

①

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Final Exam  
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$$J = 10$$

$$A = 1 \rightarrow C_2 = \begin{bmatrix} 0 \\ 1 \end{bmatrix}$$

$$C = 3$$

$$K = 11$$

$$R = 18$$

$$E = 5$$

$$Z = 26$$

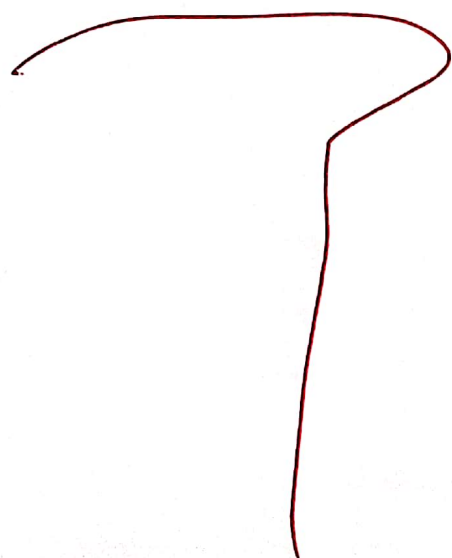
$$A = 1$$

$$\rightarrow C_1 = \begin{bmatrix} 1 \\ 0 \end{bmatrix}$$

$$[10 \ 1 \ 3 \ 11]$$

$$[18 \ 5 \ 26 \ 1]$$

Kernel:  $[-1 \ 2 \ -1]$  stride 1



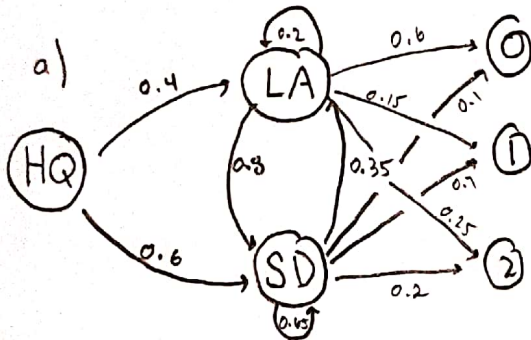
②

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A:  $\begin{matrix} & LA & SD \\ LA & 0.2 & 0.8 \\ SD & 0.35 & 0.65 \end{matrix}$

$\pi: \begin{matrix} LA & SD \\ 0.4 & 0.6 \end{matrix}$

B:  $\begin{matrix} & 0 & 1 & 2 \\ LA & 0.6 & 0.15 & 0.25 \\ SD & 0.1 & 0.7 & 0.2 \end{matrix} \rightarrow (\text{where } 0 = < 6, 1 = 6-8, 2 = > 8)$



b)  $0 = [6.5, 10, 7] = [0, 2, 1]$

	$\pi_{x_0}$	$b_{x_0}(0_0)$	$a_{x_0x_1}$	$b_{x_1}(0_1)$	$a_{x_1x_2}$	$b_{x_2}(0_2)$	
L L L	0.4	0.6	0.2	0.25	0.2	0.15	0.00036
L L S	0.4	0.6	0.2	0.25	0.8	0.7	0.00672
L S L	0.4	0.6	0.8	0.2	0.35	0.15	0.002016
* L S S	0.4	0.6	0.8	0.2	0.65	0.7	0.017472
S L L	0.6	0.1	0.35	0.25	0.2	0.15	0.0001575
S L S	0.6	0.1	0.35	0.25	0.8	0.7	0.00294
S S L	0.6	0.1	0.65	0.2	0.35	0.15	0.0004095
S S S	0.6	0.1	0.65	0.2	0.65	0.7	0.003549

The most likely sequence is LSS.

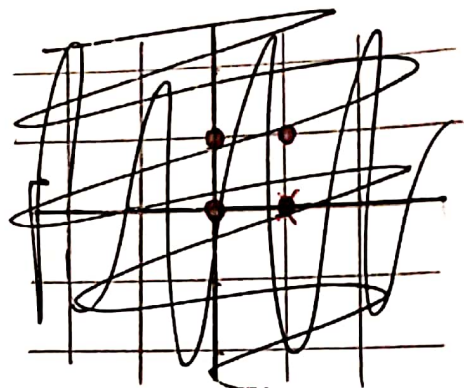
c)

$p(LA, 0, 2, 1)$	0.029808	0.0134175	0.002443
$p(SD, 0, 2, 1)$	0.007056	0.0234465	0.030681
	0.036864	0.036864	0.036864

\* LLS is maximum expected number of correct places.



③  
Class 1:  $\begin{bmatrix} 0 \\ 0 \end{bmatrix}, \begin{bmatrix} 0 \\ 1 \end{bmatrix}, \begin{bmatrix} 1 \\ 1 \end{bmatrix}$   
Class 2:  $\begin{bmatrix} 0.5 \\ 0.5 \end{bmatrix}$

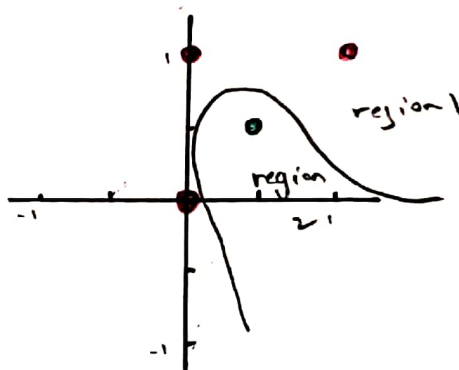


a) It is not linearly separable.

b)  $X_3 = f(x_1, x_2) = aX_1^2 + bX_2^2 + cX_1X_2 + d$

$X_3 \geq 0$  when class 1  
 $< 0$  when class 2

Find MMC ( $X_3 = \beta_0$ , find  $\beta_0$ )



~~$c_1(1,1) \quad 1 = a(1)^2 + b(1)^2 + c(1)(1) + d$   
 $1 = a + b + c + d$

$c_1(0,0) \quad 1 = d$

$c_1(0,1) \quad 1 = a(0)^2 + b(1)^2 + c(1)(0) + d$   
 $1 = b + c + 1 \quad b = -c$

$c_2(0.5,0.5) \quad -1 = a(0.5)^2 + (-c)(0.5)^2 + c(0.5)(0.5) + 1$   
 $-1 = 0.25a - 0.25c + 0.25c + 1$   
 $-2 = 0.25a \quad a = -8$~~

$Y_1 = a(1)^2 + b(1)^2 + c(1)(1) + d \quad Y_1 \geq 0$   
 $a + b + c + d \geq 0$

$(0,0) \quad Y_2 = d \quad d \geq 0 \quad Y_2 \geq 0$

$(0,1) \quad Y_3 = b + d \quad Y_3 \geq 0 \quad b + d \geq 0$

$(0.5,0.5) \quad Y_4 = 0.25a + 0.25b + 0.25c + d$   
 $a + b + c + 4d < 0 \quad Y_4 < 0$

$X_3 = 7$

$X_3 = 2X_1 - 3X_2 + 2X_1X_2 + 4$

④ (explain)

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- . . .  
. . .
- a) Single linkage will fuse first. The minimum distance between the clusters will always be smaller than the maximum, and geometrically all points between the two groups cannot be equal distances apart.
- b) They will fuse at the same point. No matter the metric used to classify the distance between 5 + 6, that distance will always be constant.

(5)

a) T

b) T

c) F

d) F

e) T

f) F

g) T

h) F

i) F

j) F

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