**3.1**
**Train Error:**
file name--> hw4train.txt
------------- regular perceptron --------------
1 th perception:
0.04128440366972477
2 th perception:
0.04036697247706422
3 th perception:
0.02110091743119266
4 th perception:
0.01834862385321101
------------- voted and average perceptron --------------
1 pass voted perceptron error:  0.06697247706422019
1 pass average perceptron error:  0.0798165137614679
--------->
2 pass voted perceptron error:  0.04036697247706422
2 pass average perceptron error:  0.05412844036697248
--------->
3 pass voted perceptron error:  0.029357798165137616
3 pass average perceptron error:  0.03761467889908257
**After 3 passes:**
**Three lowest coordinate:**
**he**
**team**
**game**
**Three largest coordiante:**
**file**
**program**
**line**
--------->
4 pass voted perceptron error:  0.024770642201834864
4 pass average perceptron error:  0.03394495412844037
—————>

**Test Error:**
file name--> hw4test.txt
------------- regular perceptron --------------
1 th perception:
0.05305039787798409
2 th perception:
0.058355437665782495
3 th perception:
0.04509283819628647
4 th perception:
0.04774535809018567
------------- voted and average perceptron --------------
1 pass voted perceptron error:  0.08753315649867374
1 pass average perceptron error:  0.11671087533156499
--------->
2 pass voted perceptron error:  0.0610079575596817
2 pass average perceptron error:  0.08222811671087533
--------->
3 pass voted perceptron error:  0.04509283819628647
3 pass average perceptron error:  0.0610079575596817
--------->
4 pass voted perceptron error:  0.04509283819628647
4 pass average perceptron error:  0.050397877984084884
————>

**3.2**

After 3 passes:
Three lowest coordinate:
he
team
game
Three largest coordiante:
file
program
line

**3.3**
**one vs all calssifier**

| [ 0.71892 | 0.00521 | 0.03429 | 0.02174 | 0.0 | 0.0 | ] |
|---|---|---|---|---|---|---|
| [ 0.01081 | 0.65625 | 0.03429 | 0.02717 | 0.01282 | 0.01852 | ] |
| [ 0.0 | 0.01562 | 0.37143 | 0.0 | 0.0 | 0.02778 | ] |
| [ 0.01622 | 0.00521 | 0.0 | 0.69022 | 0.0 | 0.0 | ] |
| [ 0.01622 | 0.03125 | 0.07429 | 0.00543 | 0.80128 | 0.12037 | ] |
| [ 0.00541 | 0.01042 | 0.03429 | 0.0 | 0.07051 | 0.49074 | ] |
| [ 0.23243 | 0.27604 | 0.45143 | 0.25543 | 0.11538 | 0.34259 | ] |