1.(a) LIKLIHOOD PROB. $P(X_{OUTLOOK} | C_i)$ GIVEN C_i, PROB OF X

	Y 0	1
A 0	2	1
1	1	2

→ $P(A=1 | Y=1) = 66\%$ → $P(A=1 | Y=0) = 33\%$

$P(B=1 | Y=1) = 66\%$ $P(B=1 | Y=0) = 66\%$

$P(C=1 | Y=1) = 33\%$ $P(C=1 | Y=0) = 66\%$

$P(A=0 | Y=1) = 33\%$ $P(A=0 | Y=0) = 66\%$

→ $P(B=0 | Y=1) = 33\%$ → $P(B=0 | Y=0) = 33\%$

→ $P(C=0 | Y=1) = 66\%$ → $P(C=0 | Y=0) = 33\%$

	Y 0	1
B 0	1	1
1	2	2

PRIOR PROB

$P(C_i) = P(Y=1) = 50\%$

$P(Y=0) = 50\%$

	Y 0	1
C 0	1	2
1	2	1

POSTERIORI PROB

$P(A=1 \; B=0 \; C=0 | Y=1) = 66\% \; 33\% \; 66\% = .148$

$P(A=1 \; B=0 \; C=0 | Y=0) = 33\% \; 33\% \; 33\% = .037$

$P(Y=1 | X) = .148 / P(X)$ ← PREDICTION Y = 1

$P(Y=0 | X) = .037 / P(X)$

b) I.GAIN (Y, A) ENTROPY $(Y) = -1/2 \log_2 1/2 * 2$

$= 1$

I.GAIN (Y, B)

I.GAIN (Y, C)

$E(A, Y) = P(A=0) * E(2,1) + P(A=1) E(1,2)$

$= .92$

$E(B, Y) = P(B=0) * E(1,1) + P(B=1) * E(2,2)$

$= 1$

$E(C, Y) = P(C=0) * E(1,2) + P(C=1) E(2,1) = .92$

$GAIN(Y,A) = E(Y) - E(A,Y) = .08$

$GAIN(Y,B) = E(Y) - E(B,Y) = 0$

$GAIN(Y,C) = E(Y) - E(C,Y) = .08$ HIGHEST

CONTINUED.

