X_1	X_2	X_3	X_4	Y
age	income	student	credit_rating	buys_computer
<=30	high	no	fair	no
<=30	high	no	excellent	no
31…40	high	no	fair	yes
>40	medium	no	fair	yes
>40	low	yes	fair	yes
>40	low	yes	excellent	no
31…40	low	yes	excellent	yes
<=30	medium	no	fair	no
<=30	low	yes	fair	yes
>40	medium	yes	fair	yes
<=30	medium	yes	excellent	yes
31…40	medium	no	excellent	yes
31…40	high	yes	fair	yes
>40	medium	no	excellent	no

Student	P_i	n_i	$I(P_i, n_i)$
Hight	2	2	1
Medium	4	1	0.7219
low	2	1	0.1384

$I(2,2) = -\frac{2}{4}\log_2\left(\frac{2}{4}\right) - \frac{2}{4}\log_2\left(\frac{2}{4}\right) = 1$

$I(4,1) = -\frac{4}{5}\log_2\left(\frac{4}{5}\right) - \frac{1}{5}\log_2\left(\frac{1}{5}\right) = 0.7219$

$I(2,1) = -\frac{2}{3}\log_2\left(\frac{2}{3}\right) - \frac{1}{3}\log_2\left(\frac{1}{3}\right) = 0.1384$

$$Info_{student}(D) = \frac{4}{12}I(2,2) + \frac{5}{12}I(4,1) + \frac{3}{12}I(2,1)$$

$$= \frac{4}{12}(1) + \frac{5}{12}(0.7219) + \frac{3}{12}(0.1384)$$

$$= 0.6887$$

$$Gain(student) = Info(D) - Info_{student}(D) = 0.9183 - 0.6887 = 0.2296$$

$$Info(D) = I(8,4) = -\frac{8}{12}\log_2\left(\frac{8}{12}\right) - \frac{4}{12}\log_2\left(\frac{4}{12}\right) = 0.9183$$

age	P_i	n_i	$I(P_i, n_i)$
<= 30	2	2	1
31..40	3	0	0
>40	3	2	0.971

$I(2,2) = -\frac{2}{4}\log_2\left(\frac{2}{4}\right) - \frac{2}{4}\log_2\left(\frac{2}{4}\right) = 1$

$I(3,0) = -\frac{3}{3}\log_2\left(\frac{3}{3}\right) - \frac{0}{3}\log_2\left(\frac{0}{3}\right) = 0$

$I(3,2) = -\frac{3}{5}\log_2\left(\frac{3}{5}\right) - \frac{2}{3}\log_2\left(\frac{2}{5}\right) = 0.971$

$$Info_{age}(D) = \frac{4}{12}I(2,2) + \frac{3}{12}I(3,0) + \frac{5}{12}I(3,2)$$

$$= \frac{1}{12}(1) + \frac{3}{12}(0) + \frac{5}{12}(0.971)$$

$$= 0.4879$$

$$Gain(age) = Info(D) - Info_{age}(D) = 0.9183 - 0.4879 = 0.4304$$