1. KNN

$x = (1, 0, 1)$

$x_1 = (1, 4, 1)$	$d = \lvert 1-1+4-0+1-1 \rvert = 4$
$x_2 = (1, 2, 3)$	$d = \lvert 1-1+2-0+3-1 \rvert = 4$
$x_3 = (0, 0, 1)$	$d = \lvert 0-1+0-0+1-1 \rvert = 1$
$x_4 = (-1, 4, 0)$	$d = \lvert -1-1+4-0+0-1 \rvert = 1$
$x_5 = (1, 0, -2)$	$d = \lvert 1-1+0-0-2-1 \rvert = 3$
$x_6 = (-1, -1, 1)$	$d = \lvert -1-1-1-0+1-1 \rvert = 3$
$x_7 = (0, -4, 0)$	$d = \lvert 0-1-4-0+0-1 \rvert = 6$
$x_8 = (1, 0, -3)$	$d = \lvert 1-1+0-0-3-1 \rvert = 4$

We found x_3, x_4, x_5 with binary output

$y = 1 \quad 1 \quad 0$

So we classify ~~$x = (1, 0, 1)$~~ $x = (1, 0, 1)$ has a binary output 1.

2. Naive Bayes:

$X = (age = youth,\ income = medium,\ student = yes,\ credit\_rating = fair)$

~~$P(buys\_computer = yes \mid yes) \quad 4/9 = 0.444444$~~

~~$P(buys$~~

$P(buys\_computer = yes) = 9/14 = 0.642857$

$P(buys\_computer = No) = 5/14 = 0.357143$

$P(age = youth \mid yes) = 2/9 = 0.222222$

$P(age = youth \mid no) = 3/5 = 0.6$

$P(income = medium \mid yes) = 4/9 = 0.444444$

$P(income = medium \mid no) = 2/5 = 0.4$

$P(student = yes \mid yes) = 6/9 = 0.666666$

$P(student = yes \mid no) = 1/5 = 0.2$

$P(credit\_rating = fair \mid yes) = 6/9 = 0.666666$

$P(credit\_rating = fair \mid no) = 2/5 = 0.4$

$P(yes)\,P(youth \mid yes)\,P \ldots = 0.642857 \times 0.222222 \times 0.444444 \times 0.666666 \times 0.666666$

$= 0.028219$

$P(no)\,P(youth \mid no)\,P \ldots = 0.6 \times 0.4 \times 0.2 \times 0.4 = 0.0068571$

So the sample X will buy a computer.

PS: I ~~wrote~~ made a mistake about writing all positive and negative symbol at the front of numbers. Please reverse them during reading.

S[+2,-3] $H = -\left[\frac{2}{5}\log_2(\frac{2}{5}) + \frac{3}{5}\log_2(\frac{3}{5})\right] = 0.971$

A_1

Yes: [+2,-2] H<0.5,0.5> H=1

No: [0,-1] H<0,1> H=0

$Gain(A_1) = 0.971 - \frac{4}{5}\times 1 - \frac{1}{5}\times 0 = 0.171$

S=[+2,-3] H=0.971

A_2

Yes: [+2,-1] $H<\frac{2}{3},\frac{1}{3}>$ $H = -\frac{2}{3}\log_2(\frac{2}{3}) - \frac{1}{3}\log_2(\frac{1}{3}) = 0.918296$

No: [0,-2] H<0,1> H=0

$Gain(A_2) = 0.971 - \frac{3}{5}\times 0.918296 = 0.42$

A_3

Yes: [1+,1-] H=1

No: [1+,2-] H=0.918296

$Gain(A_3) = 0.971 - \frac{2}{5}\times 1 - \frac{3}{5}\times 0.918296 = 0.02$

Since $Gain(A_2)$ is the largest

A_2

Yes: [2+,1-] H=0.918296

A_1

Yes: [1+,1+] H=1

No: [0+,1-] H=0

No: [0+,2-] H=0.918296

the same

A_2

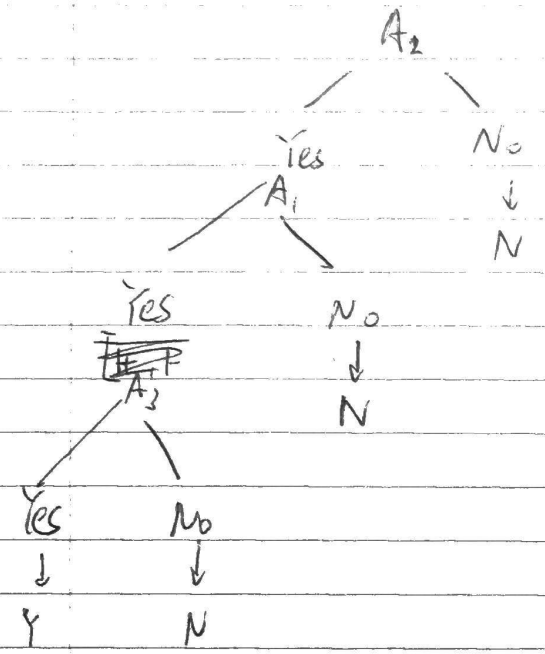
Yes

A_3

Yes: [1+,0] H=0

No: [1+,1-] H=1

No


A2
Yes
No
A1
N
Yes
No
A3
N
Yes
No
Y
N

a) 1. accuracy = 99%

2. $\frac{8}{8+16} = \frac{1}{3}$: precision

$\frac{8}{8+2} = \frac{4}{5}$ = recall