Problem #2

2) a) $H(Y) = H(50/100, 5\%/100) = -\frac{50}{100}\log_2 5\%/100 + \frac{-50}{100}\log_2\frac{50}{100}$

$= -\frac{1}{2}(\log_2 1 - \log_2 2) - \frac{1}{2}(\log_2 1 - \log_2 2)$

$= -\frac{1}{2}(0-1) - \frac{1}{2}(0-1)$

$= \boxed{1}$

b) $H(Y|A=T) = -P(Y=+|A=T)\log_2 P(Y=+|A=T) - P(Y=-|A=T)\log_2 P(Y=-|A=T)$

$-\frac{25}{25}\log_2\frac{25}{25} - 0$

$= 0$

$H(Y|A=F) = -P(Y=+|A=F)\log_2 P(Y=+|A=F) - P(Y=-|A=F)\log_2 P(Y=-|A=F)$

$= -25/75\log_2 25/75 - \frac{50}{75}\log_2\frac{50}{75}$

$= .52832 + .389975$

$= .918295$

$H(Y|A) = \frac{25}{100}(0) + \frac{75}{100}(.918295)$

$= \boxed{.6887212}$

c) $I(Y;A) = H(Y) - H(Y|A)$

$= 1 - .68872$

$= \boxed{.31128}$

d) $H(Y|B=T) = -\frac{30}{50}\log_2 30/50 - \frac{20}{50}\log_2 20/50$ $H(Y|B=F) = -\frac{20}{50}\log_2\frac{20}{50} - \frac{30}{50}\log_2\frac{30}{50}$

$= .97095059$ $= .97095059$

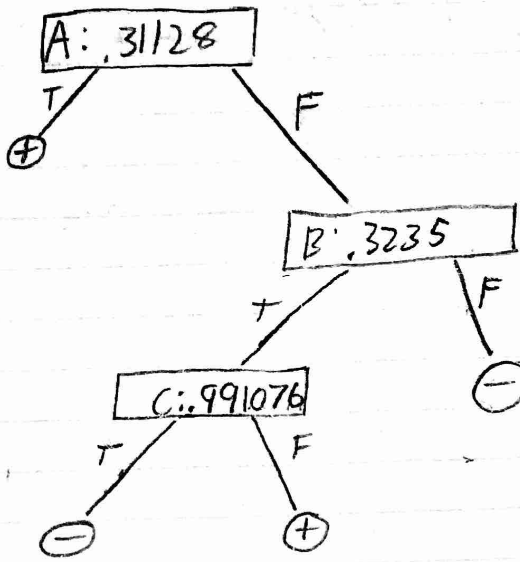
$= 1 - \frac{50}{100}(.97095059) - \frac{50}{100}(.97095059)$

$= \boxed{.0290494}$

e) $1 - \left[\frac{50}{100}\left(-\frac{25}{50}\log_2\frac{25}{50} - \frac{25}{50}\log_2\frac{25}{50}\right) + \frac{50}{100}\left(-\frac{25}{50}\log_2 \quad - \frac{25}{50}\log_2\frac{25}{50}\right)\right]$

$\boxed{0}$

f)



Which attribute for $A=F$?

$$H(Y) = H\left(\frac{25}{75}, \frac{50}{75}\right) = -\frac{1}{3}\log_2\frac{1}{3} - \frac{2}{3}\log_2\frac{2}{3} = .918296$$

$$H(Y|B) = \frac{45}{75}H\left(\frac{25}{45}, \frac{20}{45}\right) + \frac{30}{75}H\left(\frac{0}{30}, \frac{30}{30}\right) = \frac{45}{75}\left(-\frac{25}{45}\log_2\frac{25}{45} - \frac{20}{45}\log_2\frac{20}{45}\right)$$

$$= \frac{45}{75}(.99107)$$

$$I(Y;B) = .918296 - \frac{45}{75}(.99107) = .3235$$

$$H(Y|C) = \frac{50}{75}\left(-\frac{25}{50}\log_2\frac{25}{50} - \frac{25}{50}\log_2\frac{25}{50}\right) = \frac{50}{75}(1)$$

$$I(Y;C) = .918296 - 2/3 = .2515$$

Only attribute left is C, so just need calculation of $I(Y;C)$

$$H(Y) = H\left(\frac{25}{45}, \frac{20}{45}\right) = -\frac{25}{45}\log_2\frac{25}{45} - \frac{20}{45}\log_2\frac{20}{45} = .991076$$

$$I(Y;C) = .991076 - 0 = .991076$$

g) $100/100 = 1 * 100 = 100\%$