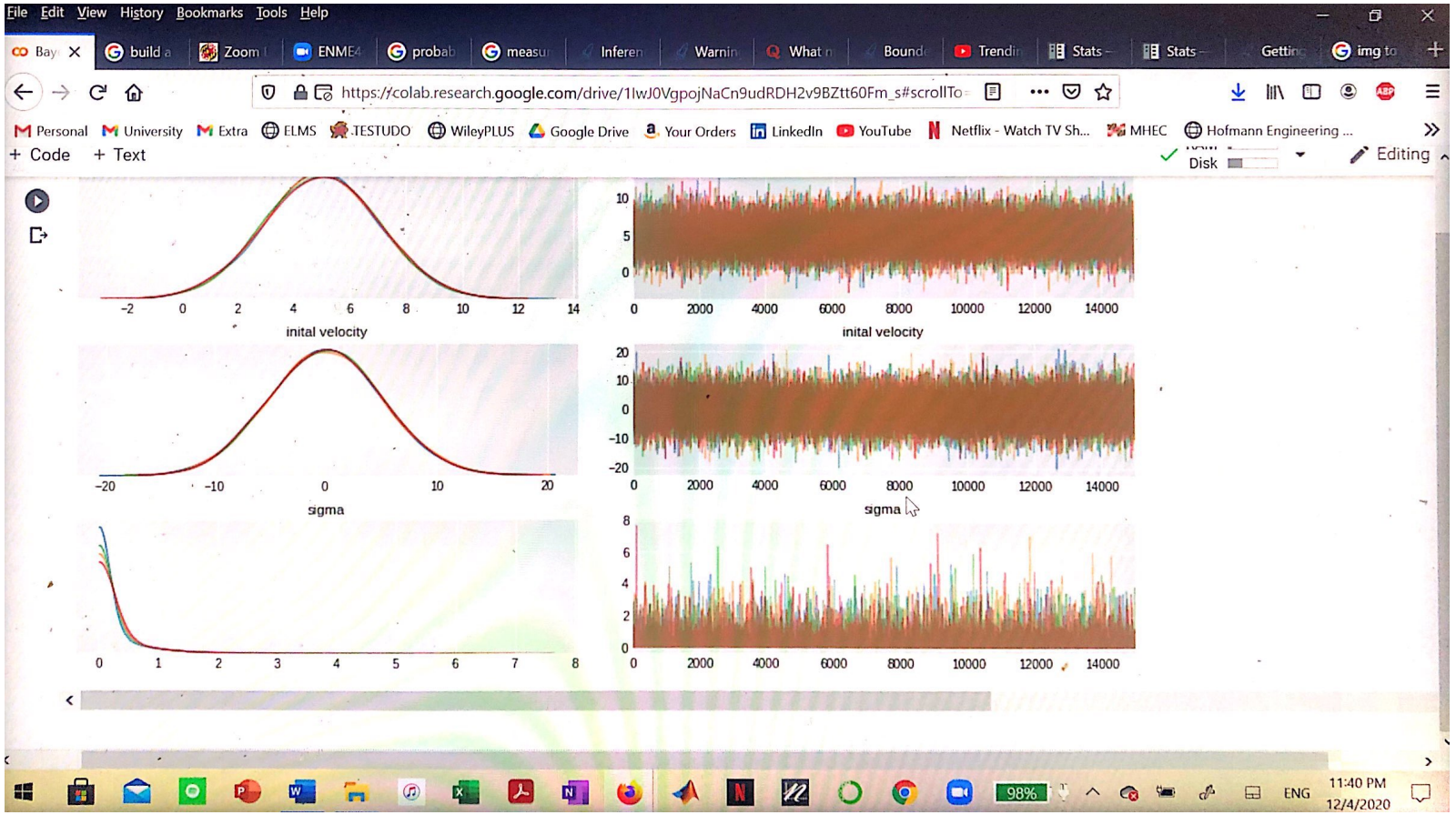


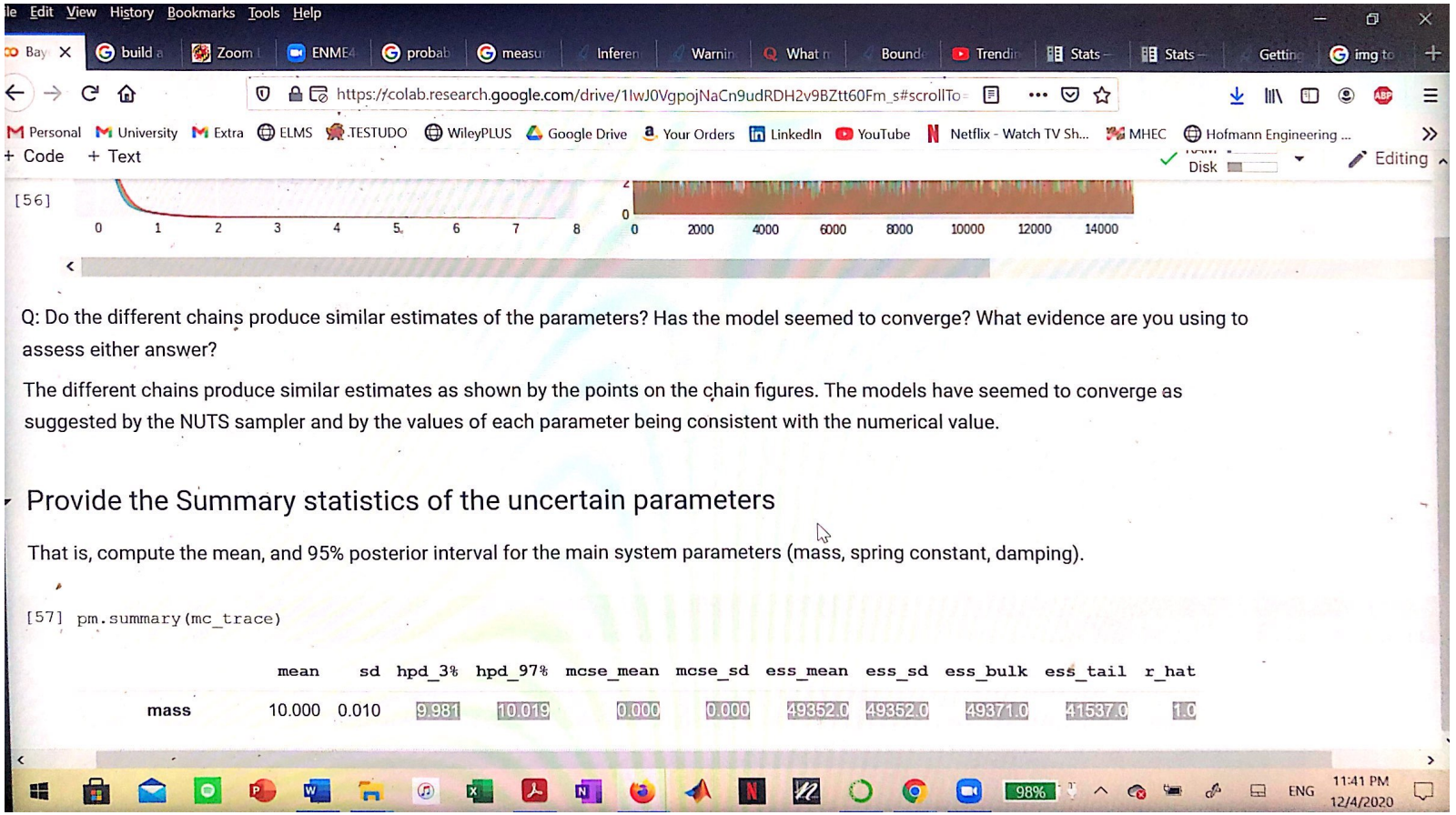
```
import pymc3 as pm
basic_model = pm.Model()

with basic_model:

    # Priors for unknown model parameters
    y0=1
    m = pm.Normal('mass', mu=10, sd=0.01)
    k = pm.Normal('spring-constant', mu=10, sd=5)
    c = pm.Normal('damping-coefficient', mu=5, sd=2)
    v0 = pm.Normal('inital velocity', mu=0, sd=5)
    sigma =pm.Gamma('sigma', 0.2, 1)
    y = MSD(time_vec,
            m,
            k,
            c,
            y0,
            v0)

    # Add Measurement Noise
    measurements = y + 0.1*np.random.randn(T)
    y_obs = pm.Normal('Y_obs', sd=sigma, observed = measurements)
```











