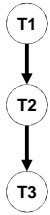


Exercise 1



- T1, T2 and T3 take the values true and false

	T1=false	T1=true
	0.8	0.2

T1	T2=false	T2=true
false	0.7	0.3
true	0.4	0.6

T2	T3=false	T3=true
false	0.7	0.3
vero	0.4	0.6

Slide 1

Exercise 1

- Compute $P(T1|\sim T2, T3)$.
- $$P(T1|\sim T2, T3) = \frac{P(T1, \sim T2, T3)}{P(\sim T2, T3)}$$

$$= \frac{P(T1, \sim T2, T3)}{P(T1, \sim T2, T3) + P(\sim T1, \sim T2, T3)}$$

Slide 2

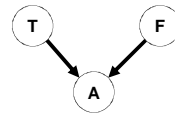
Exercise 1

- $$P(T1, \sim T2, T3) = P(T1)P(\sim T2|T1)P(T3|T1, \sim T2) = P(T1)P(\sim T2|T1)P(T3|\sim T2) = 0.2 \cdot 0.4 \cdot 0.3 = 0.024$$
- $$P(\sim T1, \sim T2, T3) = P(\sim T1)P(\sim T2|\sim T1)P(T3|\sim T1, \sim T2) = P(\sim T1)P(\sim T2|\sim T1)P(T3|\sim T2) = 0.8 \cdot 0.7 \cdot 0.3 = 0.168$$
- $$P(T1|\sim T2, T3) = \frac{0.024}{0.024 + 0.168} = 0.125$$

Slide 3

Exercise 2

- T=Terremoto, F=Furto and A=Allarme take the values true and false



Slide 4

Exercise 2

	T=false	T=true
	0.9	0.1

	F=false	F=true
	0.7	0.3

T	F	A=false	A=true
false	false	0.9	0.1
false	true	0.2	0.8
true	false	0.3	0.7
true	true	0.1	0.9

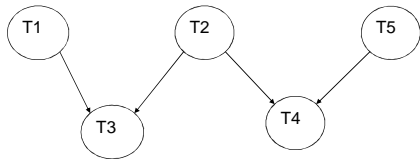
Slide 5

Exercise 2

- Compute $P(T|\sim F, A)$
- $$P(T|\sim F, A) = \frac{P(T, \sim F, A)}{P(\sim F, A)} = \frac{P(T, \sim F, A)}{P(T, \sim F, A) + P(\sim T, \sim F, A)}$$
- $$P(T, \sim F, A) = P(T)P(\sim F|T)P(A|T, \sim F) = P(T)P(\sim F)P(A|T, \sim F) = 0.1 \cdot 0.7 \cdot 0.7 = 0.049$$
- $$P(\sim T, \sim F, A) = P(\sim T)P(\sim F|\sim T)P(A|\sim T, \sim F) = P(\sim T)P(\sim F)P(A|\sim T, \sim F) = 0.9 \cdot 0.7 \cdot 0.1 = 0.063$$
- $$P(T|\sim F, A) = \frac{0.049}{0.049 + 0.063} = 0.4375$$

Slide 6

Exercise 3



Slide 7

Exercise 3

T1= falso	T1= vero	T2= falso	T2= vero	T5	T5= falso	T5= vero
0.1	0.9	0.4	0.6		0.1	0.9

T1	T2	T3= falso	T3= vero
falso	falso	0.8	0.2
falso	vero	0.6	0.4
vero	falso	0.1	0.9
vero	vero	0.3	0.7

T2	T5	T4= falso	T4= vero
falso	falso	0.5	0.5
falso	vero	0.1	0.9
vero	falso	0.4	0.6
vero	vero	0.3	0.7

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Exercise 3

- Query $P(\sim T1|T3, T4, \sim T5)$.

$$P(\sim T1|T3, T4, \sim T5) = P(\sim T1, T3, T4, \sim T5) / P(T3, T4, \sim T5)$$

$$P(\sim T1, T3, T4, \sim T5) = P(\sim T1, \sim T2, T3, T4, \sim T5) + P(\sim T1, T2, T3, T4, \sim T5)$$

$$P(T3, T4, \sim T5) = P(\sim T1, T3, T4, \sim T5) + P(T1, T3, T4, \sim T5) + P(\sim T1, \sim T2, T3, T4, \sim T5) + P(\sim T1, T2, T3, T4, \sim T5) + P(T1, \sim T2, T3, T4, \sim T5) + P(T1, T2, T3, T4, \sim T5)$$

