Abdelrahman Adel Abdelfattah 17012296 NOTES

Sheet 4

(1) Q1

Age

	L	H	P(L)	P(H)
20	0	2	0/2	2/4
23	0	0	0/2	0/4
25	2	1	2/2	1/4
45	0	1	0/2	1/4
Total	2	4	100%	100%

Car

	L	H	P(L)	P(H)
Sports	2	1	2/2	1/4
Vintage	0	1	0/2	1/4
SUV	0	2	0/2	2/4
truck	0	0	0/2	0/4
Total	2	4	100%	100%

2B Closer to 25

$P(L) > P(H)$

B 23, truck $\Rightarrow$ Class (L)

Q2 1

a_1

	Y	N	P(Y)	P(N)
T	3	1	3/4	1/5
F	1	4	1/4	4/5
Total	4	5	100%	100%

a_2

	Y	N	P(Y)	P(N)
T	2	3	2/4	3/5
F	2	2	2/4	2/5
Total	4	5	100%	100%

- $\mu = 5.111$

$$\sigma^2 = \frac{0.612321 + 3.568321 + \dots}{9}$$

$$\sigma^2 = \frac{38.889}{9} = 4.321$$

$$P(Y|1) = \frac{1}{\sqrt{2\pi\sigma}^2} \exp\left\{\frac{-(x_j - \mu)^2}{2\sigma_j^2}\right\}$$

$$= 0.329$$

$P(N|1) = 0.325$

- $P(T,F) = P(T|Y)\,P(F|Y) = 0.375$
- $P(N|T,F) = P(T|N)\,P(F|N)$
  $= 0.08$

$P(T,F,L) \Longrightarrow$ Class Y #

Q3]

$P(C_1) = 0.5$, $P(C_2) = 0.5$

$\hat{\Sigma}_1 = \begin{pmatrix} 4 & 0 \\ 2 & -1 \end{pmatrix}$, $\hat{\Sigma}_2 \begin{pmatrix} 3 & -5 \\ -5 & -4 \end{pmatrix}$

~~Classify Points~~

μ_1

$\hat{\Sigma}_1 \times \text{Point} = \begin{bmatrix} 12 \\ 2 \end{bmatrix} \times \quad = 18$

μ_2

$\hat{\Sigma}_2 \times \text{Point} = \begin{bmatrix} -29 \\ -31 \end{bmatrix} \quad \mu_2 = -3$

Point C_1

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(3) a) C_1: ⬡ → $10/25$
C_2: ○ → $7/25$
C_3: ⊕ → $8/25$

b) $\mu_{C_1} = [5.8, 3.9]$

$\mu_{C_2} = [5.29, 4]$

$\mu_{C_3} = [10.5, 3.125]$

$\Sigma_{C_1} = \frac{1}{10} Z_{C_1}^T Z_{C_1}$

=

Computed by Python

c)

	C_1	C_2	C_3
X_1 mean	5.8	5.286	10.5
X_2 mean	3.9	4	3.125
X_1 Var	5.16	2.49	2.75
X_2 Var	1.89	0.86	1.86

$P_1 = (6,5)$, ~~P_2~~ $(9,4)$, $P_3 = (8,5)$

$P(P_1/C_1) = P(6/C_1) \times P(5/C_1) = 0.03686$

~~$= 0.145 \times 0.165 = 0.0289$~~

$P(P_1/C_2) = P(6/C_2) \times P(5/C_2) = 0.0548$

~~$= 0.238 \times 0.249 = 0.0568$~~

$P(P_1/C_3) = P(6/C_3) \times P(5/C_3) = 0.0006$

~~$= 0.0061 \times 0.001 = 0.0000064$~~

$P_1 \Rightarrow C_2$

$P(P_2/C_1) = 0.0188$

$P(P_2/C_2) = 0.0068$

$P(P_2/C_3) = 0.038$

$P(P_3/C_1) = 0.023$

$P(P_3/C_2) = 0.013$

$P(P_3/C_3) = 0.008$

$P_2 \Rightarrow C_3$

$P_3 \Rightarrow C_1$