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CSCI 3202

Problem Set 3

**Problem 3.1**

1. P(N, C, L) =0.7 \* 0.4 \* 0.2 = 0.056

P(~N, C, L) = 0.3 \* 0.4 \* 0.6 = 0.072

P(N, ~C, L) = 0.7 \* 0.6 \* 0.5 = 0.21

P(~N, ~C, L) = 0.3 \* 0.6 \* 0.8 = 0.144

P(L) = 0.056 + 0.072 + 0.21 + 0.144 = 0.482

P(B) = P(B|L)P(L) + P(B|~L)P(~L)

= 0.9(0.482) + 0.2(0.518)

= 0.5374

P(M) = P(M|L)P(L) + P(M|~L)P(~L)

= 0.6(0.482) + 0.3(0.518)

= 0.4446

P(S) = P(S|M)P(M) + P(S|~M)P(~M)

= 0.8(0.4446) + 0.1(0.5554)

= 0.41122

1. New P(L) = P(L|N, C)P(N) + P(L|~N, C)P(~N) = 0.2(0.7) + 0.6(0.3) = 0.32

P(B) = P(B|L)P(L) + P(B|~L)P(~L)

= 0.9(0.32) + 0.2(0.68)

= 0.424

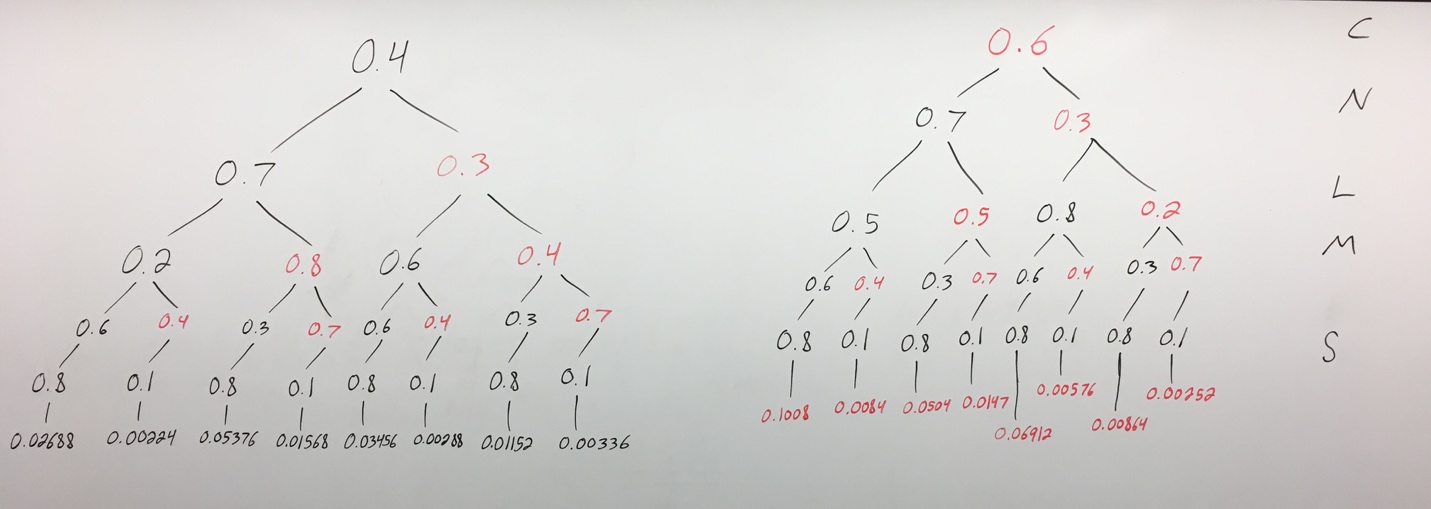
P(M) = P(M|L)P(L) + P(M|~L)P(~L)

= 0.6(0.32) + 0.3(0.68)

