

١٥ طوبة ١٧٣٨ ق

Bayes Rule Diagram

## 1- Bayes Rule

08:00

Holy Grail, Rev Thomas  
Baye,

P(C) Prior

P(Pos|C) Sensitivity

Bayes, P<sub>01</sub>

09:00

## 2- Cancer Test

Ex: P(C) = 0.01 Sensitivity

10:00

TEST: 90% Pos if have C

90% Neg if don't have C

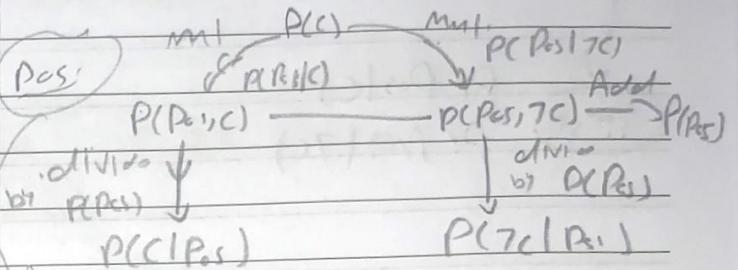
11:00

Specificity

Ques: TEST = Positive

12:00

Probability of having cancer?

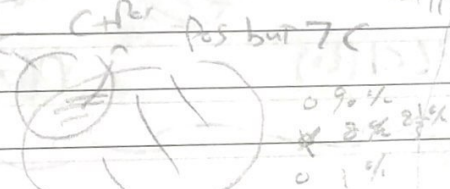


Neg

تقسيم الاحتمال لـ Pos

Cancer Probab: 1%

01:00



02:00

 $P(C) = 0.01$  $P(C|C) = 0.99$  $P(Pos|C) = 0.9$  $P(Neg|C) = 0.1$  $P(Neg|C) = 0.1$  $P(C|Neg) = 0.11$ 

03:00

## 4- Prior and Posterior

04:00

Prior + Test = Posterior  
Probability Evidence ProbabilityPrior  $P(C) = 0.01 = 1\%$   $P(C) = 0.99$ 

05:00

 $P(Pos|C) = 0.9 = 90\%$  $P(Neg|C) = 0.1$   $P(Pos|Neg) = 0.1$ 

06:00

Posterior:  $P(C|Pos) = P(C) \cdot P(Pos|C)$ Joint  $P(C|Pos) = P(C) \cdot P(Pos|C)$ 

07:00

 $0.0099$   $0.0099$ Marginal:  $P(Pos) = P(C) \cdot P(Pos|C) + P(Neg) \cdot P(Pos|Neg)$ 

08:00

 $0.0109$ Posterior:  $P(C|Pos) = \frac{0.0099}{0.0109}$  $0.9167$ 

Ex:?

 $P(C) = 0.1$  $P(C|C) = 0.9$  $P(Pos|C) = 0.9$  $P(Neg|C) = 0.1$  $P(Neg|C) = 0.1$  $P(Pos|Neg) = 0.5$ 

Res = Neg

 $P(C, Neg) = 0.01$  $P(C, Neg) = 0.09$  $P(Neg) = 0.46$  $P(C|Neg) = 0.0217$  $P(C|Neg) = 0.9783$



24

Monday  
January

٢١ جماد آخر ١٤٤٣ هـ

الأثنين  
يناير

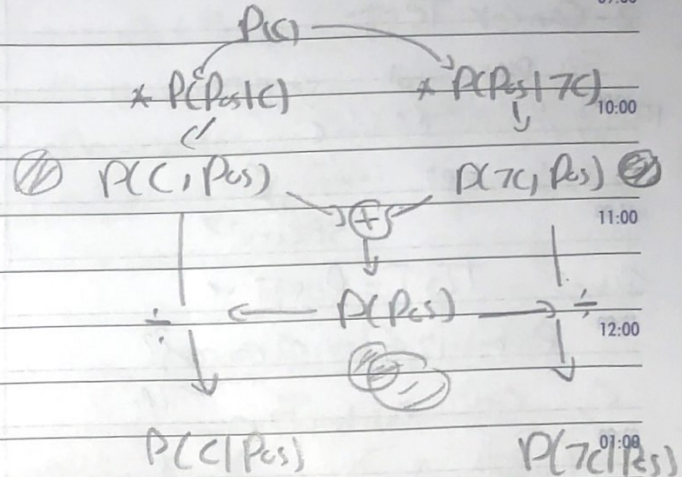
٢٤

١٦ طوبة ١٧٣٨ ق

## Bayes Rule Summary

(C) Prior  $P(C)$

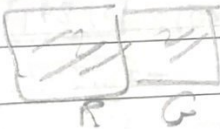
TEST  $P(Pos|C)$   
 $P(Neg|Tc)$



32 Robot Senses

$P(R) = P(G) = 0.5$

$P(S_{RR}|ATR) = 0.8$   
 $P(S_{RG}|ATR) = 0.2$



Posterior Prob

$P(ATR|S_{RR}) = 0.8$   
 $P(ATG|S_{RR}) = 0.2$

see: Rel

For  $P(R)=0, P(G)=1$

$\Rightarrow P(ATR|see R) = 0$   
 $P(ATG|see R) = 1$

For  $P(R)=0.5, P(G)=0.5$

$P(see R|ATR) = 0.8$   
 $P(see G|ATR) = 0.2$

$\Rightarrow P(ATR|see R) = 0.65$   
 $P(ATG|see R) = 0.35$

$0.1 \rightarrow 0.65$   
 $0.15 \rightarrow 0.35$   
 $0.65$

# 25 Tuesday

## January

٢٢ جماد آخر ١٤٤٣ هـ

الثلاثاء  
يناير

٢٥

١٧ طوبة ١٧٢٨ ق

08:00  $P(A) = P(B) = P(C) = \frac{1}{3}$

$P(A|A) = 0.9$

09:00  $P(G|B) = 0.9$

$P(G|C) = 0.9$

10:00  $P(A, R) = [0.3]$

$P(B, R) = [0.033]$

11:00  $P(C, R) = [0.033]$

$P(R) = [0.366]$

12:00  $P(A|R) = [0.818]$

$P(B|R) = [0.09]$

01:00  $P(C|R) = [0.09]$

$\Sigma = [1]$

02:00

SEBASTIAN:

03:00  $P(\text{gone}) = 0.6$

$P(\text{home}) = 0.4$

04:00  $P(\text{rain} | \text{home}) = 0.01$

$P(\text{vol.} | \text{gone}) = 0.3$

05:00  $P(\text{home} | \text{rain}) = [0.0217]$   
 $0.4 \cdot 0.01$

06:00  $0.4 \cdot 0.01 + 0.6 \cdot 0.3$

07:00

08:00

Quiz - Bayes' Rule

Traffic light 91

1)  $P(Y|S) = 0.12$

Traffic light 92

2)  $[0.48]$

Traffic light 93

3) prior probabilities

4) Bayes 91

$[0.45]$

5) Bayes 93

$[0.1538]$