1
e. accuracy

```
 [1] 0.6853767 0.6740522 0.6046283 0.6932546 0.6878385 0.7055638 0.6937469
 [8] 0.6824225 0.6740522 0.6755293
```

f.
output

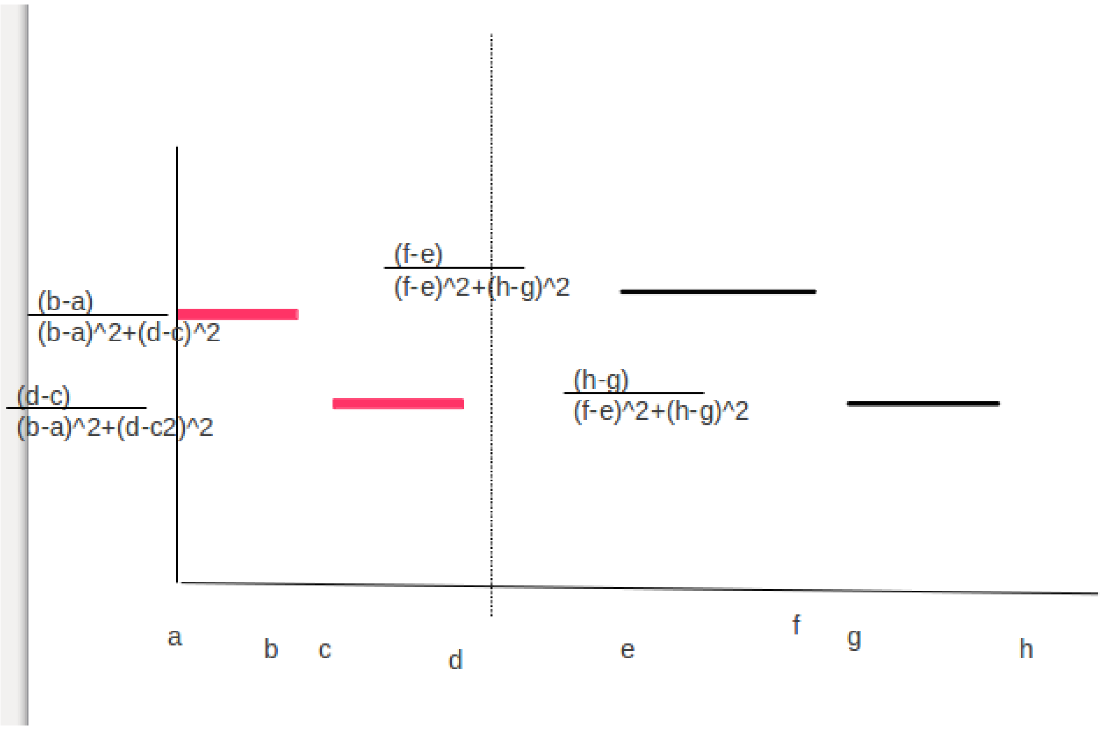
```
[1] "nnode"
[1] 3392
 [1] 0.6780990 0.6736990 0.6732302 0.6610408 0.5986873 0.6661978 0.6066573
 [8] 0.6732302 0.6666667 0.6845441
 [1] 0.6780990 0.6810387 0.6732302 0.6610408 0.5986873 0.6661978 0.6066573
 [8] 0.6732302 0.6666667 0.6845441
 [1] 0.6780990 0.6810387 0.6952474 0.6610408 0.5986873 0.6661978 0.6066573
 [8] 0.6732302 0.6666667 0.6845441
 [1] 0.6780990 0.6810387 0.6952474 0.6727095 0.5986873 0.6661978 0.6066573
 [8] 0.6732302 0.6666667 0.6845441
 [1] 0.6780990 0.6810387 0.6952474 0.6727095 0.6883880 0.6661978 0.6066573
 [8] 0.6732302 0.6666667 0.6845441
 [1] 0.6780990 0.6810387 0.6952474 0.6727095 0.6883880 0.6771191 0.6066573
 [8] 0.6732302 0.6666667 0.6845441
 [1] 0.6780990 0.6810387 0.6952474 0.6727095 0.6883880 0.6771191 0.6810387
 [8] 0.6732302 0.6666667 0.6845441
 [1] 0.6780990 0.6810387 0.6952474 0.6727095 0.6883880 0.6771191 0.6810387
 [8] 0.6565409 0.6666667 0.6845441
 [1] 0.6780990 0.6810387 0.6952474 0.6727095 0.6883880 0.6771191 0.6810387
 [8] 0.6565409 0.6746693 0.6845441
 [1] 0.6780990 0.6810387 0.6952474 0.6727095 0.6883880 0.6771191 0.6810387
 [8] 0.6565409 0.6746693 0.6114650
[1] "nnode"
[1] 6204
 [1] 0.6733301 0.6810387 0.6952474 0.6727095 0.6883880 0.6771191 0.6810387
 [8] 0.6565409 0.6746693 0.6114650
 [1] 0.6733301 0.6811312 0.6952474 0.6727095 0.6883880 0.6771191 0.6810387
 [8] 0.6565409 0.6746693 0.6114650
 [1] 0.6733301 0.6811312 0.6913701 0.6727095 0.6883880 0.6771191 0.6810387
 [8] 0.6565409 0.6746693 0.6114650
 [1] 0.6733301 0.6811312 0.6913701 0.6821063 0.6883880 0.6771191 0.6810387
 [8] 0.6565409 0.6746693 0.6114650
 [1] 0.6733301 0.6811312 0.6913701 0.6821063 0.6645539 0.6771191 0.6810387
 [8] 0.6565409 0.6746693 0.6114650
 [1] 0.6733301 0.6811312 0.6913701 0.6821063 0.6645539 0.6816187 0.6810387
 [8] 0.6565409 0.6746693 0.6114650
 [1] 0.6733301 0.6811312 0.6913701 0.6821063 0.6645539 0.6816187 0.6889322
 [8] 0.6565409 0.6746693 0.6114650
 [1] 0.6733301 0.6811312 0.6913701 0.6821063 0.6645539 0.6816187 0.6889322
 [8] 0.6738176 0.6746693 0.6114650
 [1] 0.6733301 0.6811312 0.6913701 0.6821063 0.6645539 0.6816187 0.6889322
 [8] 0.6738176 0.6879571 0.6114650
 [1] 0.6733301 0.6811312 0.6913701 0.6821063 0.6645539 0.6816187 0.6889322