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Exercise 3

$$P(\sim T1, \sim T2, T3, T4, \sim T5) = P(\sim T1)P(\sim T2)P(T3|\sim T1, \sim T2)P(\sim T5)P(T4|\sim T2, \sim T5) = 0.1 \cdot 0.4 \cdot 0.2 \cdot 0.1 \cdot 0.5 = 0.0004$$

$$P(\sim T1, T2, T3, T4, \sim T5) = P(\sim T1)P(T2)P(T3|\sim T1, T2)P(\sim T5)P(T4|T2, \sim T5) = 0.1 \cdot 0.6 \cdot 0.4 \cdot 0.1 \cdot 0.6 = 0.00144$$

$$P(T1, \sim T2, T3, T4, \sim T5) = P(T1)P(\sim T2)P(T3|T1, \sim T2)P(\sim T5)P(T4|\sim T2, \sim T5) = 0.9 \cdot 0.4 \cdot 0.9 \cdot 0.1 \cdot 0.5 = 0.0162$$

$$P(T1, T2, T3, T4, \sim T5) = P(T1)P(T2)P(T3|T1, T2)P(\sim T5)P(T4|T2, \sim T5) = 0.9 \cdot 0.6 \cdot 0.7 \cdot 0.1 \cdot 0.6 = 0.02268$$

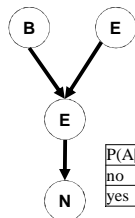
$$P(\sim T1, T3, T4, \sim T5) = 0.0004 + 0.00144 = 0.00184$$

$$P(T3, T4, \sim T5) = 0.00184 + 0.0162 + 0.02268 = 0.04072$$

$$P(\sim T1|T3, T4, \sim T5) = 0.00184 / 0.04072 = 0.04519$$

Slide 10

Alarm



P(B)		P(E)	
B=no	0.7	E=no	0.6
B=door	0.1	E=moderate	0.2
B=windows	0.2	E=severe	0.2

P(A EB)	no, no	no, do	no, wi	mo, no	mo, do	mo, wi	se, no	se, do	se, wi
no	0.99	0.1	0.2	0.8	0.08	0.1	0.7	0.05	0.07
yes	0.01	0.9	0.8	0.2	0.92	0.9	0.3	0.95	0.93

P(N A)		A=no	A=yes
N=no	0.9	0.05	
N=yes	0.1	0.95	

Slide 11

Alarm

- Compute $P(B=\text{door}|N=\text{yes}, E=\text{no})$
- $P(\text{door}|N=\text{yes}, E=\text{no}) = P(\text{door}, N, E=\text{no}) / P(N, E=\text{no})$
- $P(\text{door}, N, E=\text{no}) = P(\text{door}, E=\text{no}, A=\text{no}, N) + P(\text{door}, E=\text{no}, A=\text{yes}, N)$
- $P(N, E=\text{no}) = P(\text{door}, N, E=\text{no}) + P(\text{no}, N, E=\text{no}) + P(\text{wi}, N, E=\text{no}) = P(\text{door}, N, E=\text{no}) + P(\text{no}, N, E=\text{no}, A=\text{no}) + P(\text{no}, N, E=\text{no}, A=\text{yes}) + P(\text{wi}, N, E=\text{no}, A=\text{no}) + P(\text{wi}, N, E=\text{no}, A=\text{yes})$

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Alarm

- $P(\text{door}, E=\text{no}, A=\text{no}, N) = P(\text{door})P(E=\text{no})P(A=\text{no}|\text{door}, E=\text{no})$
 $P(N|A=\text{no}) = 0.1 * 0.6 * 0.1 * 0.1 = 0.0006$
- $P(\text{door}, E=\text{no}, A=\text{yes}, N) = P(\text{door})P(E=\text{no})$
 $P(A=\text{yes}|\text{door}, E=\text{no})P(N|A=\text{yes}) = 0.1 * 0.6 * 0.9 * 0.95 = 0.0513$
- $P(\text{no}, N, E=\text{no}, A=\text{no}) = P(\text{no})P(E=\text{no})P(A=\text{no}|\text{no}, E=\text{no})$
 $P(N|A=\text{no}) = 0.7 * 0.6 * 0.99 * 0.1 = 0.04158$
- $P(\text{no}, N, E=\text{no}, A=\text{yes}) = P(\text{no})P(E=\text{no})$
 $P(A=\text{yes}|\text{no}, E=\text{no})P(N|A=\text{yes}) = 0.7 * 0.6 * 0.01 * 0.95 = 0.00399$
- $P(\text{wi}, N, E=\text{no}, A=\text{no}) = P(\text{wi})$
 $P(E=\text{no})P(A=\text{no}|\text{wi}, E=\text{no})P(N|A=\text{no}) = 0.2 * 0.6 * 0.2 * 0.1 = 0.0024$
- $P(\text{wi}, N, E=\text{no}, A=\text{yes}) = P(\text{wi})$
 $P(E=\text{no})P(A=\text{yes}|\text{wi}, E=\text{no})P(N|A=\text{yes}) = 0.2 * 0.6 * 0.8 * 0.95 = 0.0912$

Slide 13

Alarm

- $P(\text{door}, N, E=\text{no}) = 0.0006 + 0.0513 = 0.0519$
- $P(N, E=\text{no}) = 0.0519 + 0.04158 + 0.00399 + 0.0024 + 0.0912 = 0.191070$
- $P(B=\text{door}|N=\text{yes}, E=\text{no}) = 0.0519 / 0.191070 = 0.27163$

Slide 14