Q: Do the different chains produce similar estimates of the parameters? Has the model seemed to converge? What evidence are you using to assess either answer?

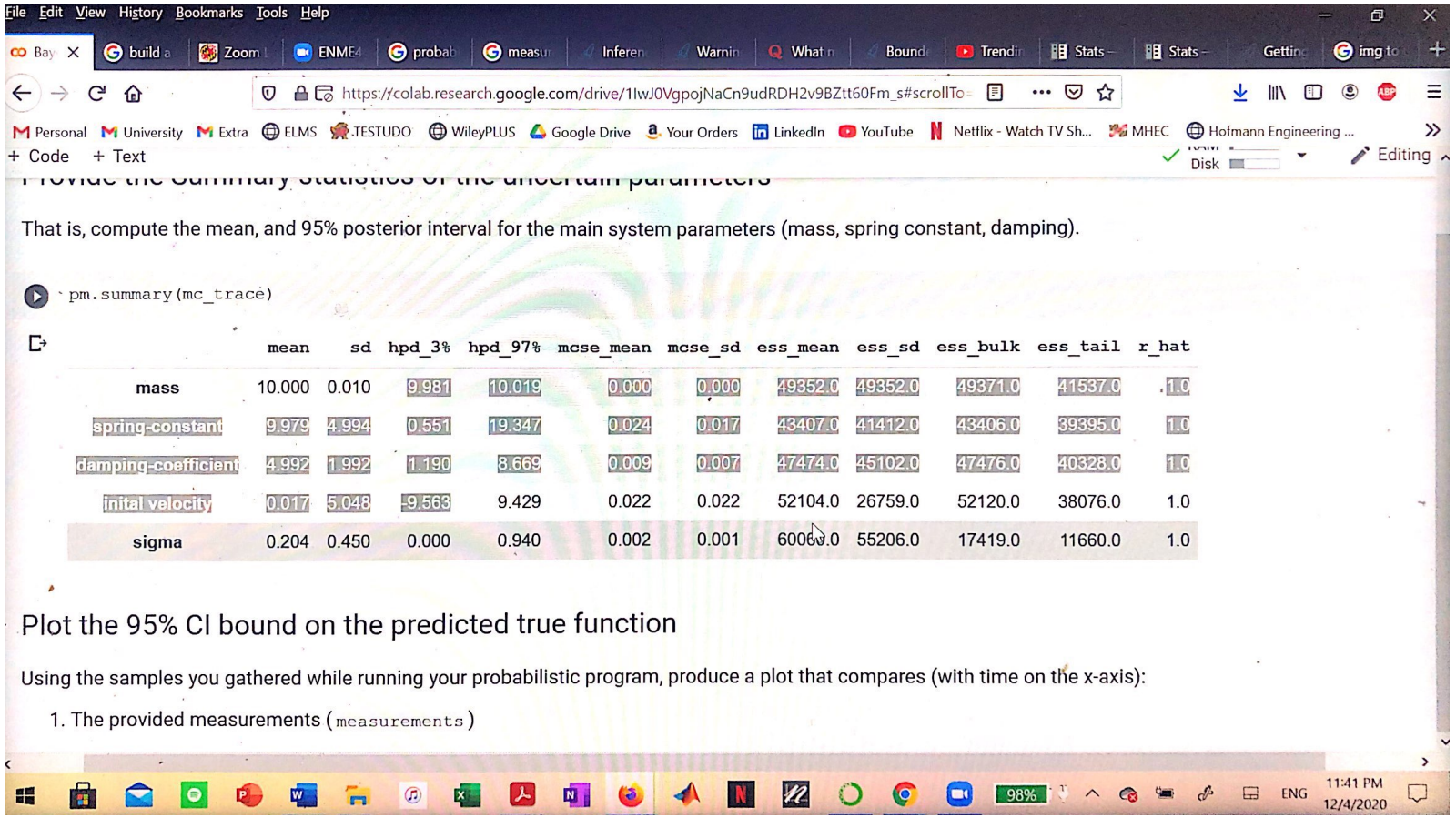
The different chains produce similar estimates as shown by the points on the chain figures. The models have seemed to converge as suggested by the NUTS sampler and by the values of each parameter being consistent with the numerical value.