1. b) FOR $C=0$

A	B	Y
0	0	0
1	0	1
0	0	1

I-GAIN $(Y, C=0 \mid A)$

HIGHEST I-GAIN $(Y, C=0 \mid B)$

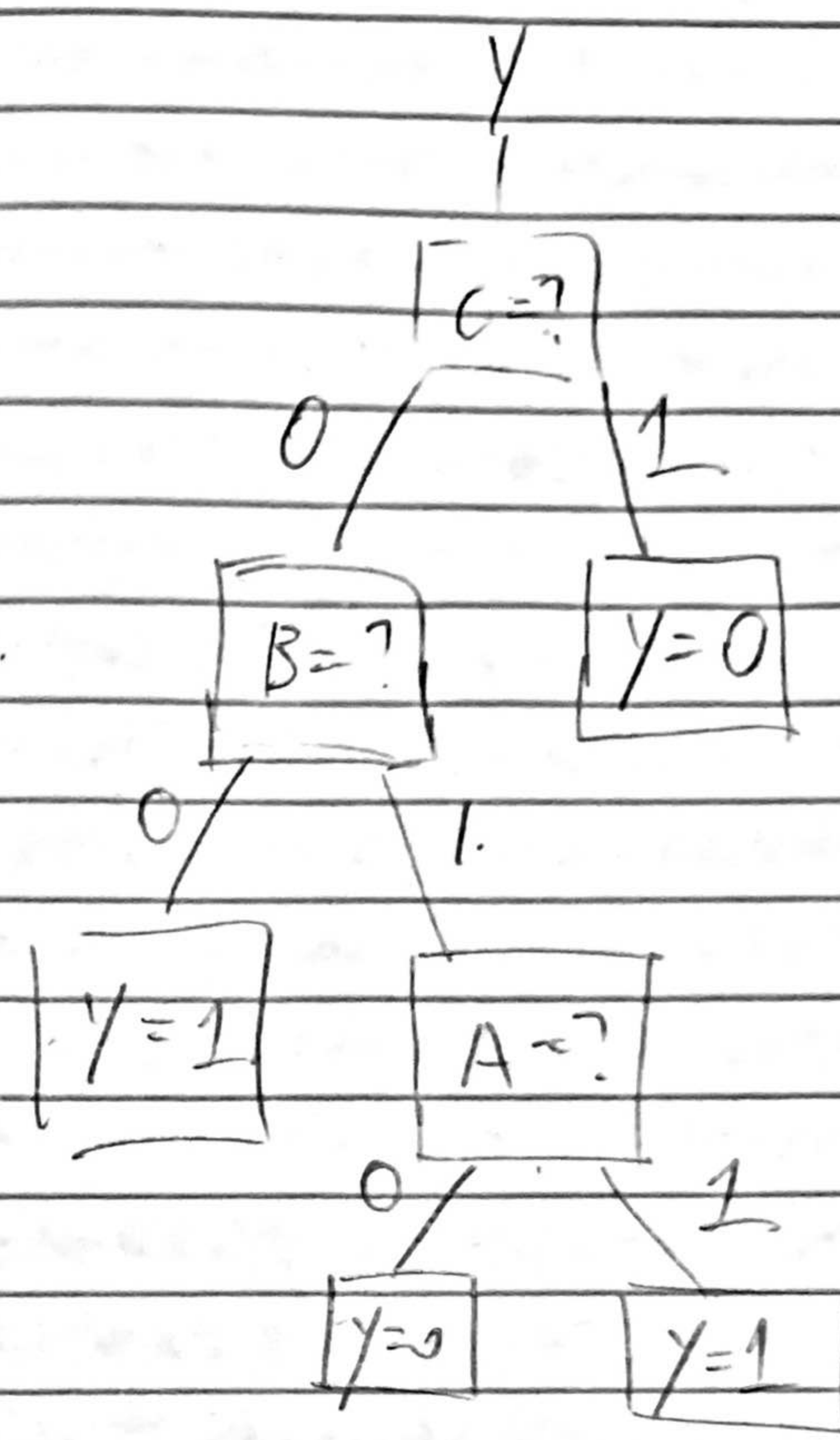
$E(A \mid Y, C=0) = 0 + 1 = 1$

$E(B \mid Y, C=0) = 0$

I-GAIN $(Y, C=0 \mid B) = E(Y) - 0$

HIGHEST $= .92$

WE ARE LEFT WITH $A=0$
$B=0$
$Y=0$



2. $K(X_i, X_j) = (X_j \cdot X_i + 1)^3$

$X = (X_1, X_2)$

$$k(x_i, x_j) = (x_{i1} x_{j1} + x_{i2} x_{j2} + 1)^3$$

$$= x_{i1}^3 x_{j1}^3 + x_{i2}^3 x_{j2}^3 + 3 x_{i1}^2 x_{j1}^2 x_{i2} x_{j2} + 3 x_{i1} x_{j1} x_{i2}^2 x_{j2}^2$$

$$+ 3 x_{i1}^2 x_{j1}^2 + 3 x_{i2}^2 x_{j2}^2 + 3 x_{i1} x_{j1} + 3 x_{i2} x_{j2}$$

$$+ 6 x_{i1} x_{j1} x_{i2} x_{j2} + 2$$

$$= \Phi(x_i)^T \Phi(x_j)$$

$$\Phi(x) = x_1^3 + x_2^3 + \sqrt{3} x_1 + \sqrt{3} x_2 + \sqrt{3} x_1^2 + \sqrt{3} x_2^2 + \sqrt{3} x_1^2 x_2$$

$$+ \sqrt{3} x_1 x_2^2 + \sqrt{6} x_1 x_2 + 1$$

3. 1. TP = TN $ACC = \frac{TP+TN}{P+N} = \frac{TP+TN}{TP+TN+FP+FN}$

F1 IS HARMONIC MEAN OF PREC & SENS

$$F1 = 2 \cdot \frac{PPV \cdot TPR}{PPV + TPR} = \frac{2TP}{2TP + FP + FN}$$

IF $TP = TN$ $ACC = F1$