= 0.396

P(B, M) = 0.424 \* 0.396

= 0.167904

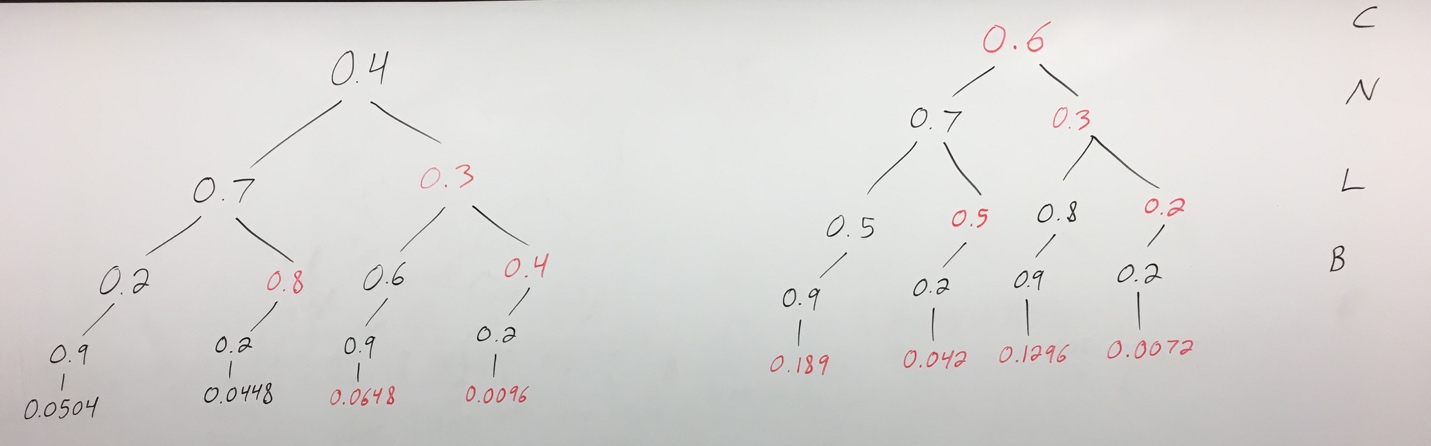


P(C|S) = P(S|C) / [P(S|C) + (S|~C)]

