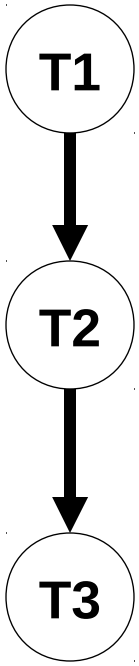
Exercise 1



- 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
falso	0.7	0.3
vero	0.4	0.6

Exercise 1

- Compute P(T1|~T2,T3).

- P(T1|~T2,T3)=
  P(T1,~T2,T3)/P(~T2,T3) =
  P(T1,~T2,T3)/(P(T1,~T2,T3)+ P(~T1,~T2,T3))

Exercise 1

	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
falso	0.7	0.3
vero	0.4	0.6

- P(T1,~T2,T3)=

  P(T1)P(~T2|T1)P(T3|T1,~T2)=

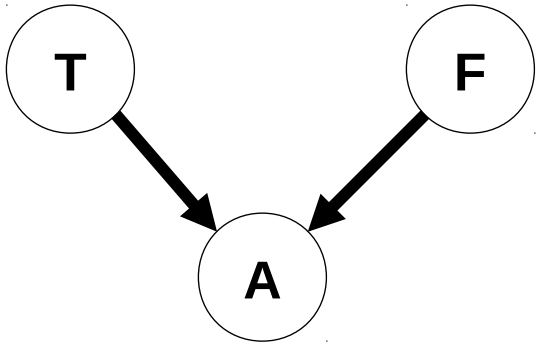
  P(T1)P(~T2|T1)P(T3|~T2) =0.2*0.4*0.3=0.024
- P(~T1,~T2,T3)=

  P(~T1)P(~T2|~T1)P(T3|~T1,~T2)=

  P(~T1)P(~T2|~T1)P(T3|~T2) =0.8*0.7*0.3=0.168
- P(T1|~T2,T3) =0.024/(0.024+0.168)=0.125

Exercise 2

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



	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

Exercise 2

- Compute P(T|~F,A)

- P(T|~F,A)=
  P(T,~F,A)/P(~F,A)=
  P(T,~F,A)/(P(T,~F,A)+ P(~T,~F,A))

Exercise 2

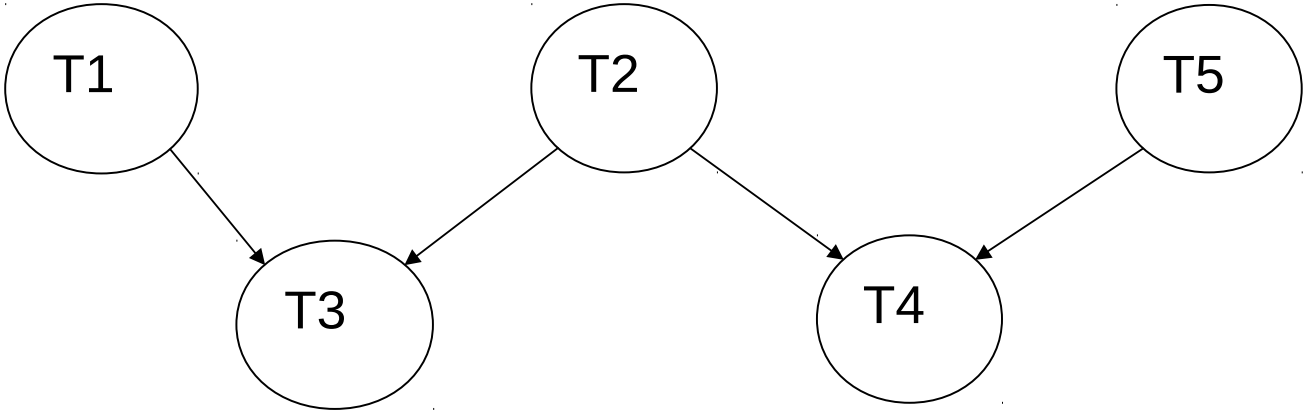
	T=false	T=true
	0.9	0.1

	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

- P(T,~F,A)=P(T)P(~F|T)P(A|T,~F)= P(T)P(~F)P(A|T,~F) = 0.1*0.7*0.7=0.049
- P(~T,~F,A)=P(~T)P(~F|~T)P(A|~T,~F)= P(~T)P(~F)P(A|~T,~F) =0.9*0.7*0.1=0.063
- P(T|~F,A) =0.049/(0.049+0.063)=0.4375

Exercise 3



	T1=Falso	T1=Vero
	0.1	0.9

	T2=Falso	T2=Vero
	0.4	0.6

T5	T5=falso	T5=vero
	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

Exercise 3

- Query P(~T1|T3,T4,~T5).