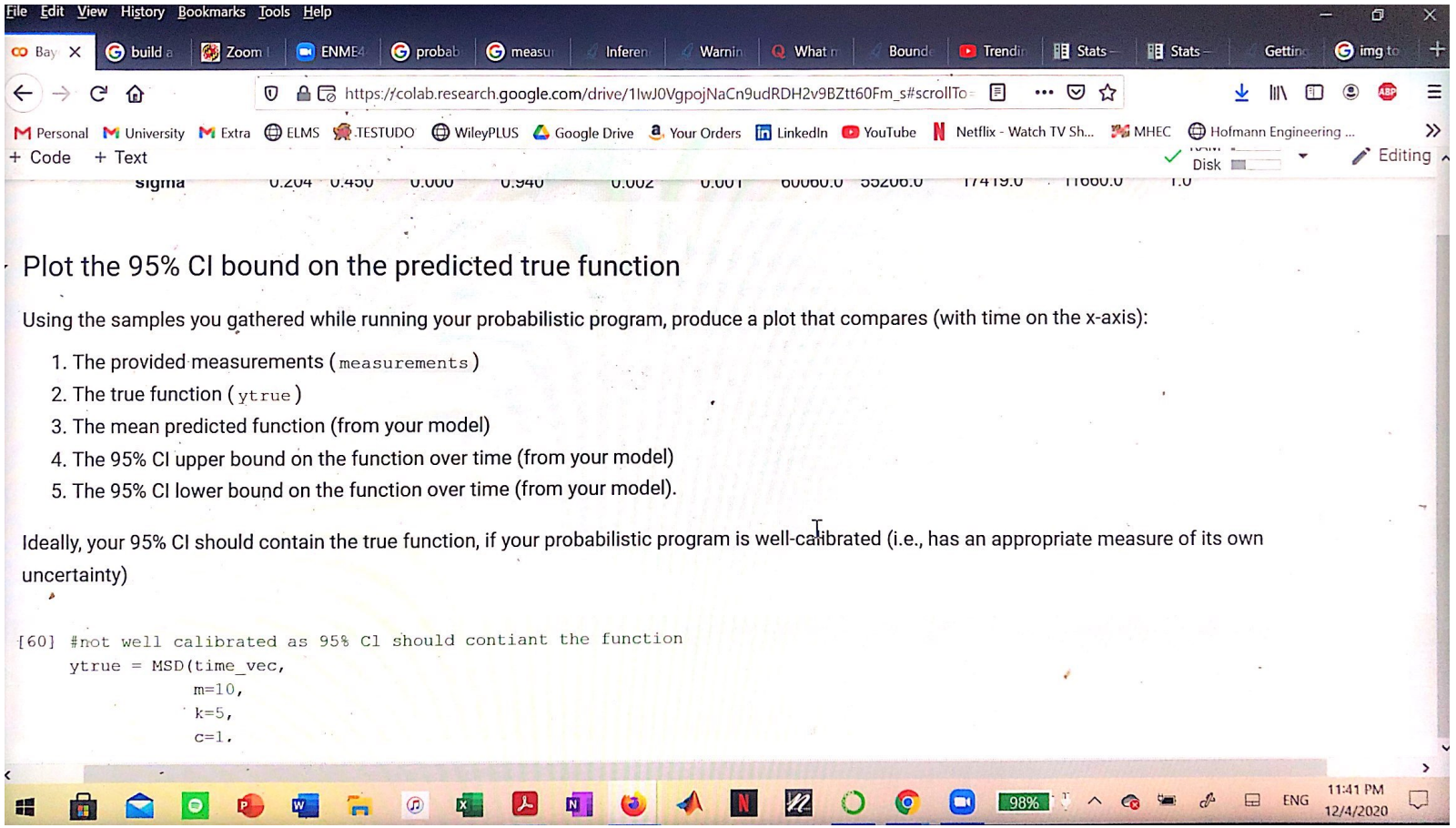
Provide the Summary statistics of the uncertain parameters

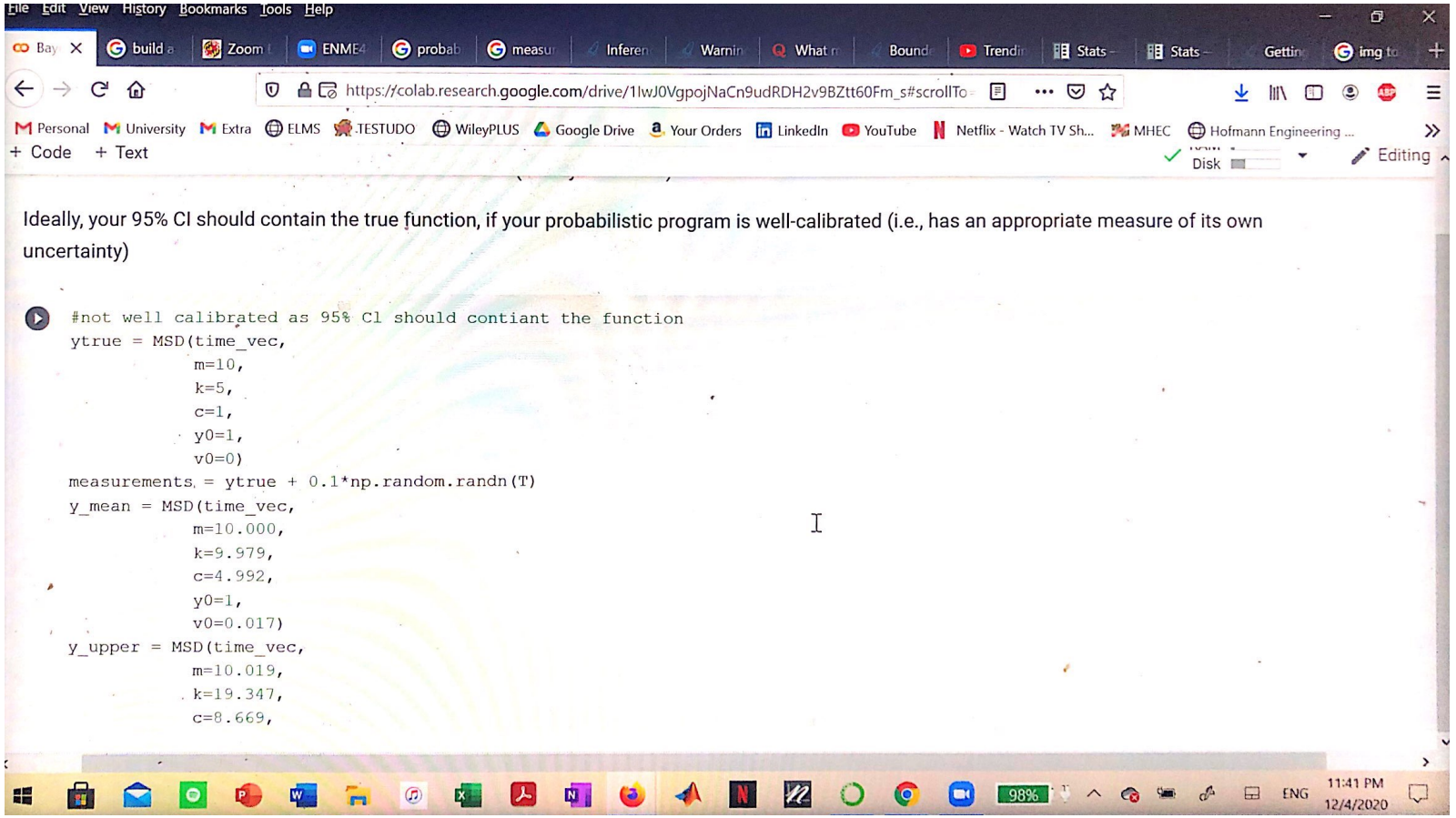
That is, compute the mean, and 95% posterior interval for the main system parameters (mass, spring constant, damping).