 [8] 0.6738176 0.6879571 0.6786933
[1] "nnode"
[1] 25389
```

```
 [1] 0.6704173 0.6811312 0.6913701 0.6821063 0.6645539 0.6816187 0.6889322
 [8] 0.6738176 0.6879571 0.6786933
 [1] 0.6704173 0.6610408 0.6913701 0.6821063 0.6645539 0.6816187 0.6889322
 [8] 0.6738176 0.6879571 0.6786933
 [1] 0.6704173 0.6610408 0.6591655 0.6821063 0.6645539 0.6816187 0.6889322
 [8] 0.6738176 0.6879571 0.6786933
 [1] 0.6704173 0.6610408 0.6591655 0.6661978 0.6645539 0.6816187 0.6889322
 [8] 0.6738176 0.6879571 0.6786933
 [1] 0.6704173 0.6610408 0.6591655 0.6661978 0.6671355 0.6816187 0.6889322
 [8] 0.6738176 0.6879571 0.6786933
 [1] 0.6704173 0.6610408 0.6591655 0.6661978 0.6671355 0.6085326 0.6889322
 [8] 0.6738176 0.6879571 0.6786933
 [1] 0.6704173 0.6610408 0.6591655 0.6661978 0.6671355 0.6085326 0.6765120
 [8] 0.6738176 0.6879571 0.6786933
 [1] 0.6704173 0.6610408 0.6591655 0.6661978 0.6671355 0.6085326 0.6765120
 [8] 0.5972808 0.6879571 0.6786933
 [1] 0.6704173 0.6610408 0.6591655 0.6661978 0.6671355 0.6085326 0.6765120
 [8] 0.5972808 0.6038444 0.6786933
 [1] 0.6704173 0.6610408 0.6591655 0.6661978 0.6671355 0.6085326 0.6765120
 [8] 0.5972808 0.6038444 0.6699484
[1] "nnode"
[1] 46276
 [1] 0.6354724 0.6610408 0.6591655 0.6661978 0.6671355 0.6085326 0.6765120
 [8] 0.5972808 0.6038444 0.6699484
 [1] 0.6354724 0.6238859 0.6591655 0.6661978 0.6671355 0.6085326 0.6765120
 [8] 0.5972808 0.6038444 0.6699484
 [1] 0.6354724 0.6238859 0.6595365 0.6661978 0.6671355 0.6085326 0.6765120
 [8] 0.5972808 0.6038444 0.6699484
 [1] 0.6354724 0.6238859 0.6595365 0.5940285 0.6671355 0.6085326 0.6765120
 [8] 0.5972808 0.6038444 0.6699484
 [1] 0.6354724 0.6238859 0.6595365 0.5940285 0.6613191 0.6085326 0.6765120
 [8] 0.5972808 0.6038444 0.6699484
 [1] 0.6354724 0.6238859 0.6595365 0.5940285 0.6613191 0.6225490 0.6765120
 [8] 0.5972808 0.6038444 0.6699484
 [1] 0.6354724 0.6238859 0.6595365 0.5940285 0.6613191 0.6225490 0.6336898
 [8] 0.5972808 0.6038444 0.6699484
 [1] 0.6354724 0.6238859 0.6595365 0.5940285 0.6613191 0.6225490 0.6336898
 [8] 0.6350267 0.6038444 0.6699484
 [1] 0.6354724 0.6238859 0.6595365 0.5940285 0.6613191 0.6225490 0.6336898
 [8] 0.6350267 0.6359180 0.6699484
 [1] 0.6354724 0.6238859 0.6595365 0.5940285 0.6613191 0.6225490 0.6336898
 [8] 0.6350267 0.6359180 0.6519608
```

accuracy decrease with number of noise.
Number of nodes constructed, and path length of parse increase with number of noise.

