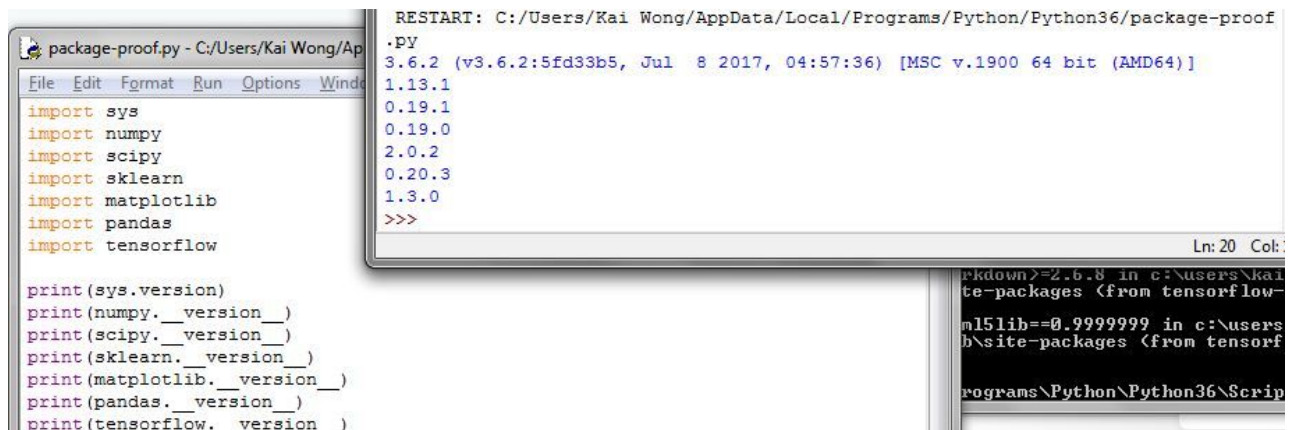


Homework 0

2.1 Proof:



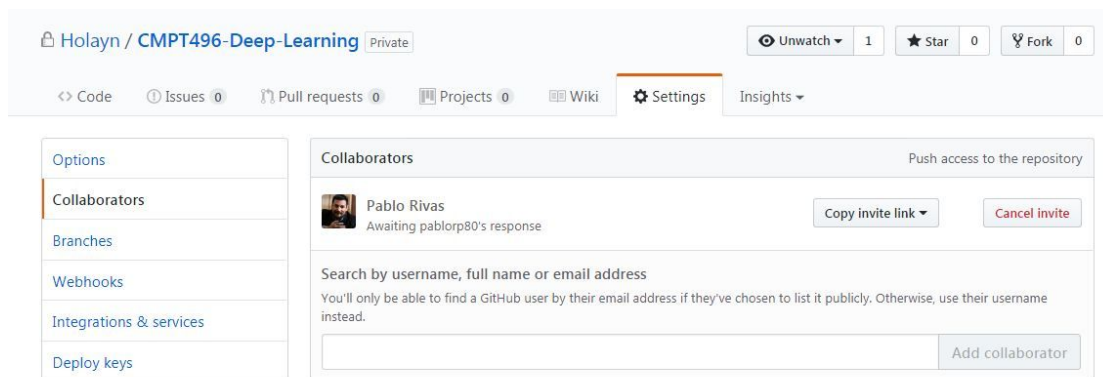
The image shows a code editor window with a file named `package-proof.py`. The script imports several Python libraries and prints their versions. The output window shows the execution results.

```
import sys
import numpy
import scipy
import sklearn
import matplotlib
import pandas
import tensorflow

print(sys.version)
print(numpy.__version__)
print(scipy.__version__)
print(sklearn.__version__)
print(matplotlib.__version__)
print(pandas.__version__)
print(tensorflow.__version__)
```

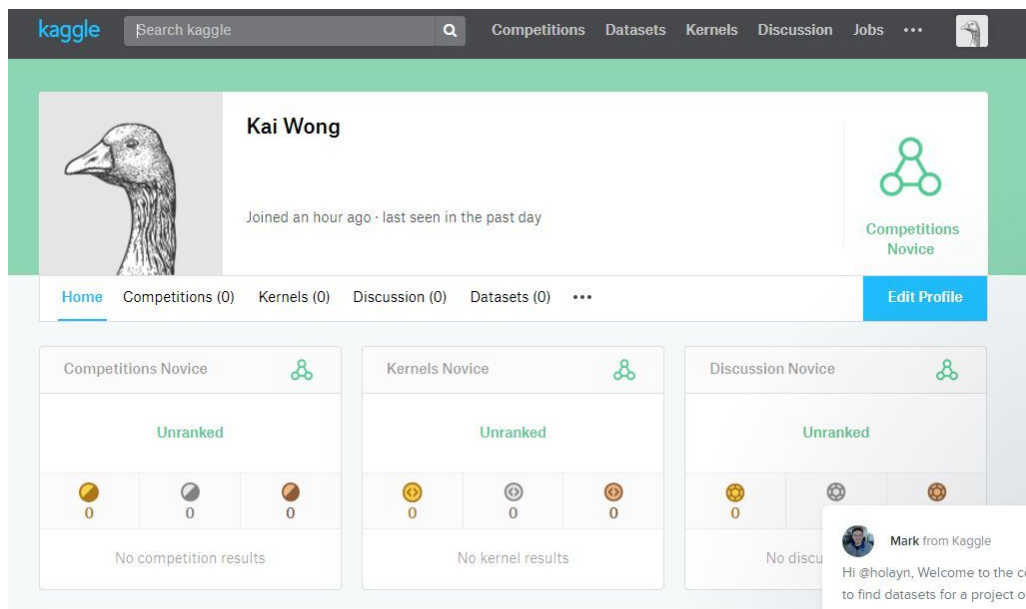
```
RESTART: C:/Users/Kai Wong/AppData/Local/Programs/Python/Python36/package-proof
> .PY
3.6.2 (v3.6.2:5fd33b5, Jul 8 2017, 04:57:36) [MSC v.1900 64 bit (AMD64)]
1.13.1
0.19.1
0.19.0
2.0.2
0.20.3
1.3.0
>>>
```

