Q 1:

```
yihuaxu@Yihuas-MacBook-Pro CS528Dataset % python3 hw2_1_laplace.py
GS = 0.0034416826003824093
variance for different epsilon: [(0.5, 9.476143297420019e-05), (1, 2.3690358243550048e-05)]
result of querying avarage age that is over 25 with noise for differet epsilon: [(0.5, 115.42114510303801), (1, 188.0600339919269)]
yihuaxu@Yihuas-MacBook-Pro CS528Dataset %
```

Q 2:

(1) GS = Δu = 1

(2)

```
yihuaxu@Yihuas-MacBook-Pro CS528Dataset % python3 hw2_2_exponential.py
['HS-grad', 'HS-grad']
yihuaxu@Yihuas-MacBook-Pro CS528Dataset %
```

Q 3:

(1) I used 'sklearn' package to build my Naive Bayes Classifier

(2) I will directly add noise to the class after predicting

(3) This is a parallel model because they will query three independent classes of Iris. I take the exponential mechanism to add noise. I will take the biggest epsilon to make the algorithm is epsilon-differential privacy.

	precision	recall	f1-score	support
0	0.29	0.40	0.33	10
1	0.29	0.20	0.24	10
2	0.44	0.40	0.42	10
accuracy			0.33	30
macro avg	0.34	0.33	0.33	30
weighted avg	0.34	0.33	0.33	30

	precision	recall	f1-score	support
0	0.29	0.40	0.33	10
1	0.25	0.20	0.22	10
2	0.25	0.20	0.22	10
accuracy			0.27	30
macro avg	0.26	0.27	0.26	30
weighted avg	0.26	0.27	0.26	30

	precision	recall	f1-score	support
0	0.25	0.30	0.27	10
1	0.33	0.40	0.36	10
2	0.17	0.10	0.12	10
accuracy			0.27	30
macro avg	0.25	0.27	0.25	30
weighted avg	0.25	0.27	0.25	30

	precision	recall	f1-score	support
0	0.10	0.10	0.10	10
1	0.42	0.50	0.45	10
2	0.25	0.20	0.22	10
accuracy			0.27	30
macro avg	0.26	0.27	0.26	30
weighted avg	0.26	0.27	0.26	30

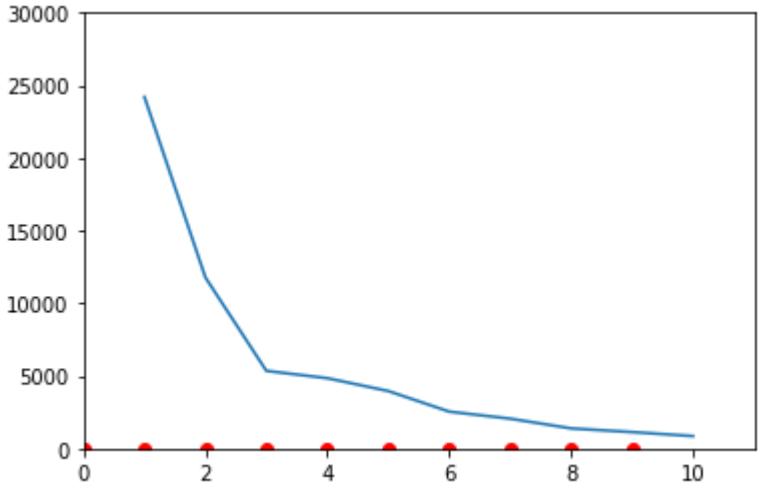
	precision	recall	f1-score	support
0	0.10	0.10	0.10	10
1	0.42	0.50	0.45	10
2	0.25	0.20	0.22	10
accuracy			0.27	30
macro avg	0.26	0.27	0.26	30
weighted avg	0.26	0.27	0.26	30

	precision	recall	f1-score	support
0	0.27	0.30	0.29	10
1	0.33	0.30	0.32	10
2	0.30	0.30	0.30	10
accuracy			0.30	30
macro avg	0.30	0.30	0.30	30
weighted avg	0.30	0.30	0.30	30

	precision	recall	f1-score	support
0	0.38	0.30	0.33	10
1	0.50	0.50	0.50	10
2	0.58	0.70	0.64	10
accuracy			0.50	30
macro avg	0.49	0.50	0.49	30
weighted avg	0.49	0.50	0.49	30

(4)

Q 4:



(2) (851.8939003332067, 0)

(3)

```
[3256, 6512, 9768, 13024, 16280, 19536, 22792, 26048, 29304, 32560]
[3284.6145021934253, 4762.109131116468, 4936.9583734394755, 6792.391099
[0, 0, 0, 0, 0, 0, 0, 0, 0, 0]
```