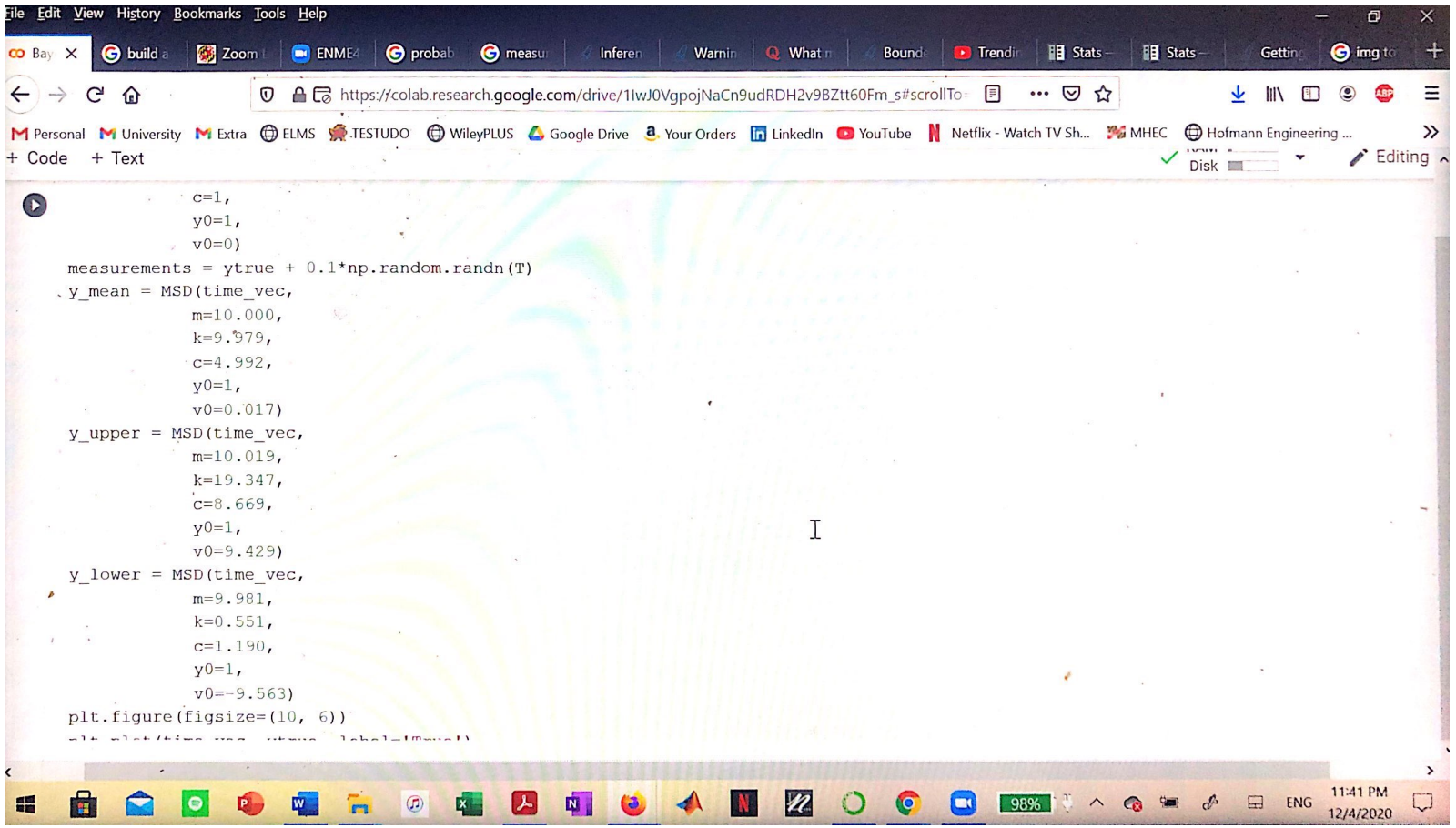
```
[57] pm.summary(mc_trace)
```

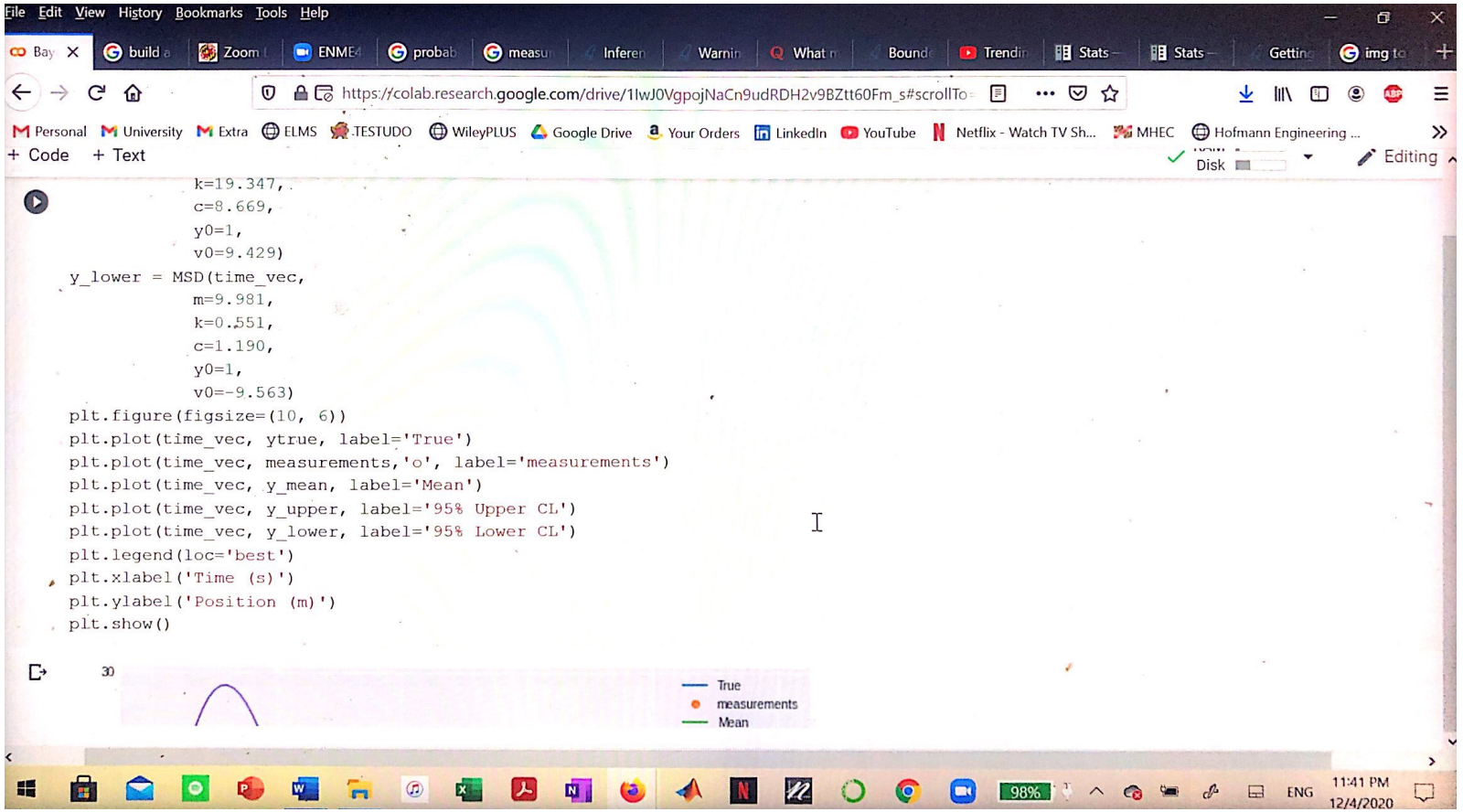
	mean	sd	hpd_3%	hpd_97%	mcse_mean	mcse_sd	ess_mean	ess_sd	ess_bulk	ess_tail	r_hat
mass	10.000	0.010	9.981	10.019	0.000	0.000	49352.0	49352.0	49371.0	41537.0	1.0

