CPE 695
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Q1.
The example in 6.2.1 has P(cancer | $\oplus$) = 0.21

Because $\frac{P(cancer \mid \oplus)\ P(cancer)}{P(cancer \mid \oplus)\ P(cancer) + P(cancer \mid \oplus) P(\oplus \mid \neg cancer)}$ = 0.21

$P(cancer \mid \oplus\oplus) = \frac{P(cancer \mid \oplus)\ P(\oplus \mid cancer)}{P(\oplus \mid cancer)\ P(cancer \mid \oplus) + P(\oplus \mid \neg cancer) \times P(\neg cancer \mid \oplus)}$

And $P(\neg cancer \mid \oplus)$ and $P(cancer \mid \oplus)$ must sum to 1
so $P(\neg cancer \mid \oplus)$ = 1 - $P(cancer \mid \oplus)$ = 0.79

$P(cancer \mid \oplus\oplus) = \frac{0.98 \times 0.21}{0.98 \times 0.21 + 0.03 \times 0.79}$ = 0.91

Q2.
Outlook (sunny - yes) => 2/9
Outlook(sunny - no) => 3/5
Outlook (Rainy - yes) = 3/9
Outlook (Rainy - no) = 2/5
Outlook (Overcast - yes) => 4/9
Outlook (Overcast - no) = 0/5

Temperature (hot - yes) => 2/9
Temperature (hot - no) => 2/5
Temperature(cool - yes) => 3/9
Temperature(cool - no) => 1/5
Temperature (mild - yes) => 4/9
Temperature(mild - no) => 2/5

Humidity (high - yes) => 3/9
Humidity (high - no) => 4/5
Humidity (normal - yes) => 6/9
Humidity (normal - no) => 1/5

Wind (strong - yes) => 3/9
Wind (strong - no) => 3/5
Wind (weak - yes) => 6/9
Wind (weak - no) => 2/5

New instance: <Outlook=sun, Temperature=cool, Humidity=high, Wind=strong>
P(yes) = (2/9) * (3/9) * (3/9) * (3/9) * (9/14) = 0.0053

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Q3.
First training iteration:
b = 0
a = 1
weights (c) = $w_{c0} + a * w_{ca} + b * w_{cb}$
= 0.1 + (1) * 0.1 + 0 = 0.2

O_c = 0.55

weights (d) = $w_{d0} + O_c * w_{dc}$
= 0.1+0.55*0.1 = 0.155

Errors when d=1:

error (c) = 0.55*(1-0.55)*(1-0.55)=0.111375

error (d) = 0.55(1-0.55)*0.1*0.111375 = 0.00275653125

a =1
b=0
Learning rate = 0.3

Δw_{d0} = 0.3*0.111375*1 = 0.0334125

Δw_{dc} = 0.3*0.111375*0.55 = 0.018376875

Δw_{c0} = 0.3*0.00275653125*1 = 0.00082695937

Δw_{ca} = 0.3*0.00275653125*1 = 0.00082695937

Δw_{cb} = 0

First iteration:

w_{d0} = 0.1 + 0.0334125 = 0.1334125

w_{dc} = 0.1 + 0.018376875 = 0.118376875

w_{c0} = 0.1 + 0.00082695937 = 0.10082695937

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w_{ca} = 0.1 + 0.00082695937 = 0.10082695937

w_{cb} = 0.1 + 0 = 0.1

Training example 2:

Errors when d=0:

error (c) = 0.55*(1-0.55)*(0 -0.55) = -0.136125

error (d) = 0.55(1-0.55)*0.1*0.136125 = 0.00336909375

a=0
b=1
Learning rate = 0.3
momentum = 0.9

Δw_{d0} = 0.3 * (0.136125) * 1 + 0.9 * 0.0334125 = 0.07090875

Δw_{dc} = 0.3 * (0.136125) * 0.55 + 0.9 * 0.018376875 = 0.0389998125

Δw_{c0} = 0.3 * (-0.0389998125) * 1 + 0.9 * 0.00082695937 = -0.01095568031

Δw_{ca} = 0.3 * (-0.0389998125) * 0 + 0.9 * 0.00082695937 = 0.00074426343

Δw_{cb} = 0.3 * (-0.0389998125) * 1 + 0.9 * 0 = -0.01169994375

Second iteration :

w_{d0} = 0.2 + 0.07090875 = 0.27

w_{dc} = 0.2 + 0.0389998125 = 0.24

w_{c0} = 0.2 + (-0.01095568031) = 0.19

w_{ca} = 0.2 + 0.00074426343 = 0.20

w_{cb} = 0.2 + (-0.01169994375) = 0.19