1.

(a)

1)B F

2)C

3)A D

4)B G

5)A E

6)A D

7)B F

8)A E

9)C

(b)

False. We should focus on the result of model in testing data rather than training data. if we over concerned in training data, the model will overfit.

2.

(a)

(i)P(B1 = 1) = 1/3

(ii)P(B2 = 0 | B1 = 1) = P(B2 = 0, B1 = 1) / P(B1 = 1)

P(B2 = 0, B1 = 1) = 1 / 3

P(B1 = 1) = 1 / 3

So P(B2 = 0 | B1 = 1) = 1

(iii)P(B1 = 1 | B2 = 0) = P(B1 = 1, B2 = 0) / P(B2 = 0)

P(B1 = 1, B2 = 0) = 1/3

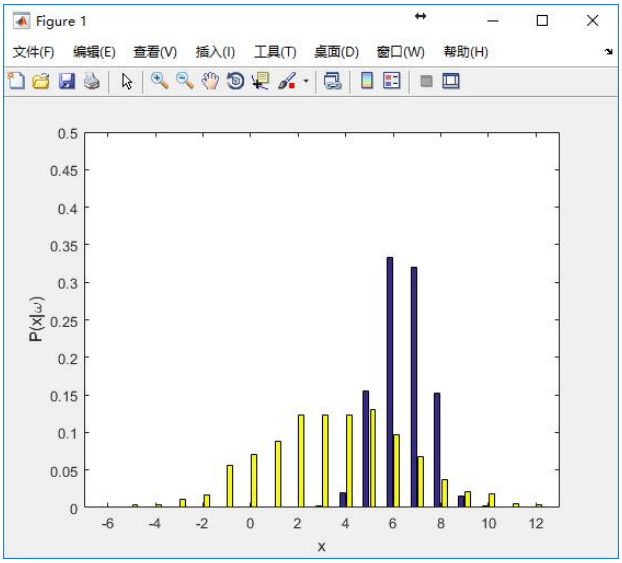
P(B2 = 0) = 1

So P(B1 = 1 | B2 = 0) = 1/3

(iv)According to the Bayes decision rule, the probability of changing choice is bigger, so I should change my choice.

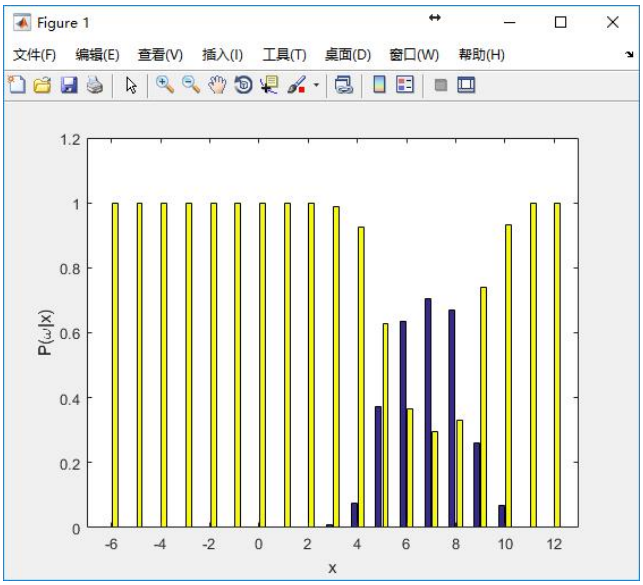
(b)

(i) The following drawing is the the distribution of P(x|ωi)



The number of misclassied test samples is 64.

(ii)The following drawing is the the distribution of P(x|ωi)



The number of misclassied test samples is 47.

(iii)The minimal total risk is 67.

3.

(a)