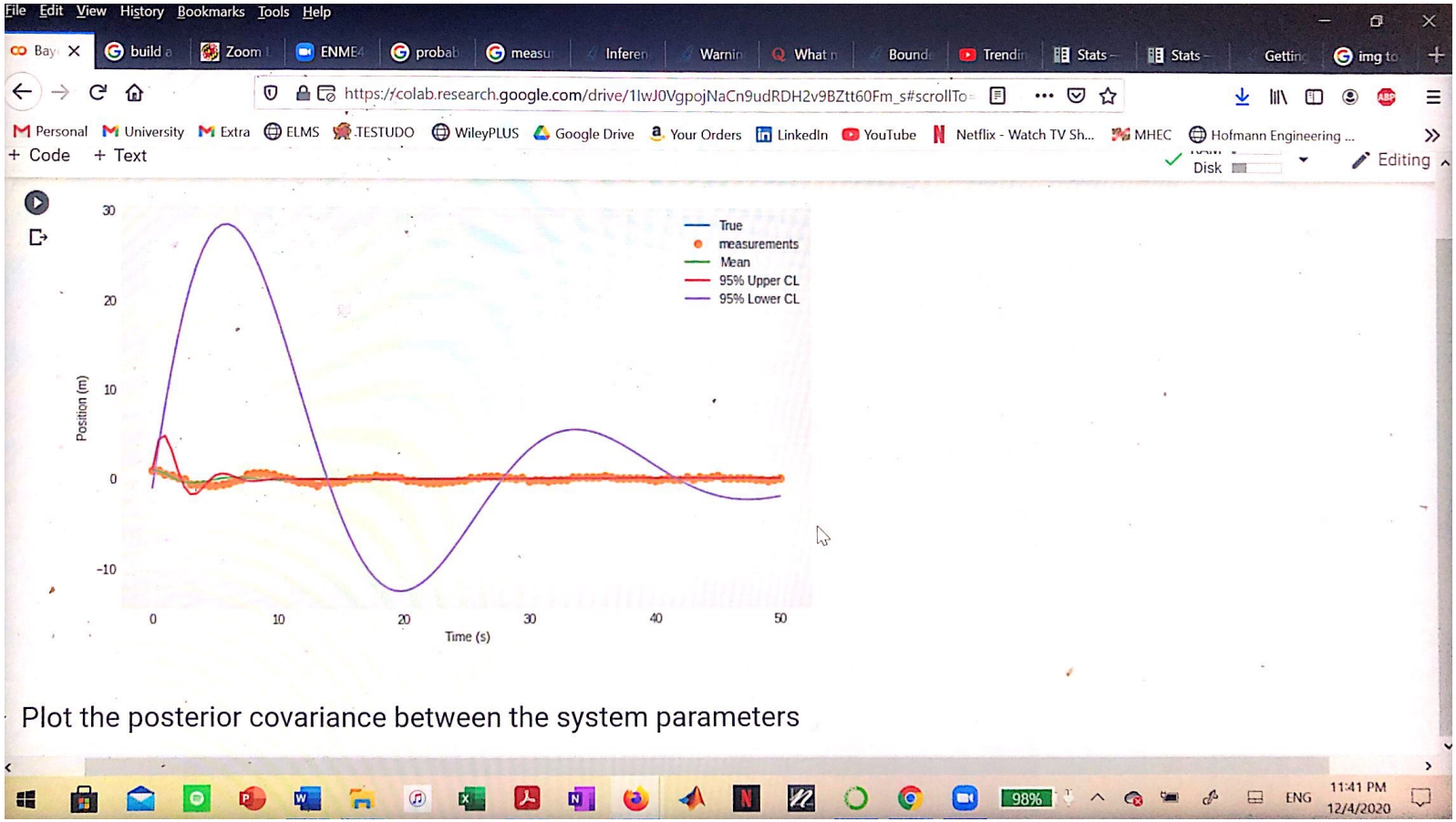


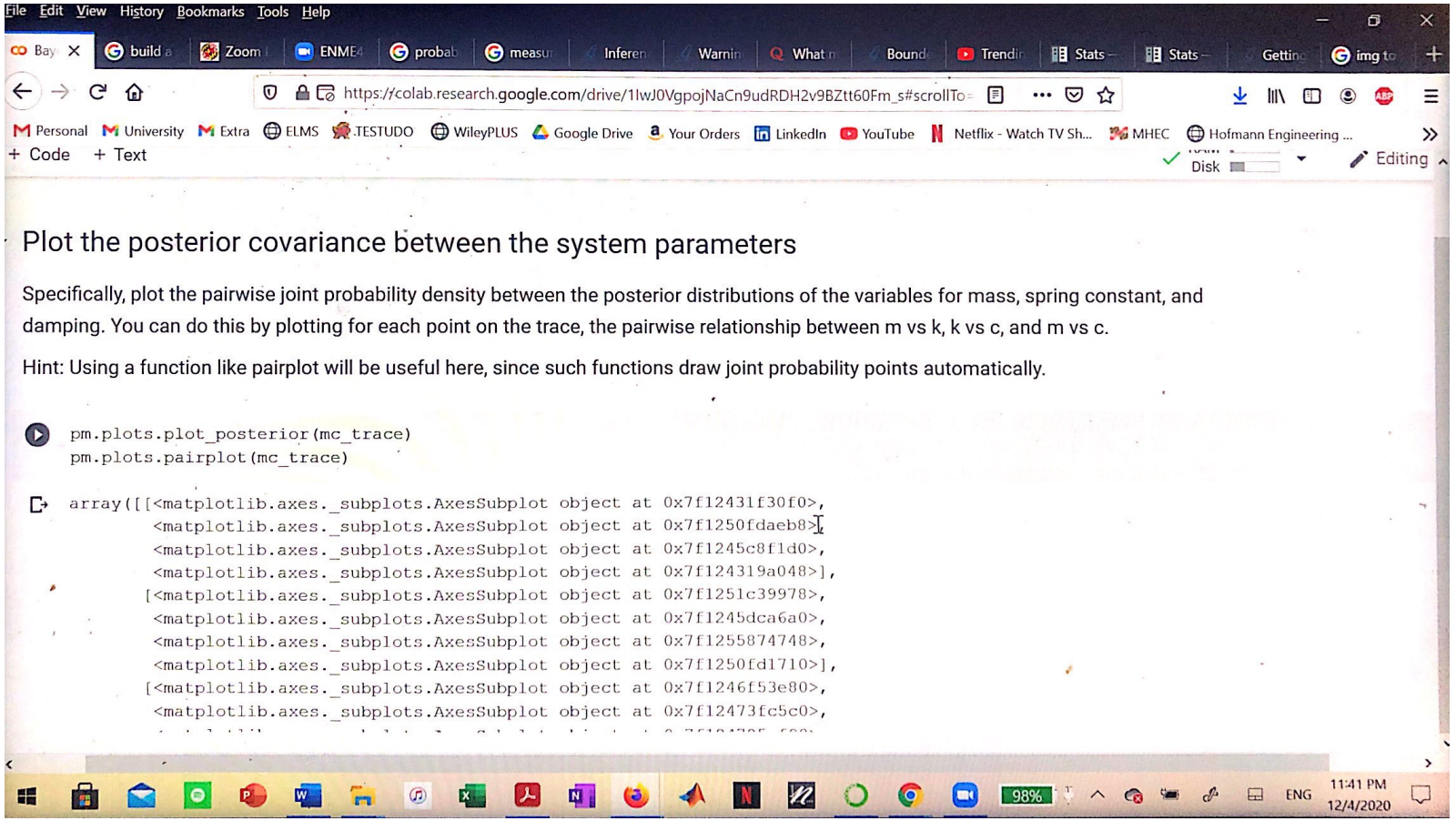


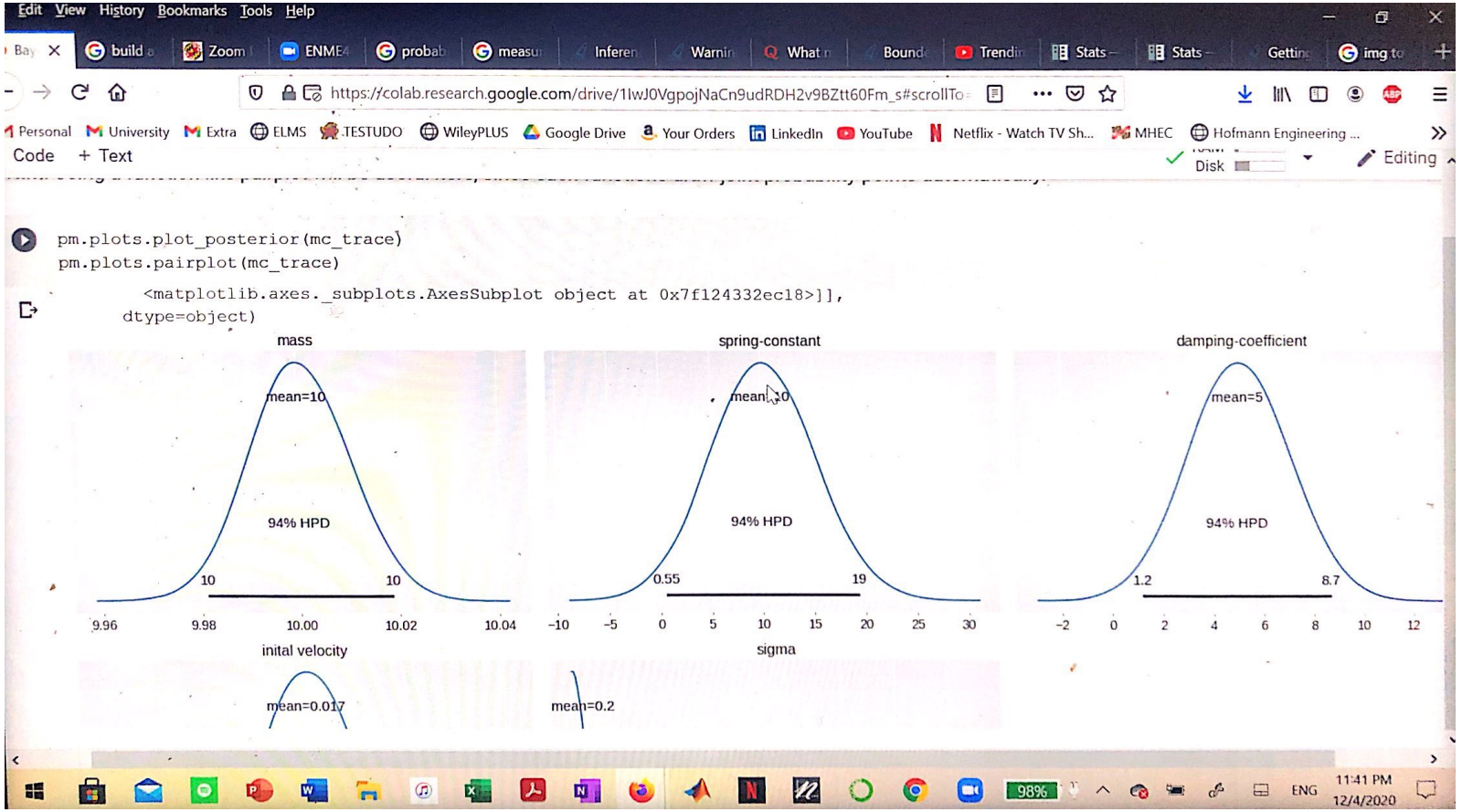


