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### 3.1

```
Not implemented for  
✖ vagrant@vagrant-ubuntu-trusty-64 > ~/workspace/bigdata/a2_nlp python q1_softmax.py  
Running basic tests...  
[[0.26894142 0.73105858]  
 [[0.26894142 0.73105858]  
  [0.26894142 0.73105858]]  
 [[0.73105858 0.26894142]]  
You should verify these results!
```

### 3.2

#### 1.

```
vagrant@vagrant-ubuntu-trusty-64 > ~/workspace/bigdata/a2_nlp python q2_sigmoid.py  
Running basic tests...  
[[0.73105858 0.88079708]  
 [0.26894142 0.11920292]]  
 [[0.19661193 0.10499359]  
  [0.19661193 0.10499359]]  
You should verify these results!
```

#### 2.

```
✖ vagrant@vagrant-ubuntu-trusty-64 > ~/workspace/bigdata/a2_nlp python q2_gradcheck.py  
Running sanity checks...  
Gradient check passed!  
Gradient check passed!  
Gradient check passed!
```

#### 3.

```
vagrant@vagrant-ubuntu-trusty-64 > ~/workspace/bigdata/a2_nlp python q2_neural.py  
Running sanity check...  
Gradient check passed!
```

### 3.3

#### 1,2,3

```

==== Gradient check for skip-gram ====
Gradient check passed!
Gradient check passed!

==== Gradient check for CBOW ====
Gradient check passed!
Gradient check passed!

=== Results ===
(11.166109001533979, array([[ 0.          ,  0.          ,  0.          ],
 [ 0.          ,  0.          ,  0.          ],
 [-1.26947339, -1.36873189,  2.45158957],
 [ 0.          ,  0.          ,  0.          ],
 [ 0.          ,  0.          ,  0.          ]]), array([[ -0.41045956,  0.18834851,  1.43272264
],
 [ 0.38202831, -0.17530219, -1.33348241],
 [ 0.07009355, -0.03216399, -0.24466386],
 [ 0.09472154, -0.04346509, -0.33062865],
 [-0.13638384,  0.06258276,  0.47605228]]))
(6.381508080584029, array([[ 0.          ,  0.          ,  0.          ],
 [ 0.          ,  0.          ,  0.          ],
 [-1.5948205 , -1.02695359,  0.17909869],
 [ 0.          ,  0.          ,  0.          ],
 [ 0.          ,  0.          ,  0.          ]]), array([[ -0.11265089,  0.05169237,  0.39321163
],
 [ 0.07307589, -0.0335325 , -0.25507379],
 [-0.22764219,  0.10445868,  0.79459256],
 [-0.10534204,  0.04833854,  0.36769985],
 [-0.32248118,  0.14797767,  1.1256312 ]]))
(5.579885628349679, array([[ 0.3741715 , -0.234476 , -1.36551259],
 [ 0.35927914, -0.11439876, -0.98756037],
 [ 0.17201142, -0.11892354, -0.53014219],
 [ 0.          ,  0.          ,  0.          ],
 [ 0.          ,  0.          ,  0.          ]]), array([[ 0.841774 ,  0.39105083, -0.47861909
],
 [-0.02845097, -0.1067265 ,  0.02802426],
 [-0.31375535, -0.06447558,  0.1492707 ],
 [-0.10632801, -0.14957598,  0.03188348],
 [-0.39323966, -0.07027277,  0.26944066]]))
(11.433689164209436, array([[ -0.56137305,  0.3785762 , -2.20958763],
 [-0.11519546, -0.20957561, -1.19656513],
 [-0.29908966,  0.04409564, -0.49380218],
 [ 0.          ,  0.          ,  0.          ],
 [ 0.          ,  0.          ,  0.          ]]), array([[ 1.48377030e-01,  3.11105219e-01, -1.
00705540e-01]

