age	p_i	n_i	$I(p_i, n_i)$
<=30	2	3	0.971
31...40	4	0	0
>40	3	2	0.971

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

Class P : buys_computer = "yes", Class N : buys_computer = "no"

$$Info(D) = I(9,5) = -\frac{9}{14}\log_2\left(\frac{9}{14}\right) - \frac{5}{14}\log_2\left(\frac{5}{14}\right) = 0.940$$

<=30 yes = 2, no = 3
31...40 yes = 4, no = 0
>40 yes = 3, no = 2

$$Info_{age}(D) = \frac{5}{14}I(2,3) + \frac{4}{14}I(4,0) + \frac{5}{14}I(3,2)$$

$$= \frac{5}{14}\left(-\frac{2}{5}\log_2\left(\frac{2}{5}\right) - \frac{3}{5}\log_2\left(\frac{3}{5}\right)\right) + \frac{4}{14}\left(-\frac{4}{4}\log_2\left(\frac{4}{4}\right)\right)$$

$$+ \frac{5}{14}\left(-\frac{3}{5}\log_2\left(\frac{3}{5}\right) - \frac{2}{5}\log_2\left(\frac{2}{5}\right)\right) = 0.694$$

$$Info_{income} = \frac{4}{14}I(2,2) + \frac{6}{14}I(4,2) + \frac{4}{14}I(3,1)$$

$$= 0.911$$

high yes = 2, no = 2
medium yes = 4, no = 2
Low yes = 3, no = 1

$$Info_{student} = \frac{7}{14}I(6,1) + \frac{7}{14}I(3,4)$$

$$= 0.789$$

yes yes = 6, no = 1
no yes = 3, no = 4

$$Info_{credit} = \frac{8}{14}I(6,2) + \frac{6}{14}I(3,3)$$

$$= 0.892$$

fair yes = 6, no = 2
excellent yes = 3, no = 3

$$Gain(age) = Info(D) - Info_{age}(D) = 0.940 - 0.694 = 0.246$$

$$Gain(income) = 0.029$$
$$Gain(student) = 0.151$$
$$Gain(credit\_rating) = 0.048$$

age	income	student	credit_rating	buy_computer
<=30	high	no	fair	no
<=30	high	no	excellent	no
<=30	medium	no	fair	no
<=30	low	yes	fair	yes
<=30	medium	yes	excellent	yes

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

high: yes = 0, no = 2
medium: yes = 1, no = 1
low: yes = 1, no = 0

$$Info_{income} = \frac{2}{5}I(0,2) + \frac{2}{5}I(1,1) + \frac{1}{5}I(1,0)$$

$$= \frac{2}{5}\left(-\frac{0}{2}\log_2\left(\frac{0}{2}\right) - \frac{2}{2}\log_2\left(\frac{2}{2}\right)\right) + \frac{2}{5}\left(-\frac{1}{2}\log_2\left(\frac{1}{2}\right) - \frac{1}{2}\log_2\left(\frac{1}{2}\right)\right) + \frac{1}{5}\left(-\frac{1}{1}\log_2\left(\frac{1}{1}\right)\right) = 0.4$$

yes: yes = 2, no = 0

no: yes = 0, no = 3

$$Info_{student} = \frac{3}{5}I(0,3) + \frac{2}{5}I(2,0) = 0$$

$$Info_{credit} = \frac{3}{5}I(1,2) + \frac{2}{5}I(1,1) = 0.951$$

fair: yes = 1, no = 2

excellent: yes = 1, no = 1

$$Gain_{income} = Info(D) - Info_{income} = 0.971 - 0.4 = 0.571$$

$$Gain_{student} = Info(D) - Info_{student} = 0.971 - 0 = 0.971$$

$$Gain_{credit\_rating} = Info(D) - Info_{credit} = 0.971 - 0.951 = 0.02$$

age	income	student	credit_rating	buy_computer
30...46	high	no	fair	yes
30...40	low	yes	excellent	yes
30...40	medium	no	excellent	yes
30...40	high	yes	fair	yes

age	income	student	credit_rating	buy_computer
>40	medium	no	fair	yes
>40	low	yes	fair	yes
>40	low	yes	excellent	no
>40	medium	yes	fair	yes
>40	medium	no	excellent	no

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

$$Info_{income} = \frac{3}{5} I(2,1) + \frac{2}{5} I(1,1)$$

$$= \frac{3}{5}\left(-\frac{2}{3}\log_2\left(\frac{2}{3}\right) - \frac{1}{3}\log_2\left(\frac{1}{3}\right)\right) + \frac{2}{5}\left(-\frac{1}{1}\log_2\left(\frac{1}{1}\right) - \frac{1}{1}\log_2\left(\frac{1}{1}\right)\right)$$

$$= 0.951$$

medium: yes = 2, no = 1

low: yes = 1, no = 1

$$Info_{student} = \frac{3}{5} I(2,1) + \frac{2}{5} I(1,1) = 0.951$$

yes: yes = 2, no = 1

no: yes = 1, no = 1

$$Info_{credit} = \frac{3}{5} I(3,0) + \frac{2}{5} I(0,2) = 0$$

fair: yes = 3, no = 0

excellent: yes = 0, no = 2

$$Gain_{income} = Info(D) - Info_{income} = 0.02$$

$$Gain_{student} = Info(D) - Info_{student} = 0.02$$

$$Gain_{credit\_rating} = Info(D) - Info_{credit} = 0.971$$

- Resulting tree: