Entropy $= -\sum_{i=1}^{K} P_i \log_K (P_i)$

Gini $= F(S) - \sum_{i=1}^{K} P_i F(S, Q_i)$

$F(\text{Buy\_iphone}) = F(5, 9)$

$= -\left(\frac{9}{14} \log_2 \frac{9}{14}\right) - \left(\frac{5}{14} \log_2 \frac{5}{14}\right)$

$= 0.94$

Age

$F(\text{Age}, \text{Less than } 25) = F(2, 3)$

$= -\frac{2}{5} \log_2 \frac{2}{5} - \frac{3}{5} \log_2 \frac{3}{5} = 0.97$

$F(\text{Age}, 25 \text{ to } 35) = F(4, 0)$

$= -\frac{4}{4} \log_2 \frac{4}{4} - \frac{0}{4} \log_2 \frac{0}{4} = 0$

$F(\text{Age}, \text{Greater than } 25) = F(3, 2)$

$= \frac{-3}{5} \log_2 \left(\frac{3}{5}\right) - \frac{2}{5} \log_2 \frac{2}{5} = 0.97$

$\therefore$ Gini $= 0.94 - \frac{5}{14} 0.97 - \frac{4}{14} 0 - \frac{5}{14} 0.97$

$= 0.247$

income

$E(\text{income, High}) = E(2,2)$

$= -\frac{2}{4}\log_2\frac{2}{4} - \frac{2}{4}\log_2\frac{2}{4} = 1$

$E(\text{income, medium}) = E(4,2)$

$= -\frac{4}{6}\log_2\frac{4}{6} - \frac{2}{6}\log_2\frac{2}{6} = 0.918$

$E(\text{income, low}) = E(3,1)$

$= -\frac{3}{4}\log_2\frac{3}{4} - \frac{1}{4}\log_2\frac{1}{4} = 0.811$

$\therefore Gini = 0.94 - \frac{4}{14}\cdot 1 - \frac{6}{14}\times 0.918$

$- \frac{4}{14}\times 0.811 = \boxed{0.029}$

is_student

$E(\text{is\_student}) = E(6,1)$

$= -6/7\log_2 6/7 - 1/7\log_2 1/7$

$= 0.59$

$E(\text{is\_student, N}) = E(3,4)$

$= -3/7\log_2 3/7 - 4/7\log_2 4/7 = 0.99$

$\therefore Gini = 0.94 - \frac{7}{14}\times 0.59 - \frac{7}{14}\times 985$

$= 0.1525$

credit Rating

E(credit, fair) = E(6, 2)

$= -6/8 \log_2 6/8 - 2/8 \log_2 2/8$

$= 0.811$

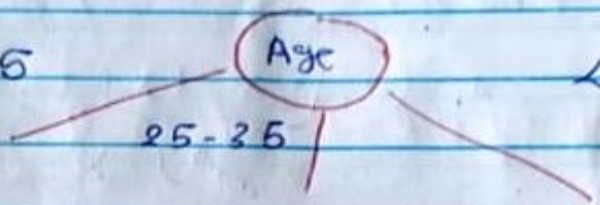
E(credit, excellent) = E(3, 3)

$= -3/6 \log_2 3/6 - 3/6 \log_2 3/6 = 1$

∴ Gine = $0.94 - 8/14 * 0.811 - 6/14 \times 1$

$= 0.048$

* The best Root is Age



yes

>25

	income	is-student	credit	Buy-iphone
1	high	No	Fair	No
2	high	No	Excellent	No
3	medium	No	Fair	No
4	Low	Yes	Fair	Yes
5	medium	yes	Excellent	yes

E(Buy-iphone) = E(2, 3)

$= -2/5 \log_2 2/5 - 3/5 \log_2 3/5$

$= 0.97$

income

E(income: High) = E(0,2)

$= -0/2 \log_2 0/2 - 2/2 \log_2 2/2 = 0$

E(income: medium) = E(1,1)

$= -1/2 \log_2 1/2 - 1/2 \log_2 1/2 = 1$

E(income: low) = E(1,0)

$= -1/1 \log_2 1/1 - 0/1 \log_2 0/1 = 0$

$\therefore$ Gini = $0.97 - 2/5 \times 0 - 2/5 \times 1 - 1/5 \times 0$

$= 0.57$

is-studet

E(is-student:) E(2,0)

$= -2/2 \log_2 2/2 - 0 \log_2 0 = 0$

E(is-student: No) = E(0,3)

$= -0/3 \log_2 0/3 - 3/3 \log_2 3/3 = 0$

$\therefore$ Gini = 0.97

credit

E(credit: Fair) = E(1,2)

$-1/3 \log_2 1/3 - 2/3 \log_2 2/3 = 0.918$

E(credit: Excellent)

