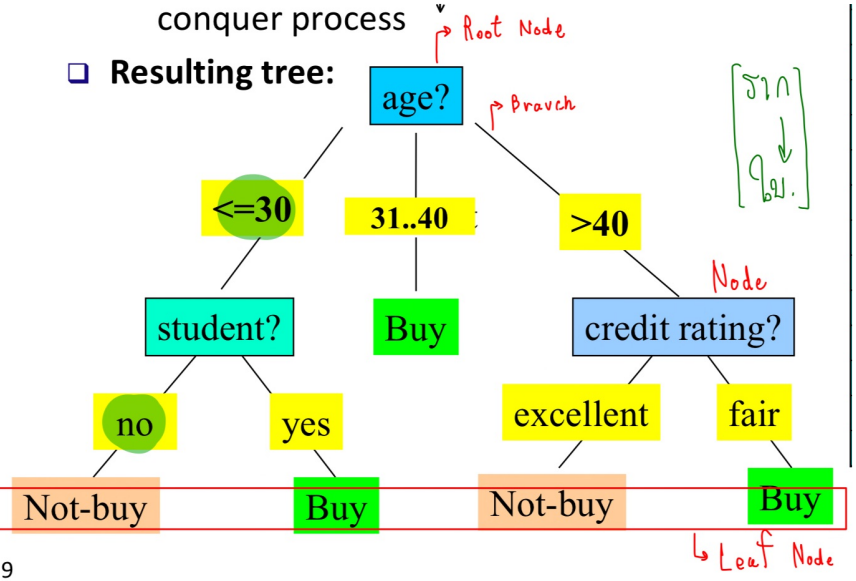
conquer process

- **Resulting tree:**



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

er?

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

1.) $Info(D) = -\sum_{i=1}^{m} p_i \log_2(p_i)$ → $Info(D) = I(9,5) = -\frac{9}{14}\log_2(\frac{9}{14}) - \frac{5}{14}\log_2(\frac{5}{14}) = 0.940$

2. $Info_A(D) = \sum_{j=1}^{v} \frac{|D_j|}{|D|} \times Info(D_j)$

2.1 $Info_{age}(D) = \frac{5}{14} I(2,3) + \frac{4}{14} I(4,0) + \frac{5}{14} I(3,2) = \frac{5}{14}\left[-\frac{2}{5}\log_2(\frac{2}{5}) - \frac{3}{5}\log_2(\frac{3}{5})\right] + \frac{4}{14}\left[-\frac{4}{4}\log_2(\frac{4}{4})\right] + \frac{5}{14}\left[-\frac{3}{5}\log_2(\frac{3}{5}) - \frac{2}{5}\log_2(\frac{2}{5})\right] = 0.694$

2.2 $Info_{income}(D) = \frac{4}{14} I(2,2) + \frac{6}{14} I(4,2) + \frac{4}{14} I(3,1) = \frac{4}{14}\left[-\frac{2}{4}\log_2(\frac{2}{4}) - \frac{2}{4}\log_2(\frac{2}{4})\right] + \frac{6}{14}\left[-\frac{4}{6}\log_2(\frac{4}{6}) - \frac{2}{6}\log_2(\frac{2}{6})\right] + \frac{4}{14}\left[-\frac{3}{4}\log_2(\frac{3}{4}) - \frac{1}{4}\log_2(\frac{1}{4})\right] = 0.911$

2.3 $Info_{student}(D) = \frac{7}{14} I(6,1) + \frac{7}{14} I(3,4) = \frac{7}{14}\left[-\frac{6}{7}\log_2(\frac{6}{7}) - \frac{1}{7}\log_2(\frac{1}{7})\right] + \frac{7}{14}\left[-\frac{3}{7}\log_2(\frac{3}{7}) - \frac{4}{7}\log_2(\frac{4}{7})\right] = 0.789$

2.4 $Info_{credit\_rating}(D) = \frac{8}{14} I(6,2) + \frac{6}{14} I(3,3) = \frac{8}{14}\left[-\frac{6}{8}\log_2(\frac{6}{8}) - \frac{2}{8}\log_2(\frac{2}{8})\right] + \frac{6}{14}\left[-\frac{3}{6}\log_2(\frac{3}{6}) - \frac{3}{6}\log_2(\frac{3}{6})\right] = 0.892$

3. $Gain(A) = Info(D) - Info_A(D)$ คำนวณ Information Gain โดยค่า Gain ที่สูงที่สุด จะเป็น (root node)

3.1 $Gain(age) = 0.940 - 0.694 = 0.246$ → เลือก Gain (age) เป็น (root node) มีค่าสูงสุด

3.2 $Gain(income) = 0.940 - 0.911 = 0.029$

3.3 $Gain(student) = 0.940 - 0.789 = 0.151$

3.4 $Gain(credit\_rating) = 0.940 - 0.892 = 0.048$

4. แยกกลุ่ม feature ตามค่าใน (root node)

4.1 <=30 → $Info(D) = I(2,3) = 0.971$

→ $Info_{income}(D) = \frac{2}{5} I(0,2) + \frac{2}{5} I(1,1) + \frac{1}{5} I(1,0) = 0.4$

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

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

คำนวณ Information Gain

$Gain(Income) = 0.971 - 0.4 = 0.571$

$Gain(Student) = 0.971 - 0 = 0.971$

$Gain(Credit-rating) = 0.971 - 0.951 = 0.02$

* เลือก Gain (Student) เป็น node ถัดไป <= 30

4.2 31…40

yes = 4, no = 0 เมื่ออายุ 31…40

สามารถตอบ yes ใน buys_computer ได้เลย

4.3 >40 → $Info(D) = I(3,2) = -\frac{3}{5}\log_2(\frac{3}{5}) - \frac{2}{5}\log_2(\frac{2}{5}) = 0.971$

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

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

คำนวณ Information Gain

$Gain(Income) = 0.971 - 0.951 = 0.02$

$Gain(Student) = 0.971 - 0.951 = 0.02$

$Gain(Credit-rating) = 0.971 - 0 = 0.971$

* เลือก Gain (credit-rating) เป็น node ถัดไป >40

ณัฐกรณ์ พวงแก้ว
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5. สามารถสร้าง Decision Tree ได้ดังนี้