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

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

| 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 |

$$Info_{age}(D) = \frac{5}{14}I(2,3) + \frac{4}{14}I(4,0)$$
$$+ \frac{5}{14}I(3,2) = 0.694$$

$\frac{5}{14}I(2,3)$ means "age <=30" has 5 out of 14 samples, with 2 yes'es and 3 no's.

Hence

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

Similarly, we can get

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

Info(D) = I(8,4) = -log(8/12)log2(8/12)-(4/12)log2(4/12)=0.291

Infoage(D)

| Age | pi | ni | I(pi,ni) |
|-----|-----|-----|----------|
| <=30 | 2 | 2 | -0.193 |
| 31...40 | 3 | 0 | 0 |
| >40 | 3 | 2 | 0.152 |

Infoage(D): 4/12(I(2,2))+3/12(I(3,0))+5/12(I(3,2))=(4/12)(-0.193)+0+(5/12)(0.152)=-0.001

Gain(age)=0.291+0.001=0.292

Infoincome(D)

| Income | Pi | Ni | I(pi,ni) |
|--------|-----|-----|----------|
| High | 2 | 2 | -0.193 |
| Medium | 4 | 1 | 0.393 |
| Low | 2 | 1 | 0.2911 |

Infoincome(D):(4/12)(-0.193)+(5/12)(0.393)+(3/12)(0.2911)=0.172

Gain(student)=0.119

Infostudent

| student | Pi | Ni | I(pi,ni) |
|---------|-----|-----|----------|
| Yes | 5 | 1 | 0.383 |
| No | 3 | 3 | -0.193 |

Infostudent(D)=(6/12)(0.383)+(6/12)(-0.193)=0.095

Gain(student) = 0.196

Infocredit

| Credit_rating | Pi | Ni | I(pi,ni) |
|---|---|---|---|
| Fair | 6 | 1 | 0.367 |
| Excellent | 2 | 3 | -0.769 |

Infocredit = (7/12)(0.367)+(5/12)(-0.769)=-0.106

Gain(credit)= 0.397