01.112MACHINELEARNING (2017)
HW1

ZHOU XUEXUAN 1001603

Q1.

a. Suppose a vector ϕ that is orthogonal to the hyperplane

$\boldsymbol{\Phi} = y - x_0$

According to the given plane equation, normal vector is θ.

Then we apply vector projection formula:

$$distance = \frac{\theta \cdot v}{|\theta| \cdot |v|}|v| = \frac{y \cdot \theta - x_0 \cdot \theta}{|\theta|} = \frac{y \cdot \theta + \theta_0}{|\theta|}$$

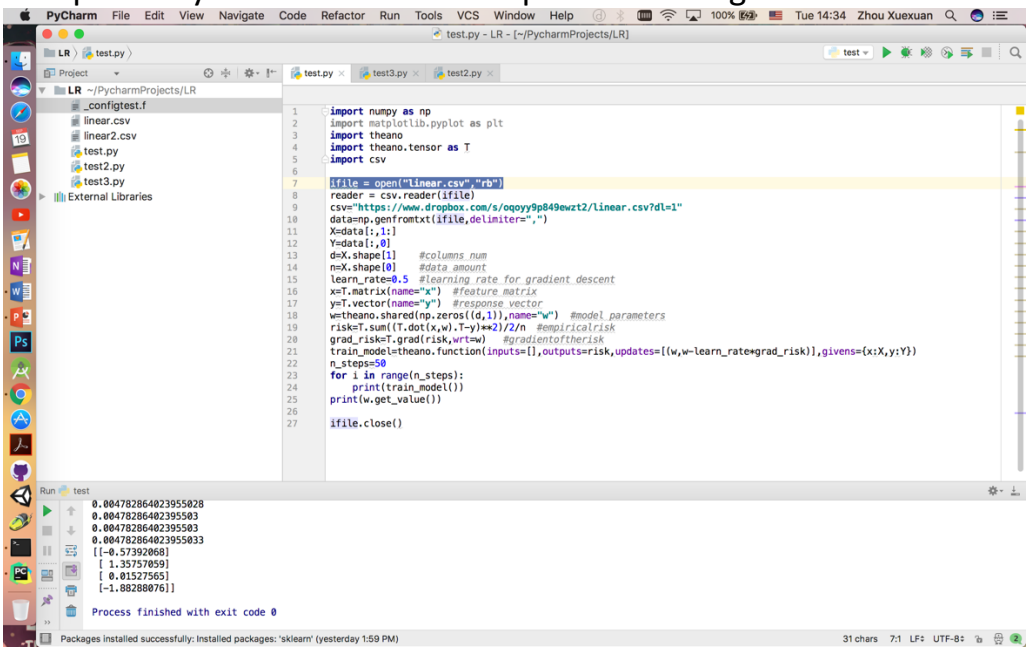
b. $$P(Z = k) = \sum_{n=0}^{k} P(x = n) \cdot P(y = k - n)$$
$$= \sum_{n=0}^{k} \frac{\alpha^{-n} e^{-\alpha}}{n!} \cdot \frac{\beta^{-(k-n)} e^{-\beta}}{(k-n)!}$$
$$= \sum_{n=0}^{k} \frac{1}{n!(k-n)!} \alpha^{-n} \beta^{-(k-n)} e^{-(\alpha+\beta)}$$
$$= \left(\sum_{n=0}^{k} C_k^n \, \alpha^{-n} \beta^{-(k-n)}\right) \frac{e^{-(\alpha+\beta)}}{k!}$$
(According to binomial theorem)
$$= (\alpha + \beta)^k \frac{e^{-(\alpha+\beta)}}{k!}$$

Q2.

a. Python 3.6.1 and Theano 0.90

Q3.