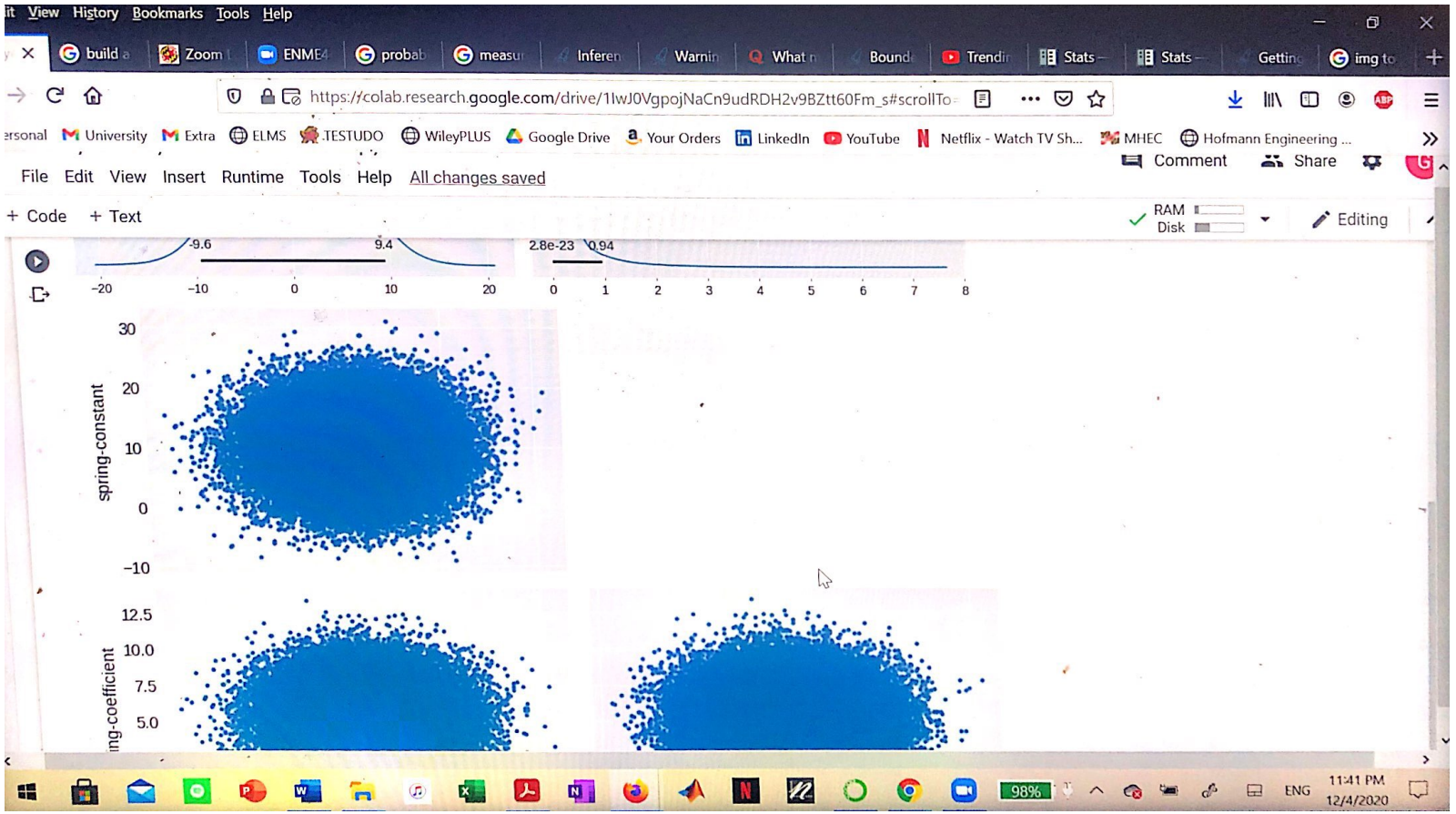


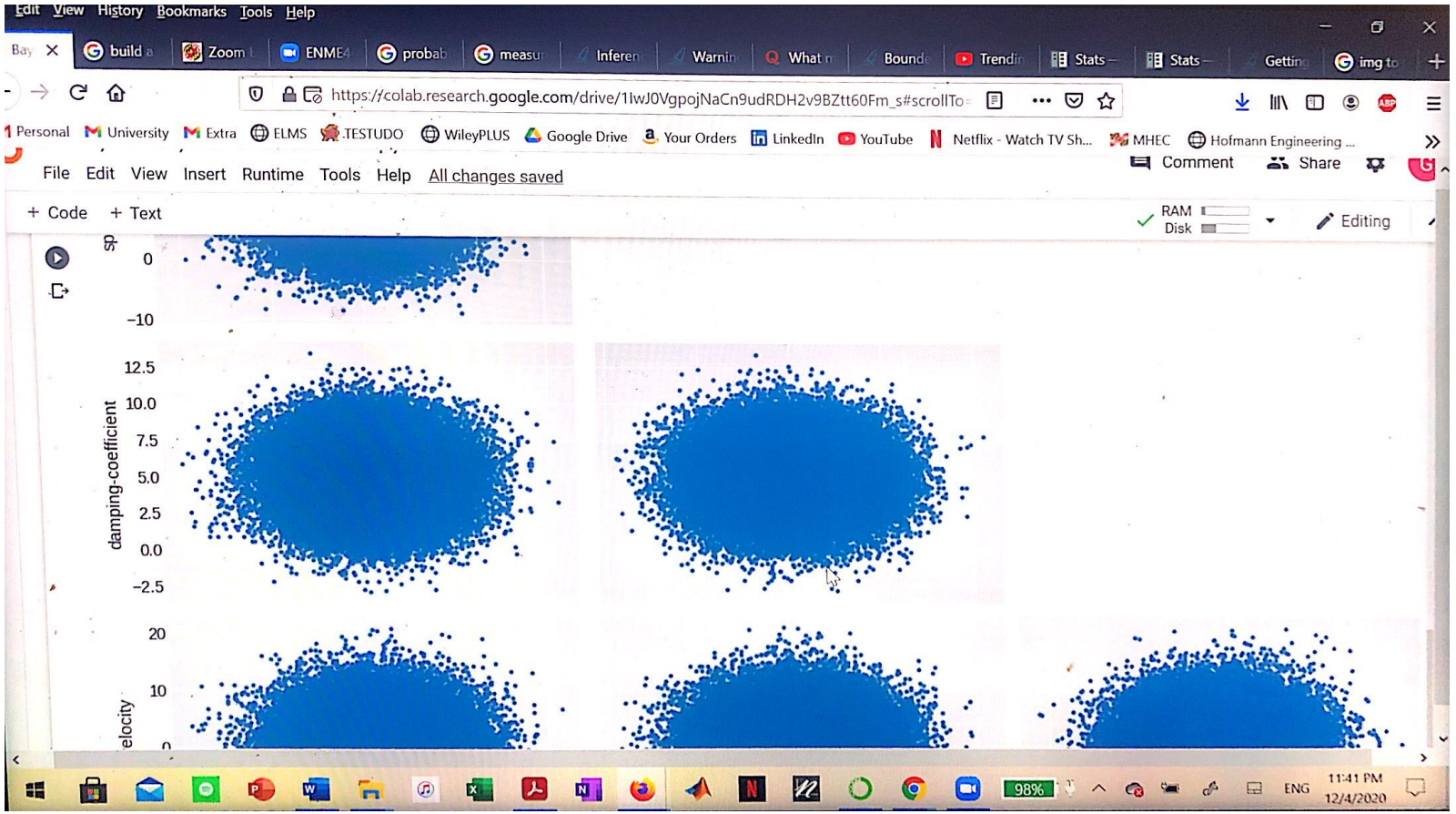