Make $P(x| y = 0) * P(y = 0) = P(x | y = 1) * P(y = 1)$

So $P(x | y = 0) = P(x | y = 1)$

So $(x1 - 1)^2 + (x2 - 1)^2 = x1^2 + x2^2$

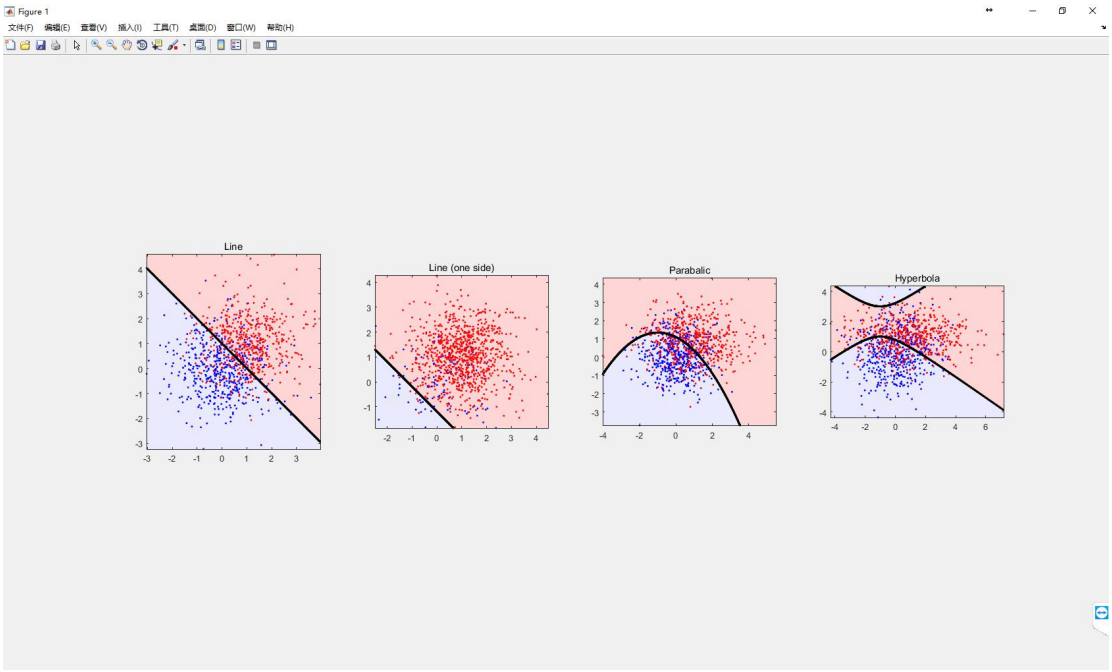
So the boundary is $x1 + x2 = 1$

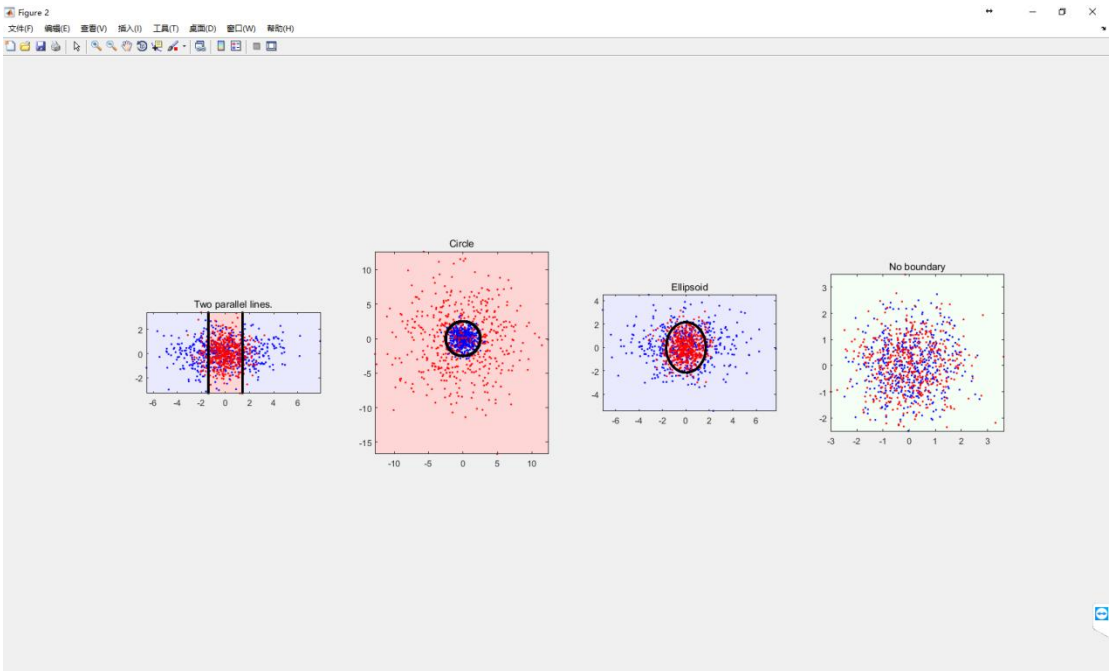
(b)

I have finished gaussian_pos_prob.m to calculate posterior probability.

(c)

My result:





(d)

Φ = sum(y=1) / (sum(y=0) + sum(y=1))

μ 0 = mean(xi,y=0)

μ 1 = mean(xi,y=1)

4.

(a) The top 10 words list as follow:

gauze id=19957
opportune id=56930
recess id=13613
mexzx id=37568
superbowl id=65398
swam id=9494
noaa id=45153
ejwah id=38176
allyannis id=75526
phenotype id=30033

(b)

The accuracy of my spam filter on the testing set is 98.57%

(c)

False, if the ratio of positive(negative) sample is lower than 1%, a model with 99% accuracy is not always a good model.

(d)

	Spam(label)	Ham(label)
Spam(predict)	TP = 1093	FP = 28
Ham(predict)	FN = 31	TN = 2983

Precision = 97.50%

Recall = 97.24%

(e)

For a spam filter, precision is more important, because classify ham to spam is terrible.

For a classifier to identify drugs and bombs at airport, recall is more important, if a class' label is drug or bomb, but our prediction is normal, it is dangerous.