= summation of black leaf nodes / summation of all leaf nodes

= 0.15088 / 0.41122

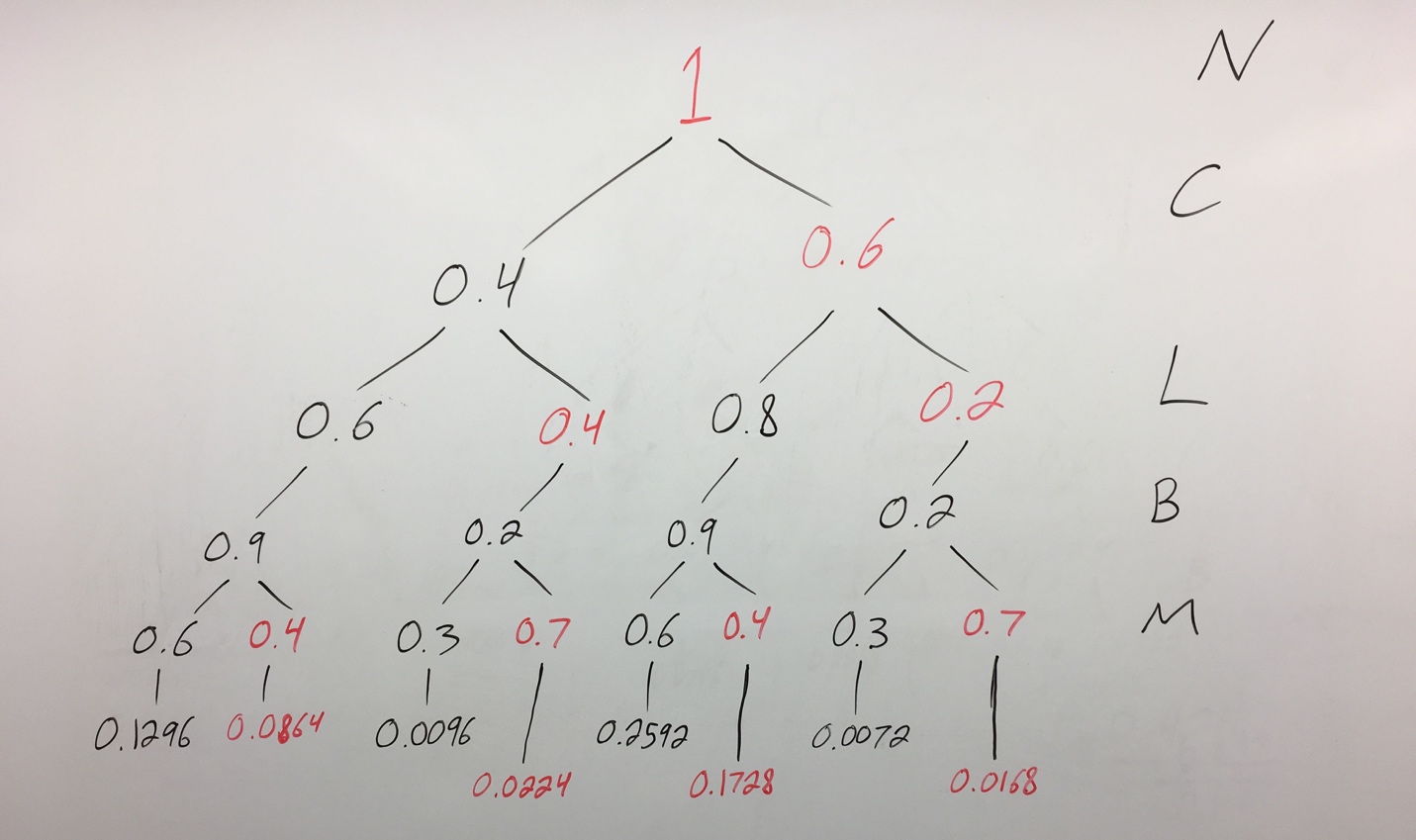
≈ 0.3669



P(C, N|B) = summation of black leaf nodes / summation of all leaf nodes

= 0.0952 / 0.5374

≈ 0.17715



P(M|B, ~N) = summation of black leaf nodes / summation of all leaf nodes

= 0.4056 / 0.704

≈ 0.5761

**Problem 3.2**

1. Starting information =

=

= 1

Attribute A Set 1 =

= 0.6 \* (0.38998 + 0.52832)

= 0.6 \* (0.9183)

= 0.55098

Attribute A Set 2 =

= 0.4 \* (0.5 + 0.31128)

= 0.4 \* (0.811280

= 0.324512

Attribute A = 0.55098 + 0.324512

= 0.875492

Attribute B Set 1 =

= 0.875 \* (0.4613 + 0.5239)

= 0.875 \* (0.9852)

= 0.8621

Attribute B Set 2 =

= 0.125 \* (0+ 0)

= 0.125 \* (0)

= 0

Attribute B = 0.8621 + 0

= 0.8621

The *change in information* by using attribute B is greater, so B is the more informative attribute.

1. Starting information =

=

= 1

Attribute A Set 1 =

= 0.5 \* (0.2575 + 0.4644)

= 0.5 \* (0.7219)

= 0.36095

Attribute A Set 2 =

= 0.5 \* (0.4644 + 0.2575)

= 0.5 \* (0.7219)

= 0.36095

Attribute A = 0.36095 + 0.36095

= 0.7219

Attribute B Set 1 =

Attribute B Set 2 =

Attribute B =

**Problem 3.3**

Use city example