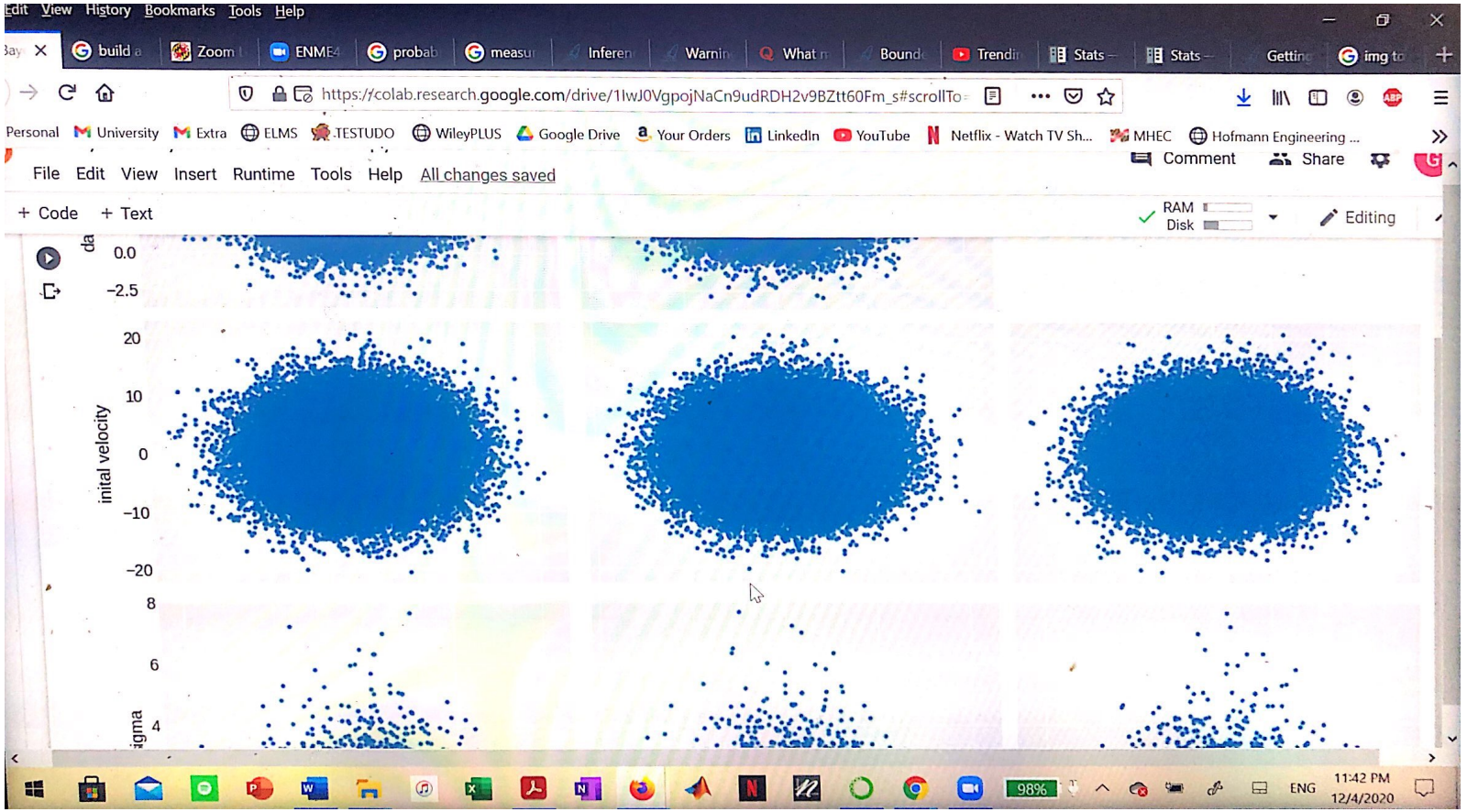


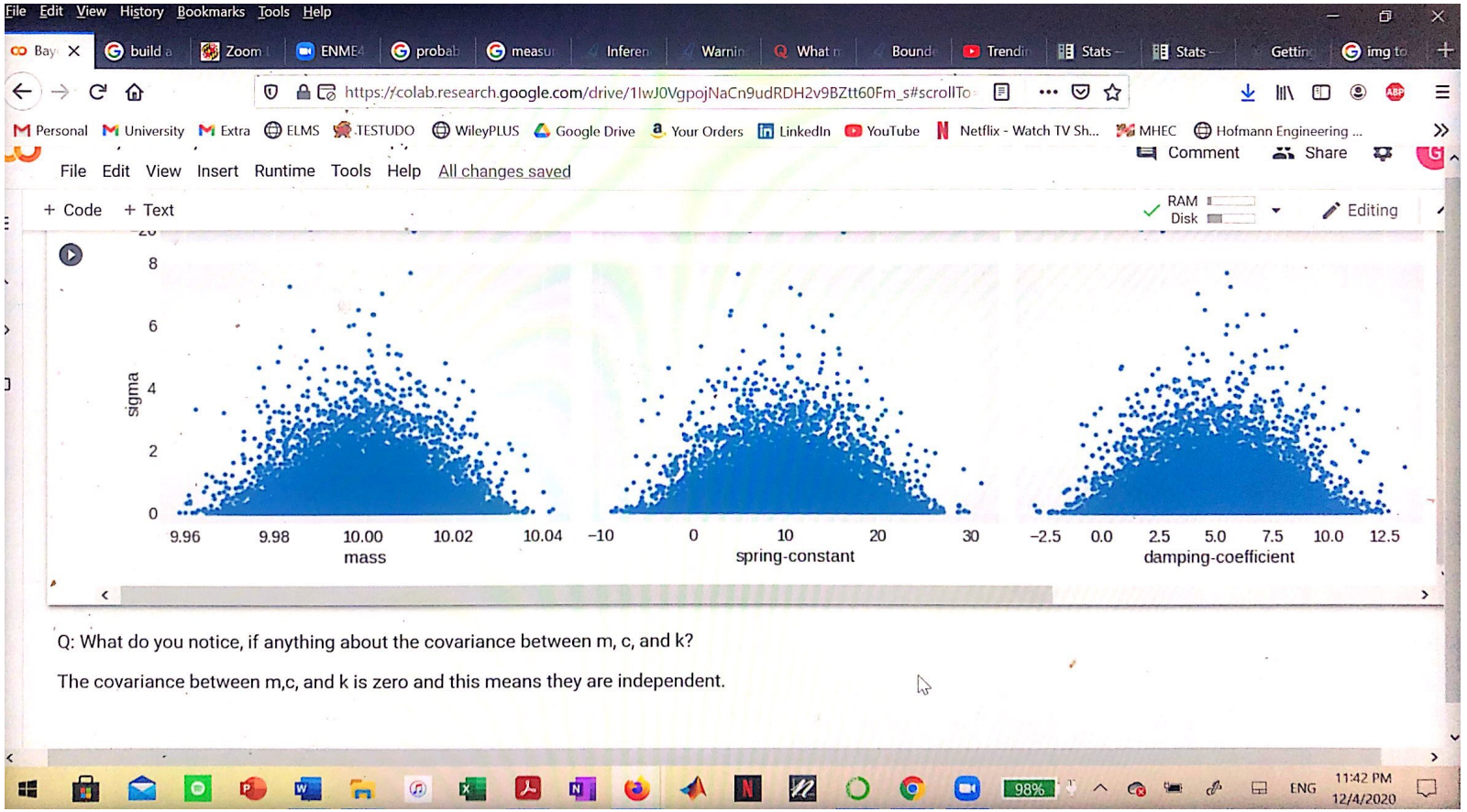












Q: What do you notice, if anything about the covariance between m, c, and k?

The covariance between m,c, and k is zero and this means they are independent.