Theory Question 1

a.

$$H\left(\frac{12}{21},\frac{9}{21}\right)=-\frac{12}{21}\log_2\frac{12}{21}-\frac{9}{21}\log_2\frac{9}{21}\approx 0.9852$$

b.

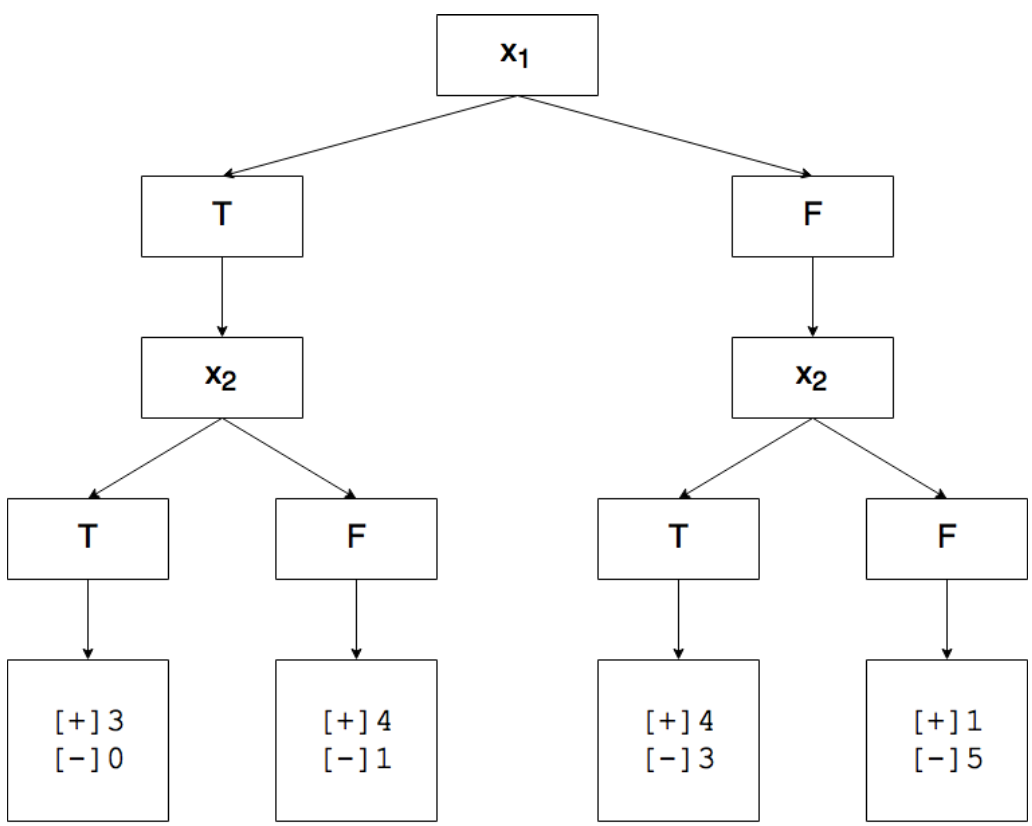
$$remainder(x_1)=\frac{8}{21}H\left(\frac{7}{8},\frac{1}{8}\right)+\frac{13}{21}H\left(\frac{5}{13},\frac{8}{13}\right)=0.8021$$

$$remainder(x_2)=\frac{10}{21}H\left(\frac{7}{10},\frac{3}{10}\right)+\frac{11}{21}H\left(\frac{5}{11},\frac{6}{11}\right)=0.9403$$

$$IG(x_1)=H\left(\frac{12}{21},\frac{9}{21}\right)-remainder(x_1)=0.1831$$

$$IG(x_2)=H\left(\frac{12}{21},\frac{9}{21}\right)-remainder(x_2)=0.0449$$

c.



Theory Question 2

a.

$$P(A = Yes) = \frac{3}{5}$$

$$P(A = No) = \frac{2}{5}$$

b.

Standardized feature, $\mu_1 = 208.0000$, $\mu_2 = 4.0260$, $\sigma_1 = 145.2154$, $\sigma_2 = 1.3256$

$$data = \begin{bmatrix} +0.0551 & +1.2477 \\ -0.9572 & +0.5688 \\ +0.6473 & -1.2945 \\ -1.0192 & -0.6533 \\ +1.2740 & +0.1313 \end{bmatrix}$$

For Given A = Yes:

$$data = \begin{bmatrix} +0.0551 & +1.2477 \\ -0.9572 & +0.5688 \\ -1.0192 & -0.6533 \end{bmatrix}$$

$\mu_1 = -0.6404$, $\mu_2 = 0.3877$, $\sigma_1 = 0.6031$, $\sigma_2 = 0.9633$

For Given A = No:

$$data = \begin{bmatrix} +0.6473 & -1.2945 \\ +1.2740 & +0.1313 \end{bmatrix}$$

$\mu_1 = 0.9607$, $\mu_2 = -0.5816$, $\sigma_1 = 0.4431$, $\sigma_2 = 1.0082$

c.

Using normal PDF. Standardize data first, it becomes to 0.2341 and 0.4028.

$$P(GetA|R) \propto P(GetA)\times P(f_1|GetA)\times P(f_2|GetA) = \frac{3}{5}\times 0.2312\times 0.4141 = 0.0574$$

$$P(NotA|R) \propto P(NotA)\times P(f_1|NotA)\times P(f_2|NotA) = \frac{2}{5}\times 0.2347\times 0.2457 = 0.0232$$

$0.0574 > 0.0232$, so that it should get an A.

k-Nearest Neighbors (KNN)

Precision	0.925234
Recall	0.841837
F-Measure	0.881567
Accuracy	0.913242