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1

a) Prove Pr(A, B | K) = Pr(A | B, K) Pr(B | K)

Pr(A, B, K) = Pr (A, B | K) * Pr (k)
Pr(A, B, K) = Pr (A | B, K) * Pr (B, K)   since Pr(B, K) = Pr (B | K) * Pr(k)
= Pr (A | B, K) * Pr (B | K) * Pr(K)

So Pr (A, B | K) * Pr (k) = Pr (A | B, K) * Pr (B | K) * Pr(K)   divide both sides by Pr(K)
Then I proved Pr(A, B | K) = Pr(A | B, K) Pr(B | K)

b) Prove Pr(A, B | K) = Pr(B | A, K) Pr (A| K) / Pr (B | K)

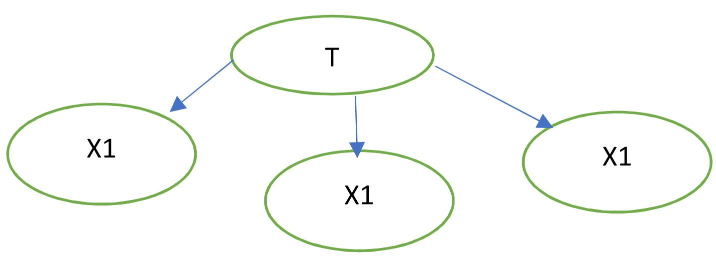
Pr(A, B, K) = Pr (A| B , K) * Pr (B, k) = Pr (A | B , K) * Pr (B | K) * Pr (K)
Pr(A, B, K) = Pr(B | A, K) * Pr(A, K) = Pr(B | A, K) * Pr(A | K)* Pr(K)

So Pr (A | B, K) * Pr (B | K) * Pr (K) = Pr(B | A, K) * Pr(A | K)* Pr(K)
I divide both sides by Pr (K) and Pr (B | K)

Then I proved Pr(A, B | K) = Pr(B | A, K) Pr (A| K) / Pr (B | K)

2

We assume a random variable T denoting which coin {a, b, c} we drew



The CPT for the A is

T	P (T)
a	1/3
b	1/3
c	1/3

Since the Xi (I = 1,2,3) are independent from each other. The probability to get heads are the same for i = 1,2,3. The CPT for Xi give T is

T	Xi	P(T)
a	Heads	0.2
b	Heads	0.6
c	heads	0.8

3

black	square	one	Pr
1	1	1	2/13
1	1	0	4/13
1	0	1	1/13
1	0	0	2/13
0	1	1	1/13
0	1	0	1/13
0	0	1	1/13
0	0	0	1/13

A1: Pr(black) = 2/13 + 4/13 + 1/13 + 2/13 = 9/13 = 0.692

A2: Pr(square) = 2/13 + 4/13 + 1/13 + 1/13 =8/13 = 0.615

A3: Pr(square, (one V black) / Pr(one V black) = (7/13) / (11/13) = 7/11

For the two sentences

A = one, β = square, γ = black Pr(one| black) = 1/3 Pr(one | black, square) = 1/3

Pr(one| black) = Pr(one | black, square) So it is Independent

A = one, β = square, γ = ¬black Pr(one| ¬black) = 1/3 Pr(one | ¬black, square) = 1/3

Pr(one| ¬black) = Pr(one | ¬black, square) So it is Independent

4

a)

I (A, ∅, {B, E})

I (B, ∅, {A, C})

I (C, A, {B, D, E})

I (D, {A, B}, {C, E})

I (E, B, {A, C, D, F, G})

I (F, {C, D}, {A, B, E})

I (G, F, {A, B, C, D, E, H})

I (H, {E, F}, {A, B, C, D, G})

b)

False: because path ACFHE is open.

False: because path GFHE is open.

False: because path BEH is open.

c)

$P(a,b,c,d,e,f,g,h) = P(a|b,c,d,e,f,g,h)P(b|c,d,e,f,g,h)P(c|d,e,f,g,h)P(d|e,f,g,h)P(e|f,g,h)P(f|g,h)P(g|h)P(h)$

d)

A and B are independent

$P(A = 0,B = 0) = P(A = 0) * P(B = 0) = 0.8 * 0.3 = 0.24$

A and E are independent

$P(E = 1 \mid A = 1) = P(E = 1)$

$P(E = 1) = P(E = 1|B = 0)P(B = 0) + P(E = 1|B = 1)P(B = 1) = 0.9*0.3 + 0.1*0.7 = 0.34$