P(~T1|T3,T4,~T5)=P(~T1,T3,T4,~T5)/P(T3,T4,~T5)

P(~T1,T3,T4,~T5)= P(~T1,~T2,T3,T4,~T5)+
P(~T1,T2,T3,T4,~T5)

P(T3,T4,~T5)= P(~T1,T3,T4,~T5)+ P(T1,T3,T4,~T5)=
P(~T1,~T2,T3,T4,~T5)+ P(~T1,T2,T3,T4,~T5)+
P(T1,~T2,T3,T4,~T5)+ P(T1,T2,T3,T4,~T5)

Exercise 3

	T1=Falso	T1=Vero
	0.1	0.9

	T2=Falso	T2=Vero
	0.4	0.6

T5	T5=falso	T5=vero
	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

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

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

0.00144

Exercise 3

	T1=Falso	T1=Vero
	0.1	0.9

	T2=Falso	T2=Vero
	0.4	0.6

T5	T5=falso	T5=vero
	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

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

0.0162

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

Exercise 3

P(~T1,~T2,T3,T4,~T5)=0.0004

P(~T1,T2,T3,T4,~T5)=0.00144

P(T1,~T2,T3,T4,~T5)=0.0162

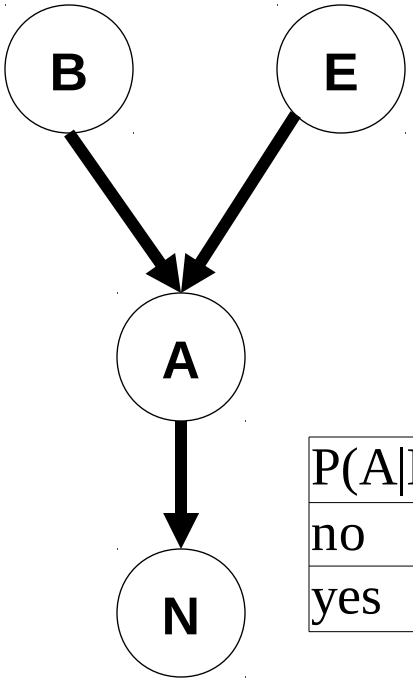
P(T1,T2,T3,T4,~T5)=0.02268

P(~T1,T3,T4,~T5)= 0.0004+0.00144 =0.00184

P(T3,T4,~T5)= 0.00184+ 0.0162+0.02268=0.04072

P(~T1|T3,T4,~T5) = 0.00184/0.04072=0.04519

Alarm



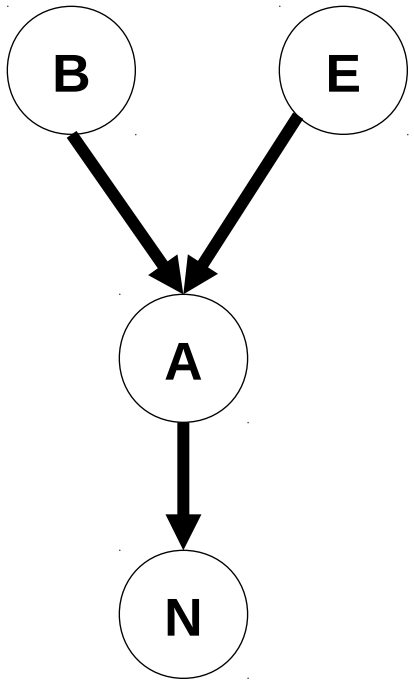
P(B)	
B=no	0,7
B=door	0,1
B=windows	0,2

P(E)	
E=no	0,6
E=moderate	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

Alarm



- Compute P(B=door|N=yes,E=no)
- P(door|N=yes,E=no)= P(door,N,E=no)/P(N,E=no)
- P(door,N,E=no)=P(door,E=no,A=no,N) +P(door,E=no,A=yes,N)
- P(N,E=no)=P(door,N,E=no) +P(no,N,E=no)+P(wi,N,E=no)= P(door,N,E=no)+ P(no,N,E=no,A=no) +P(no,N,E=no, A=yes)+ P(wi,N,E=no,A=no) +P(wi,N,E=no,A=yes)

Alarm

P(B)	
B=no	0,7
B=door	0,1
B=windows	0,2

P(E)	
E=no	0,6
E=moderate	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

- P(door,E=no,A=no,N)=P(door)P(E=no)P(A=no|door,E=no) P(N|A=no)=0.1*0.6*0.1*0.1=0.0006
- P(door,E=no,A=yes,N)=P(door)P(E=no) P(A=yes| door,E=no)P(N|A=yes)=0.1*0.6*0.9*0.95=0.0513

Alarm

P(B)	
B=no	0,7
B=door	0,1
B=windows	0,2

P(E)	
E=no	0,6
E=moderate	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

- P(no,N,E=no,A=no)=P(no) P(E=no)P(A=no|no,E=no) P(N|A=no)=0.7*0.6*0.99*0.1=0.04158
- P(no,N,E=no,A=yes)= P(no) P(E=no) P(A=yes|no,E=no)P(N|A=yes)=0.7*0.6*0.01*0.95=0.00399

Alarm

P(B)	
B=no	0,7
B=door	0,1
B=windows	0,2

P(E)	
E=no	0,6
E=moderate	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

- P(wi,N,E=no,A=no)= P(wi) P(E=no)P(A=no|wi,E=no)P(N|A=no)=0.2*0.6*0.2*0.1= 0.0024
- P(wi,N,E=no, A=yes)= P(wi) P(E=no)P(A=yes|wi,E=no)P(N|A=yes)=0.2*0.6*0.8*0.95= 0.0912

Alarm

- P(door,E=no,A=no,N)=0.0006
- P(door,E=no,A=yes,N)=0.0513
- P(no,N,E=no,A=no)=0.04158
- P(no,N,E=no,A=yes)=0.00399
- P(wi,N,E=no,A=no)=0.0024
- P(wi,N,E=no, A=yes)=0.0912

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