

1.

	M	F
C ₀	8	4
C ₁	2	6

 $Gini(M) = Gini(F) = 0.4$

	F	S	L
C ₀	17	4	1
C ₁	0	2	6

 $Gini(F) = 0.31$
 $Gini(S) = 0.48$
 $Gini(L) = 0.25$ ✓

	S	M	L	E
C ₀	3	3	3	3
C ₁	2	4	1	1

 $G(S) = 0.48$
 $G(M) = 0.45$
 $G(L) = 0.47$
 $G(E) = 0.47$

$Gini = 0.25$
 Car Type = Luxury?
 yes (7) $Gini = 0$ Customer ID = 10?
 yes C₀ No C₁
 No (13) Customer ID = 13?
 yes C₁ No $Gini = 0$ Customer ID = 17?
 yes C₁ No C₀

2. Gender = M, Car = Sports, Shirt = Medium
 $P(X|class=C_0) P(C_0)$
 $= P(Gender=M|C_0) \times P(Car=Sports|C_0) \times P(Shirt=Medium|C_0) P(C_0)$
 $= \frac{2}{318} \times \frac{4}{12} \times \frac{3}{12} P(C_0)$
 $= \frac{1}{218} \times \frac{12}{20} = \frac{1}{30}$

$P(X|class=C_1) P(C_1)$
 $= P(G=M|C_1) P(C=S|C_1) P(S=M|C_1) P(C_1)$
 $= \frac{2}{8} \times \frac{2}{20} \times \frac{4}{8} \times \frac{8}{20}$
 $= \frac{1}{80}$

$\frac{1}{30} > \frac{1}{80}$
C₀ #

① ② ③ ④ ⑤ ⑥ ⑦ $h(f) > h(t)$
 4 8 3 2 11 9 6

X_2
 7
 6
 5
 4
 3
 2
 1
 0
 0 1 2 3 4 5 6 7 X_1

$y = X - 1$
 (2,3)
 (4,1)

maximize $\frac{2}{\|w\|^2}$ s.t. $y_i(w^T x_i - b) \geq 1, \forall x_i$
 support vector: (2,3), (4,1) #

3. $X_1 - X_2 - 1 = 0$
 $w = \begin{bmatrix} 0.5 \\ -0.5 \end{bmatrix}$ $b = -0.5$ #
 $< X_1 - C X_2 - C = 0$
 $w = \begin{bmatrix} C \\ -C \end{bmatrix}$ $b = -C = -0.5$
 hyperplane: $\frac{1}{2} X_1 - \frac{1}{2} X_2 - \frac{1}{2} = 0$ #

$\frac{2}{\|w\|} = 2\sqrt{2}$ $\|w\| = \sqrt{2}C = \frac{1}{\sqrt{2}}, C = \frac{1}{2}$