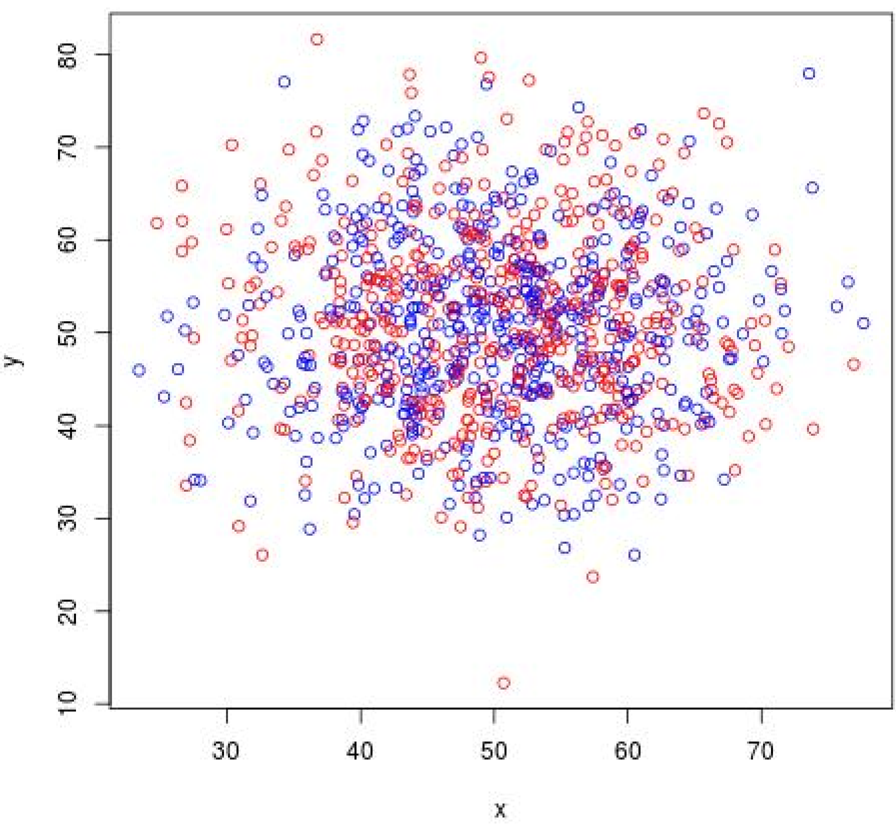
2

a.i. two bimodal distributions, which are mixure of two uniform distributions, whose regions are not overlapping or cross could be seperate linearly with optimal



a.ii two normal distributions with means close to each other could not be seperate linearly. for example, two data set which could not pass two-sample t-test.

Plot of x<-rnorm(1000,m=50,sd=10); y<-rnorm(1000,m=51,sd=10)



b. for a decision region R_i and x_1, x_2 in it
there exit k , such that

$g_k(x_1) > g_l(x_1)$

$g_k(x_2) > g_l(x_2)$

for all l
we will prove

$g_k(\lambda x_1 + (1 - \lambda)x_2) > g_l(\lambda x_1 + (1 - \lambda)x_2)$

for all l

$$g_k(\lambda x_1 + (1 - \lambda)x_2) = \mathbf{W(}\lambda x_1 + (1 - \lambda)x_2\mathbf{)} + w_{k0} = \mathbf{W(}\lambda(x_1-x_2) + x_2\mathbf{)} + w_{k0}$$
$$= \mathbf{W(}\lambda(x_1-x_2) + \lambda w_{k0} - \lambda w_{k0} + x_2\mathbf{)} + w_{k0} = \lambda(\mathbf{W}x_1+w_{k0}) - \lambda(\mathbf{W}x_2+w_{k0}) + \mathbf{W}x_2+w_{k0}$$
$$= \lambda(\mathbf{W}x_1+w_{k0})+(1-\lambda)(\mathbf{W}x_2+w_{k0})$$
$$= \lambda * g_k(x_1)+(1-\lambda) * g_k(x_2)$$

(because $g_k(x_1) > g_l(x_1)$ $g_k(x_2) > g_l(x_2)$, $0<\lambda<1$, $0<1-\lambda<1$, for all l)

$$> \lambda * g_l(x_1)+(1-\lambda) * g_l(x_2)$$

this imply that all points on a line connecting two points in the set are in the set.