



2.

Circle 1:

A	B	C	D
1	1	1	X
1	0	X	1

E-step: $P(D|A,B,C) = P(A)P(B|A)P(C|A)P(D|B,C) / A \propto 0.1 = 0.1$
 $P(\bar{D}|A,B,C) = P(A)P(B|A)P(C|A)P(\bar{D}|B,C) / A \propto 0.9 = 0.9$
 $P(C|A,\bar{B},D) = P(A)P(\bar{B}|A)P(C|A)P(D|\bar{B},C) / A \propto 0.7 \times 0.1 = 0.5385$
 $P(\bar{C}|A,\bar{B},D) = P(A)P(\bar{B}|A)P(\bar{C}|A)P(D|\bar{B},C) / A \propto 0.3 \times 0.2 = 0.4615$

1	1	1	1
1	1	1	0
1	0	1	1
1	0	0	1

M-Step:

	P(A)	A	P(B)	A	P(C)	
0.1						
0.9						
0.5385	T	0.33 <4.8>	T	0.5833 <7.5>	T	0.7115 <8.5385, 3.4615>
0.4615			F	0.3 <3.7>	F	0.1 <1.9>

B	C	P(D)
F	F	0.2353 <2.4615, 8>
F	T	0.1460 <1.5385, 9>
T	F	0.3 <3.7>
T	T	0.1 <1.1, 9.9>

Circle 2:

A	B	C	D
1	1	1	1
1	1	1	0
1	0	1	1
1	0	0	1

E-step: $P(D|A,B,C) = 0.1$ $P(\bar{D}|A,B,C) = 0.9$
 $P(\bar{C}|A,\bar{B},D) \propto 0.2885 \times 0.2353 = 0.3952$
 $P(C|A,\bar{B},D) \propto 0.7115 \times 0.1460 = 0.6048$

M-Step:

B	C	P(D)
F	F	0.2304 <0.3952, 8>
F	T	0.1573 <1.6048, 9>
T	F	0.3 <3.7>
T	T	0.1 <1.1, 9.9>

Circle 3:

A B C D

E-step: $P(D|A,B,C) = 0.1$ $P(\bar{D}|A,B,C) = 0.9$

$P(C|A,\bar{B},D) \propto 0.7171 \times 0.1513 = 0.10847$

$P(\bar{C}|A,\bar{B},D) \propto 0.2829 \times 0.2304 = 0.06523$

M-step:

A	B	C	D	P(A)	P(B)	P(C)
1	1	1	1	0.1		
1	1	1	0	0.9	T 0.33 <4.8>	T 0.7187 <8.6247, 3.3753>
1	0	1	1	0.6247	F 0.3 <3.7>	F 0.1 <1.9>
1	0	0	1	0.3753		
	B	C	P(C)			
	F	F	0.2289	<2.3753, 8>		
	F	T	0.1529	<1.6247, 9>		
	T	F	0.3	<3.7>		
	T	T	0.1	<1.9.9>		