2.2 Proof:



Link to repo: <https://github.com/Holayn/CMPT496-Deep-Learning>

2.3 Proof:



Kaggle username: Holayn @ <https://www.kaggle.com/holayn>

4 Derivations and Solutions to Problems:

1. In order to find the value of x that maximizes $g(x)$, we first take the derivative of $g(x)$ like so:

$$g(x) = -3x^2 + 24x - 30$$

$$g'(x) = -6x + 24$$

Next, we determine what values of x make $g'(x) = 0$. This signifies that the slope is equal to zero.

$$0 = -6x + 24$$

$$6x = 24$$

$$x = 4$$

We can see that at $x = 4$, the slope of the graph is 0. When the slope of a graph is 0, we know that it is neither increasing nor decreasing; thus it must be flat, so we can test if it is a maximum or minimum. We can test the value of the slope of the graph at $x=3$ and $x=5$. If the value of the slope at $x=3$ is positive, and the slope at $x=5$ is negative, we can conclude that $x=4$ maximizes $g(x)$, since the graph has positive slope, becomes flat, then has negative slope, indicating a maximum.

$$g'(3) = -6(3) + 24 = 6$$

$$g'(5) = -6(5) + 24 = -6$$

The slope of $x=3$ is positive, and the slope of $x=5$ is negative. Thus, $x=4$ maximizes $g(x)$.

2. In order to take the partial derivatives of $f(x)$ with respect to x_0 and x_1 , we first take the derivative of $f(x)$ with respect to x_0 :

$$f(x) = 3x_0^3 - 2x_0x_1^2 + 4x_1 - 8$$

$$f_{x_0} = 9x_0^2 - 2x_1^2$$

Now we take the derivative of f_{x_0} with respect to x_1 :

$$f_{x_0x_1} = -4x_1$$

3. Considering the matrix A and B where...

$$A = \begin{bmatrix} 1 & 4 & -3 \\ 2 & -1 & 3 \end{bmatrix}$$

$$B = \begin{bmatrix} -2 & 0 & 5 \\ 0 & -1 & 4 \end{bmatrix}$$

- a. You cannot multiply the two matrices. In order to perform matrix multiplication, matrix A's number of columns has to equal matrix B's number of rows. Matrix A has 3 columns. Matrix B has 2 rows. $3 \neq 2$, so one cannot multiply these matrices together.

- b. Taking the transpose of A results in $A^T = \begin{bmatrix} 1 & 2 \\ 4 & -1 \\ -3 & 3 \end{bmatrix}$

To perform matrix multiplication, multiply the members of a column in one matrix to the members of a row in the other matrix, and then add the results to get the new value in the matrix. Repeat for all rows and columns.

$$A^TB = \begin{bmatrix} ((1*-2)+(2*0)), ((1*0)+(2*-1)), ((1*5)+(2*4)) \\ ((4*-2)+(-1*0)), ((4*0)+(-1*-1)), ((4*5)+(-1*4)) \end{bmatrix}$$

$$\begin{aligned}
& [((-3*-2)+(3*0)),((-3*0)+(3*-1)),((-3*5)+(3*4))] \\
= & \begin{bmatrix} -2 & -2 & 13 \\ -8 & 1 & 16 \\ 6 & -3 & -3 \end{bmatrix}
\end{aligned}$$

In order to get the matrix's rank, we must find the number of linearly independent row vectors. This means that no row can be derived from a linear combination of any other rows. In A^TB shown above, there is one row vector that is not linearly independent: the third row. Subtracting the second row vector from the first row vector creates the third row vector. Therefore, A^TB has one non-linearly independent row vector. It has 3 row vectors, so its rank is 2, since it has two linearly independent row vectors.

4. If we are to find the expected value of X of a normal distribution with a mean or expected value of 2 and a variance of 3, we can see that the expected value of X of this normal distribution is 2, as the expected value, or the mean, of the normal distribution is 2.