```

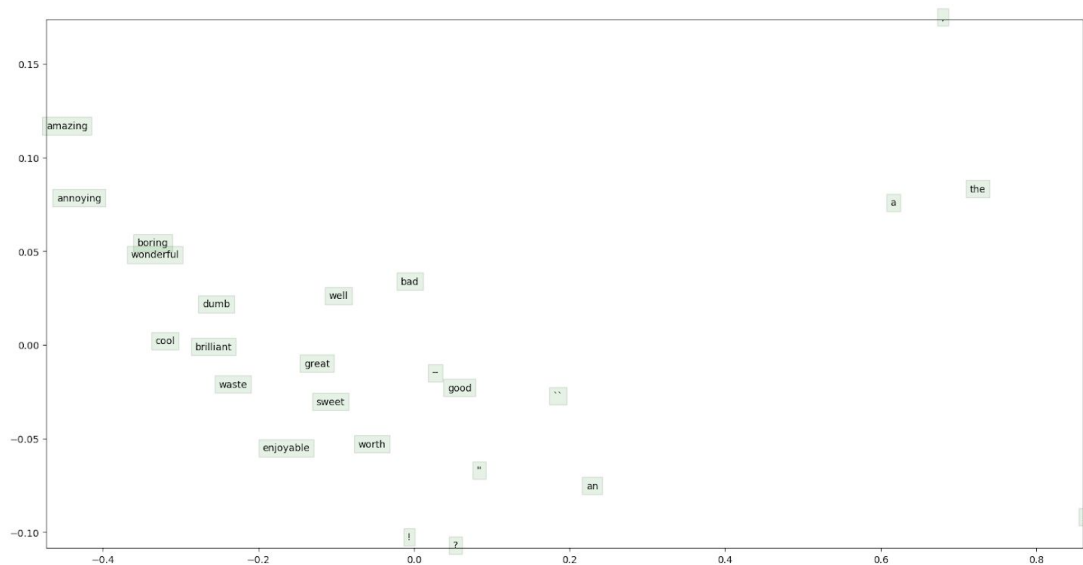
4.

```

vagrant@vagrant-ubuntu-trusty-64 ➤ ~/workspace/bigdata/a2 nlp ➤ python q3_sgd.py
Running sanity checks...
iter 100: 0.004578
iter 200: 0.004353
iter 300: 0.004136
iter 400: 0.003929
iter 500: 0.003733
iter 600: 0.003546
iter 700: 0.003369
iter 800: 0.003200
iter 900: 0.003040
iter 1000: 0.002888
test 1 result: 8.41483678608e-10
iter 100: 0.000000
iter 200: 0.000000
iter 300: 0.000000
iter 400: 0.000000
iter 500: 0.000000
iter 600: 0.000000
iter 700: 0.000000
iter 800: 0.000000
iter 900: 0.000000
iter 1000: 0.000000
test 2 result: 0.0
iter 100: 0.041205
iter 200: 0.039181
iter 300: 0.037222
iter 400: 0.035361
iter 500: 0.033593
iter 600: 0.031913
iter 700: 0.030318
iter 800: 0.028802
iter 900: 0.027362
iter 1000: 0.025994
test 3 result: -2.52445103582e-09

```

5.



```

iter 39930: 9.656687
iter 39940: 9.719975
iter 39950: 9.739466
iter 39960: 9.723659
iter 39970: 9.661740
iter 39980: 9.629146
iter 39990: 9.584816
iter 40000: 9.609267
sanity check: cost at convergence should be around or below 10

```

### 3.4

#### 1.

```

vagrant@vagrant-ubuntu-trusty-64:~/workspace/bigdata/a2_nlp$ python q4_softmaxreg.py
==== Gradient check for softmax regression ====
Gradient check passed!

=== Results ===
(1.9090602153623348, array([[ 0.14080648,  0.01168914,  0.06119674,  0.14637578,  0.0711719 ],
        [-0.10938236, -0.07499234,  0.00852349,  0.09048024,  0.02329987],
        [ 0.03037895, -0.07003952,  0.00510437, -0.00256201, -0.0817831 ],
        [ 0.11555212,  0.23390651, -0.0305698 , -0.05599756, -0.0317812 ],
        [ 0.16376864,  0.07456775, -0.06367415,  0.00590286, -0.24757671],
        [ 0.01010793, -0.03069943,  0.28680727,  0.11856594,  0.09281364],
        [-0.14668533, -0.16448039, -0.23519681, -0.14252623,  0.08534886],
        [ 0.10992796,  0.06278405, -0.03904405,  0.10979171, -0.11455541],
        [-0.25308316,  0.1756363 ,  0.07432147,  0.09125918,  0.01989027],
        [-0.05468889, -0.00213282,  0.10967463, -0.06105177,  0.10419883]]), array([0, 0, 0, 0,
0, 0, 0, 0, 0, 0, 1]))

```

#### 2.

1.862087E-02	27.247191	25.522252
3.758374E-02	27.247191	25.522252
7.585776E-02	27.247191	25.522252
1.531087E-01	27.247191	25.522252
3.090295E-01	27.247191	25.522252
6.237348E-01	14.946161	14.895550
1.258925E+00	12.816011	12.806540

Best regularization value: 1.659587E-05  
Test accuracy (%): 28.099548

#### 3.

