Name Mussab Ammar Roll no i16-0242

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

Entropy:

$$\frac{8}{14} \quad -\left[\frac{9}{14}\log_2\left(\frac{9}{14}\right) + \frac{5}{14}\log_2\left(\frac{5}{14}\right)\right]$$

$$= 0.9403 \checkmark$$

Age:

$$-\frac{5}{14}\left[\frac{3}{5}\log_2\left(\frac{3}{5}\right) + \frac{2}{5}\log_2\left(\frac{2}{5}\right)\right] \qquad 0.3468$$

$$-\frac{4}{14}\left[\frac{4}{4}\log_2\left(\frac{4}{4}\right)\right] \qquad 0 \qquad \Big\} \; 0.6936$$

$$-\frac{5}{14}\left[\frac{3}{5}\log_2\left(\frac{3}{5}\right) + \frac{2}{5}\log_2\left(\frac{2}{5}\right)\right] \qquad 0.3468$$

Income:

high
$$-\frac{4}{14}\left[\frac{2}{4}\log_2\left(\frac{2}{4}\right) + \frac{2}{4}\log_2\left(\frac{2}{4}\right)\right] \qquad 0.2857$$

med
$$-\frac{6}{14}\left[\frac{4}{6}\log_2\left(\frac{4}{6}\right) + \frac{2}{6}\log_2\left(\frac{2}{6}\right)\right] \qquad 0.3936 \qquad \Big\} \; 0.9111$$

Low
$$-\frac{4}{14}\left[\frac{3}{4}\log_2\left(\frac{3}{4}\right) + \frac{1}{4}\log_2\left(\frac{1}{4}\right)\right] \qquad 0.2318$$

Student:

Yes $\quad -\frac{7}{14}\left[\frac{6}{7}\log_2\left(\frac{6}{7}\right) + \frac{1}{7}\log_2\left(\frac{1}{7}\right)\right] \quad \Big|\; 0.2958 \quad \Big\} \; 0.788$

No $\quad -\frac{1}{14}\left[\frac{4}{7}\log_2\left(\frac{4}{7}\right) + \frac{3}{7}\log_2\left(\frac{3}{7}\right)\right] \quad \Big|\; 0.4926$

Credit_Rating

Fair $\quad -\frac{8}{14}\left[\frac{2}{8}\log_2\left(\frac{2}{8}\right) + \frac{6}{8}\log_2\left(\frac{6}{8}\right)\right] \quad \Big|\; 0.4636 \quad \Big\} \; 0.8922$

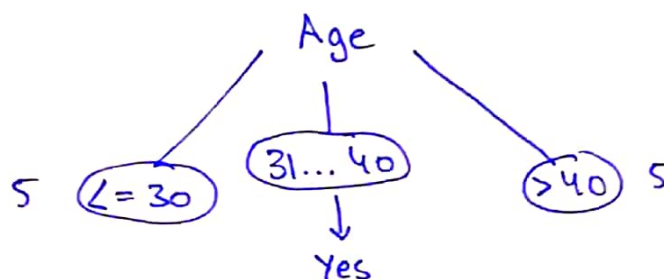Excellent $\quad -\frac{6}{14}\left[\frac{3}{8}\log_2\left(\frac{3}{6}\right) + \frac{3}{6}\log_2\left(\frac{3}{6}\right)\right] \quad \Big|\; 0.4286$

Information Gain

✓ Age $= \dfrac{0.9403 - 0.6936}{} \qquad$ Credit-Rating $= 0.9403 - 0.8922$

$\qquad = \boxed{0.2467} \qquad\qquad\qquad\qquad = \boxed{0.0481}$

Income $= 0.9403 - 0.9111 = \boxed{0.0292}$

Student $= 0.9403 - 0.7884 = \boxed{0.1519}$

Age
$\qquad\qquad$ / | \
5 $\;(\leq 30) \qquad (31\ldots 40) \qquad (>40)\; 5$
$\qquad\qquad\qquad\qquad \downarrow$
$\qquad\qquad\qquad\qquad$ Yes

≤ 30 Entropy:

$-\left[\frac{3}{5}\log_2\left(\frac{3}{5}\right) + \frac{2}{5}\log_2\left(\frac{2}{5}\right)\right] = 0.9710$

Income

High $\quad -\frac{2}{5}\left[\frac{2}{2}\log_2\frac{2}{2}\right] \qquad\qquad\qquad \Big|\; 0$

Med $\quad -\frac{2}{5}\left[\frac{1}{2}\log_2\frac{1}{2} + \frac{1}{2}\log_2\frac{1}{2}\right] \;\Big|\; 0.4$

