Assignment3

Q1:

a) Whether we including the columns of the ones in the predictor or not, the result average error is pretty much identical. The observation is an indication of the successful implementation of the Naïve Bayes since the bias column should not have any effect on the Naïve Bayes prediction.

```
zeeman@Zeeman-PC:/mnt/c/Users/akazf/Desktop/A3/a3barebones$ python3 script_classify.py

Running learner = Naive Bayes   Run = 0
Cross validate parameters: {'usecolumnones': True}
average error: 25.680000000000007
Cross validate parameters: {'usecolumnones': False}
average error: 25.680000000000007

Running learner = Naive Bayes   Run = 1
Cross validate parameters: {'usecolumnones': True}
average error: 25.539999999999992
Cross validate parameters: {'usecolumnones': False}
average error: 25.539999999999992

Running learner = Naive Bayes   Run = 2
Cross validate parameters: {'usecolumnones': True}
average error: 25.260000000000005
Cross validate parameters: {'usecolumnones': False}
average error: 25.260000000000005

Running learner = Naive Bayes   Run = 3
Cross validate parameters: {'usecolumnones': True}
average error: 26.0
Cross validate parameters: {'usecolumnones': False}
average error: 26.0
```

b) Implemented

```
Running learner = Logistic Regression   Run = 5
Cross validate parameters: {'stepsize': 0.001}
average error: 25.200000000000003
Cross validate parameters: {'stepsize': 0.01}
average error: 23.11999999999999

Running learner = Logistic Regression   Run = 6
Cross validate parameters: {'stepsize': 0.001}
average error: 24.980000000000004
Cross validate parameters: {'stepsize': 0.01}
average error: 23.519999999999996

Running learner = Logistic Regression   Run = 7
Cross validate parameters: {'stepsize': 0.001}
average error: 24.92
Cross validate parameters: {'stepsize': 0.01}
average error: 22.680000000000007
```

c) Implemented

```
Running learner = Neural Network        Run = 0
Cross validate parameters: {'epochs': 100, 'nh': 4}
average error: 23.58
Cross validate parameters: {'epochs': 100, 'nh': 8}
average error: 23.22
Cross validate parameters: {'epochs': 100, 'nh': 16}
average error: 23.180000000000007
Cross validate parameters: {'epochs': 100, 'nh': 32}
average error: 23.14

Running learner = Neural Network        Run = 1
Cross validate parameters: {'epochs': 100, 'nh': 4}
average error: 22.39999999999999
Cross validate parameters: {'epochs': 100, 'nh': 8}
average error: 21.480000000000004
Cross validate parameters: {'epochs': 100, 'nh': 16}
average error: 21.480000000000004
Cross validate parameters: {'epochs': 100, 'nh': 32}
average error: 21.340000000000003
```

d) Implemented

```
Running learner = Naive Bayes   Run = 2
Cross validate parameters: {'usecolumnones': True}
average error: 25.68
Cross validate parameters: {'usecolumnones': False}
average error: 25.68


Running learner = Logistic Regression   Run = 2
Cross validate parameters: {'stepsize': 0.001}
average error: 25.880000000000006
Cross validate parameters: {'stepsize': 0.01}
average error: 23.9
Cross validate parameters: {'stepsize': 0.1}
average error: 24.6


Running learner = Neural Network        Run = 2
Cross validate parameters: {'epochs': 100, 'nh': 4}
average error: 23.020000000000003
Cross validate parameters: {'epochs': 100, 'nh': 8}
average error: 23.059999999999995
Cross validate parameters: {'epochs': 100, 'nh': 16}
average error: 22.919999999999998
Cross validate parameters: {'epochs': 100, 'nh': 32}
average error: 23.12


Best Parameter for Naive Bayesis {'usecolumnones': True}
Best Parameter for Logistic Regressionis {'stepsize': 0.01}
Best Parameter for Neural Networkis {'epochs': 100, 'nh': 16}



Average error for Naive Bayes: 25.76666666666667
Standard error for Naive Bayes: 0.17290545479046246
Average error for Logistic Regression: 23.620000000000005
Standard error for Logistic Regression: 0.061824123303305674
Average error for Neural Network: 22.433333333333334
Standard error for Neural Network: 0.36833961784483216
```

Q2:

a) Implemented

```
zeeman@Zeeman-PC:/mnt/c/Users/akazf/Desktop/A3/a3barebones$ python3 script_classify.py


Running learner = Kernel Logistic Regression    Run = 0
Cross validate parameters: {'centers': 10, 'stepsize': 0.01}
average error: 40.239999999999995
Cross validate parameters: {'centers': 20, 'stepsize': 0.01}
average error: 36.22
Cross validate parameters: {'centers': 40, 'stepsize': 0.01}
average error: 35.02
Cross validate parameters: {'centers': 80, 'stepsize': 0.01}
average error: 28.6


Best Parameter for Kernel Logistic Regressionis {'centers': 80, 'stepsize': 0.01}



Average error for Kernel Logistic Regression: 26.42
Standard error for Kernel Logistic Regression: 0.0
```

The average error for the Kernel Logistic Regression(~28) is higher than the Logistic Regression(~23) implemented in the Q1 b).

b) Implemented

```
zeeman@Zeeman-PC:/mnt/c/Users/akazf/Desktop/A3/a3barebones$ python3 script_classify.py


Running learner = KernelLogisticRegressionHamming       Run = 0
Cross validate parameters: {'centers': 10, 'stepsize': 0.01}
average error: 27.940000000000005
Cross validate parameters: {'centers': 20, 'stepsize': 0.01}
average error: 23.04
Cross validate parameters: {'centers': 40, 'stepsize': 0.01}
average error: 18.86
Cross validate parameters: {'centers': 80, 'stepsize': 0.01}
average error: 17.020000000000003


Best Parameter for KernelLogisticRegressionHammingis {'centers': 80, 'stepsize': 0.01}



Average error for KernelLogisticRegressionHamming: 25.480000000000004
Standard error for KernelLogisticRegressionHamming: 0.0
```

The average error for the Kernel Logistic Regression Hamming (~25) is lower than the Kernel Logistic Regression(~28) implemented in the Q2 a).

Bonus:

a) Implemented in classalgorithms.py >

b) `class NeuralNet2Hidden(Classifier)`