Wilsen Kosasih
HW7
604501335

1)
a)
P(A,B|K) = P(A|B,K) P(B|K)
P(A,B,K) / P(K) = P(A,B,K) P(B,K) / (P(B,K) P(K))
P(A,B,K) / P(K) = P(A,B,K) / P(K)
➔ LHS = RHS Proven

b)
P(A|B,K) = P(B|A,K)P(A|K)P(B|K)
P(A,B|K) / P(B|K) = P(B,A,K)P(A,K)P(B,K)/(P(A,K) P(K) P(K))
P(A,B|K) / P(B|K) = P(B,A,K)P(B,K) / (P(K) P(K))
P(A,B,K) P(B,K) / (P(K) P(K)) = P(B,A,K)P(B,K) / (P(K) P(K))
➔ LHS = RHS Proven

2)
Given:
P(Oil) = 0.5
P(Gas) = 0.2
P(Neither) = 0.3
P(+|Oil) = 0.9
P(+|Gas) = 0.3
P(+|Neither) = 0.1

P(+) = P(+|Oil)P(Oil) + P(+|Gas)P(Gas) + P(+|Neither)P(Neither)
= 0.5*0.9 + 0.2*0.3 + 0.1*0.3
= 0.54

P(Oil|+) = P(+|Oil) * P(Oil) / P(+)
= 0.9 * 0.5/ 0.54
= 0.83

➔ 0.83

3)

W	Black	Square	One	P
1	F	F	F	1/13
2	F	F	T	1/13
3	F	T	F	1/13
4	F	T	T	1/13
5	T	F	F	2/13
6	T	F	T	1/13
7	T	T	F	4/13
8	T	T	T	2/13

Ai) P(Black) = (2+1+4+2)/13 = 9/13
Aii) P(Square) = (1+1+4+2)/13 = 8/13
Aiii) P(Square | Black or One) = ((1+4+2)/13) / (11/13) = 7/11

Given gamma = Not black

1) alpha = square, beta = one are independent
2) alpha = square, beta = not one are independent

4)
a)
I (A, 0, {B,E})
I (B, 0, {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)

1) d_separated(A, BH, E)
   false, because H unblocks the path A-C-F-H-E
2) d_separated(G, D, E)
   false, because D unblocks the path A-D-B-E
3) d_separated (AB,F,GH)
   true

c) 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) P(A = 0, B = 0) = P(A=0) P(B=0) since A and B are independent
= 0.8 * 0.3
= 0.24

b) $P(E=1|A=1)$ $= P(E=1)$ since A and E are independent

$= P(E=1|B=0)P(B=0) + P(E=1|B=1)P(B=1)$

$= 0.9 * 0.3 + 0.1 * 0.7$

$= 0.34$