Low $\quad -\frac{1}{5}\left[\frac{1}{1}\log_2\frac{1}{1}\right] \qquad\qquad\qquad \Big|\; 0$

Student

$-\frac{3}{5}\left[\frac{3}{3}\log_2\frac{3}{3}\right] \qquad \Big|\; 0$

$-\frac{2}{5}\left[\frac{2}{2}\log_2\frac{2}{2}\right] \qquad \Big|\; 0$

Credit-Rating:

$-\frac{3}{5}\left[\frac{2}{3}\log_2\frac{2}{3} + \frac{1}{3}\log_2\frac{1}{3}\right] \;\Big|\; 0.5510$

$-\frac{2}{5}\left[\frac{1}{2}\log_2\frac{1}{2} + \frac{1}{2}\log_2\frac{1}{2}\right] \;\Big|\; 0.4$

$\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad 0.951$

Info Gain

Income $= 0.9710 - 0.4 = 0.571$

Student $= 0.9710 - 0 = 0.9710$ ✓

Credit-Rating $= 0.9710 - 0.951 = 0.02$
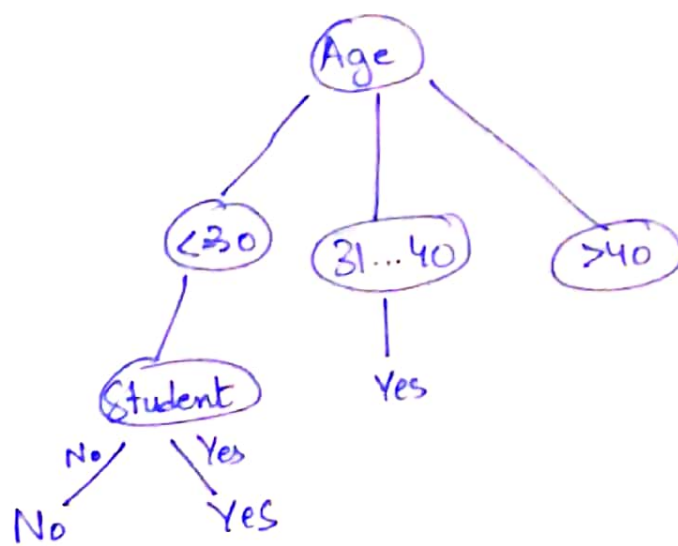
>40 Entropy

$$-\left[\frac{3}{5}\log_2\frac{3}{5} + \frac{2}{5}\log_2\frac{2}{5}\right] = 0.9710$$

Income

med $-\frac{2}{5}\left[\frac{2}{2}\log_2\frac{2}{2}\right] = 0$

Low $-\frac{3}{5}\left[$

Med $-\frac{3}{5}\left[\frac{1}{3}\log_2\frac{1}{2} + \frac{2}{3}\log_2\frac{2}{3}\right] = 0.5510$

Low $-\frac{2}{5}\left[\frac{1}{2}\log_2\frac{1}{2} + \frac{1}{2}\log_2\frac{1}{2}\right] = 0.4$

$\left.\right\}$ 0.951 ~~1~~

Student

0.4

No $-\frac{2}{5}\left[\frac{1}{2}\log_2\frac{1}{2} + \frac{1}{2}\log_2\frac{1}{2}\right] = 0.551a$

Yes $-\frac{3}{5}\left[\frac{2}{3}\log_2\frac{2}{3} + \frac{1}{3}\log_2\frac{1}{3}\right] = 0.5510$

$\left.\right\}$ 0.951

Credit_rating

Fair $-\frac{3}{5}\left[\frac{3}{3}\log_2\frac{3}{3}\right] = 0$

Exe $-\frac{2}{5}\left[\frac{2}{2}\log_2\frac{2}{2}\right] = 0$

Info Gain

Income $= 0.9710 - 0.951 = 0.02$

Student $= 0.9710 - 0.951 = 0.02$

✓ Credit- $= 0.9710 - 0 = 0.9710$

```
                          ( Age )
                            |
          ┌─────────────────┼─────────────────┐
      [ <=30 ]          [ 31...40 ]        [ 40< ]
          |                  |                  |
     [ Student ]          ( Yes )          [ Credit ]
          |                                     |
     ┌────┴────┐                      ┌─────────┴─────────┐
   [ No ]   [ Yes ]                 [ Fair ]        [ Excellent ]
     |        |                        |                  |
   ( No )  ( Yes )                  ( Yes )            ( No )
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