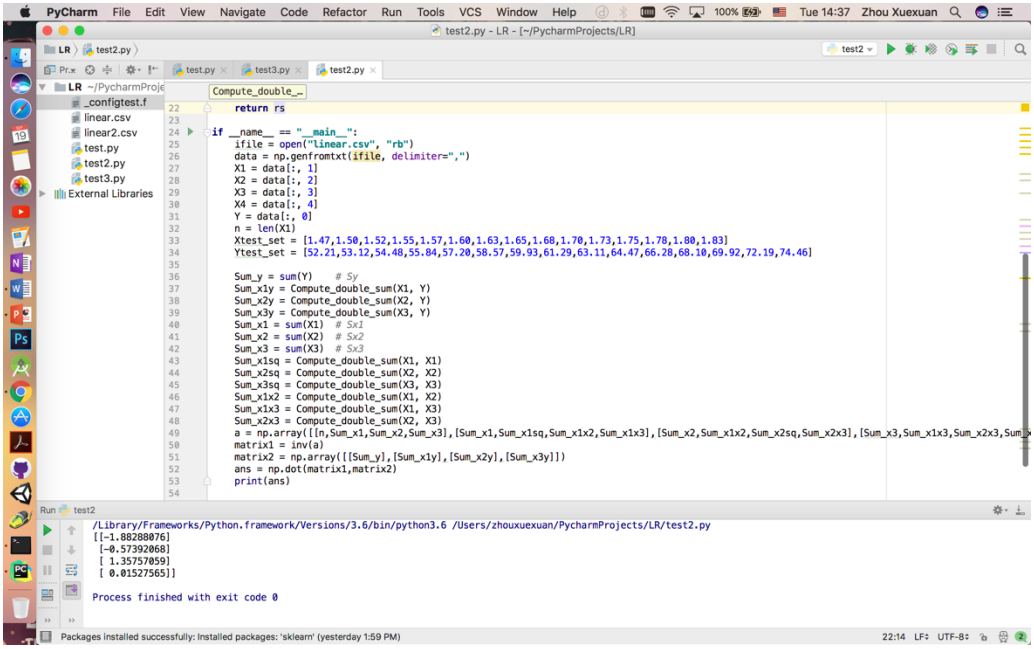
a. Computed by theano and ended up with convergence



answer return

y = -0.574x1+1.358x2+0.016x3-1.883

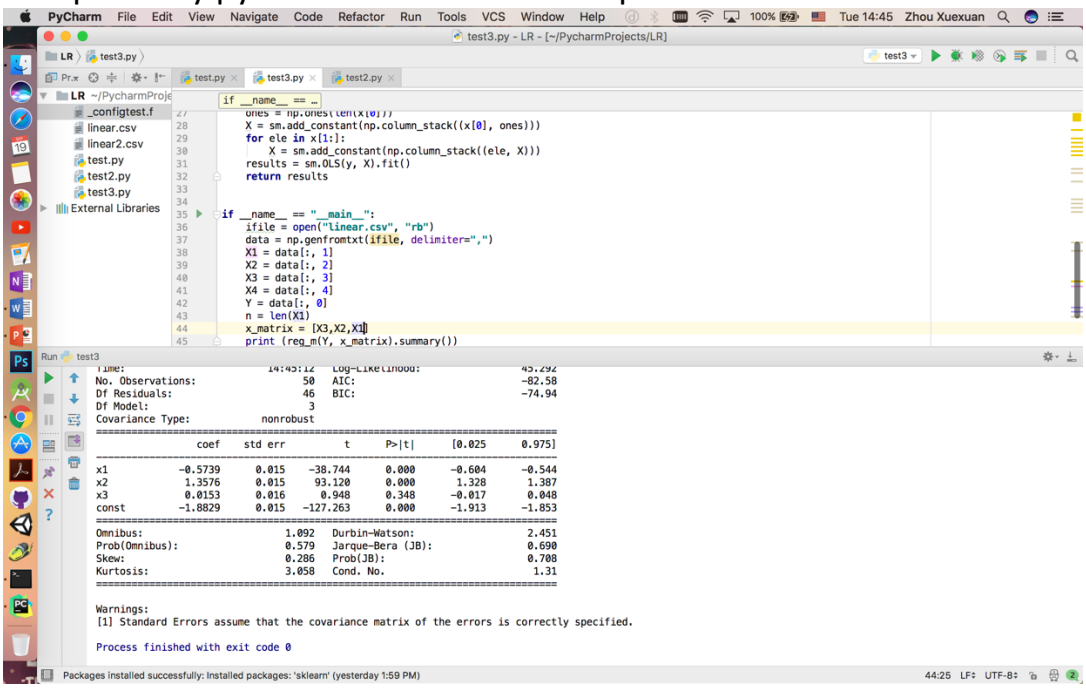
b. Computed by python with numpy applying method of least squares



answer return

y = -1.883-0.574x1+1.358x2+0.015x3

c. Computed by python with statsmodels.api



answer return

y = -0.574x1+1.358x2+0.015x3-1.8829

Conclusion:

All three methods return almost exactly the same answers as showing above which is suggest that the theano training method has fairly well-performed accuary.