= E(1,1) = 1

$\therefore$ Gini = $0.97 - 3/5 \times 0.918 - 2/5 = 0.0192$

$= 0.0192$

The best Root is is-student

L 35

	income	is-student	Credit	Buy
1	medium	No	Fair	Yes
2	low	Yes	Fair	Yes
3	Low	Yes	Excellent	No
4	medium	Yes	Fair	Yes
5	medium	No	Excellent	No

E(Buy-iphone) = E(3,2)

$= -3/5 \log_2 3/5 - 2/5 \log_2 2/5 = 0.97$

income

E(income, medium) = E(2,1)

$= -2/3 \log_2 2/3 - 1/3 \log_2 1/3 = 0.918$

E(income, low) = E(1,1)

$= -1/2 \log_2 1/2 - 1/2 \log_2 1/2 = 1$

∴ Gini = $0.97 - 3/5 \times 0.918 - 2/5 \times 1$

$= 0.019$

is-student

E(is-student, Yes) = E(2,1)

$= 0.918$

E(is-student, No) = E(1,1)

$= 1$

∴ Gini = 0.019

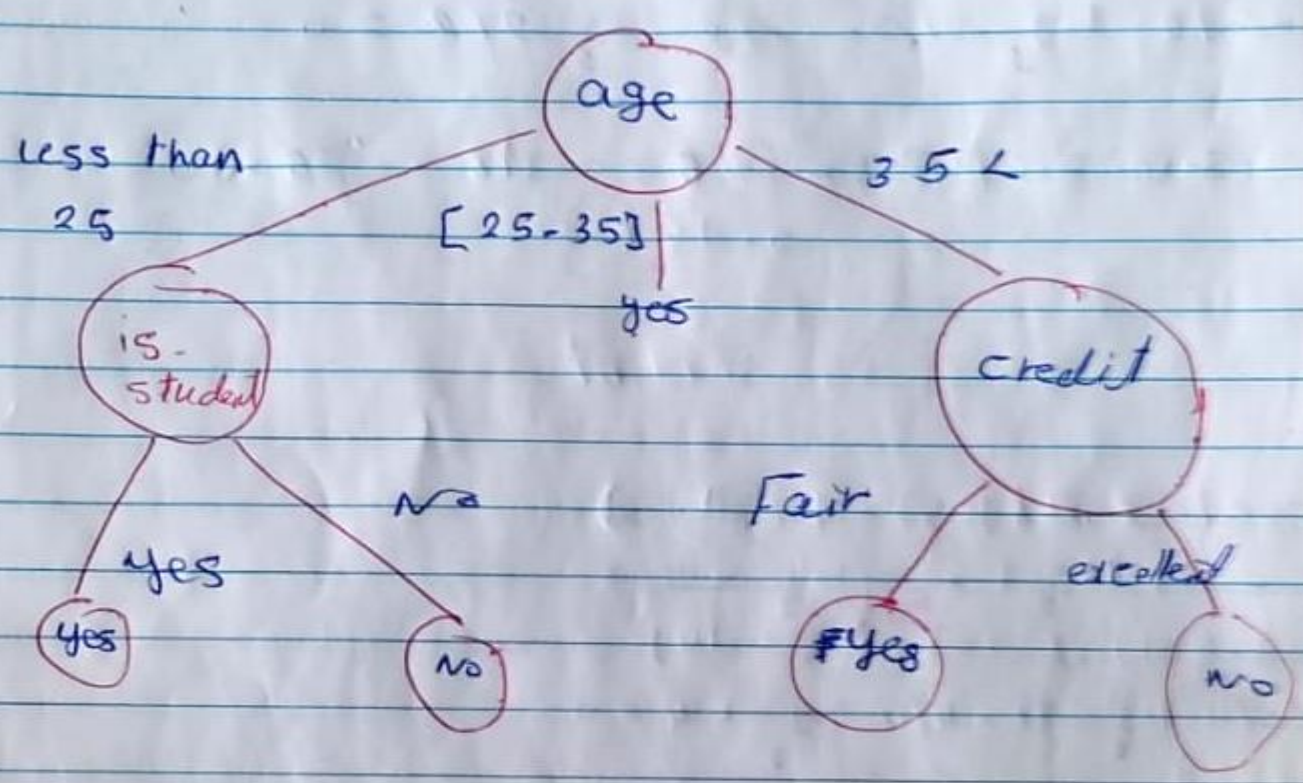
E(credit; Fair) = E(3,0)

= 0

E(credit, excellent) = E(0,2)

∴ Gini E, 0.97

* The best Root is credit



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*(2) predict The class of This instance?

[age: ≤ 20, income = medium,
is. student: yes, credit = fair]

* 1. age ≤ = 20
2. is. student = yes

Then: He will buy iphone