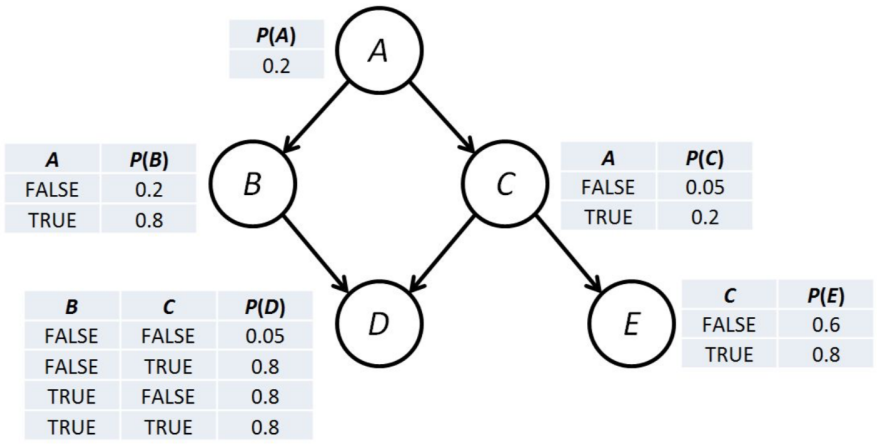

Figure 1: Node Graph

Q1. Complete Enumeration

A1.1 **For P(+D)** , we need to calculate all possibilities related to other variables.

$$P(+D) = P(+D, A, B, C, E) = \sum_{A,B,C,E} = P(A) * P(B|A) * P(C|A) * P(D|B,C) * P(E|C)$$

$$= P(A) * P(B|A) * P(C|A) * P(D|B,C) * P(E|C) + P(A) * P(B|A) * P(C|A) * P(D|B,C) * P(-E|C)$$
$$= P(A)*P(B|A)*P(-C|A)*P(D|B,-C)*P(E|-C)+P(A)*P(B|A)*P(-C|A)*P(D|B,-C)*P(-E|-C)$$
$$= P(A)*P(-B|A)*P(C|A)*P(D|-B,C)*P(E|C)+P(A)*P(-B|A)*P(C|A)*P(D|-B,C)*P(-E|C)$$
$$= P(A)*P(-B|A)*P(-C|A)*P(D|-B,-C)*P(E|-C)+P(A)*P(-B|A)*P(-C|A)*P(D|-B,-C)*P(-E|-C)$$
$$= P(-A)*P(B|-A)*P(C|-A)*P(D|B,C)*P(E|C)+P(-A)*P(B|-A)*P(C|-A)*P(D|B,C)*P(-E|C)$$
$$= P(-A)*P(B|-A)*P(-C|-A)*P(D|B,-C)*P(E|-C)+P(-A)*P(B|-A)*P(-C|-A)*P(D|B,-C)*P(-E|-C)$$
$$= P(-A)*P(-B|-A)*P(C|-A)*P(D|-B,C)*P(E|C)+P(-A)*P(-B|-A)*P(C|-A)*P(D|-B,C)*P(-E|C)$$
$$= P(-A)*P(-B|-A)*P(-C|-A)*P(D|-B,-C)*P(E|-C)+P(-A)*P(-B|-A)*P(-C|-A)*P(D|-B,-C)*P(-E|-C)$$

Now, we can place numbers corresponding them.

$$= (0.2) * (0.8) * (0.2) * (0.8) * (0.8) + (0.2) * (0.8) * (0.2) * (0.8) * (0.2)$$
$$= (0.2) * (0.8) * (0.8) * (0.8) * (0.6) + (0.2) * (0.8) * (0.8) * (0.8) * (0.8)$$
$$= (0.2) * (0.2) * (0.2) * (0.8) * (0.8) + (0.2) * (0.2) * (0.2) * (0.8) * (0.2)$$
$$= (0.2) * (0.2) * (0.8) * (0.05) * (0.6) + (0.2) * (0.2) * (0.2) * (0.8) * (0.2)$$
$$= (0.2) * (0.2) * (0.8) * (0.05) * (0.6) + (0.8) * (0.2) * (0.05) * (0.8) * (0.2)$$
$$= (0.8) * (0.2) * (0.95) * (0.8) * (0.6) + (0.8) * (0.2) * (0.95) * (0.8) * (0.4)$$
$$= (0.8) * (0.8) * (0.05) * (0.8) * (0.8) + (0.8) * (0.8) * (0.05) * (0.8) * (0.2)$$
$$= (0.8) * (0.8) * (0.95) * (0.05) * (0.6) + (0.8) * (0.8) * (0.95) * (0.05) * (0.4)$$
$$= \mathbf{0.32} \ \checkmark\checkmark$$

A1.2 **For P(+D,-A)** , we need to calculate all possibilities related to other variables.

$$P(+D) = P(+D, -A, B, C, E) = \sum_{B,C,E} = P(-A) * P(B| - A) * P(C| - A) * P(D|B, C) * P(E|C)$$

$$= P(-A)*P(B|-A)*P(C|-A)*P(D|B,C)*P(E|C)+P(-A)*P(B|-A)*P(C|-A)*P(D|B,C)*P(-E|C)$$
$$= P(-A)*P(B|-A)*P(-C|-A)*P(D|B,-C)*P(E|-C)+P(-A)*P(B|-A)*P(-C|-A)*P(D|B,-C)*P(-E|-C)$$
$$= P(-A)*P(-B|-A)*P(C|-A)*P(D|-B,C)*P(E|C)+P(-A)*P(-B|-A)*P(C|-A)*P(D|-B,C)*P(-E|C)$$
$$= P(-A)*P(-B|-A)*P(-C|-A)*P(D|-B,-C)*P(E|-C)+P(-A)*P(-B|-A)*P(-C|-A)*P(D|-B,-C)*P(-E|-C)$$

Now, we can place numbers corresponding them.

$$= (0.2) * (0.2) * (0.8) * (0.05) * (0.6) + (0.8) * (0.2) * (0.05) * (0.8) * (0.2)$$
$$= (0.8) * (0.2) * (0.95) * (0.8) * (0.6) + (0.8) * (0.2) * (0.95) * (0.8) * (0.4)$$
$$= (0.8) * (0.8) * (0.05) * (0.8) * (0.8) + (0.8) * (0.8) * (0.05) * (0.8) * (0.2)$$
$$= (0.8) * (0.8) * (0.95) * (0.05) * (0.6) + (0.8) * (0.8) * (0.95) * (0.05) * (0.4)$$
$$= \mathbf{0.184} \ \checkmark\checkmark$$

A1.3 **For P(+E |-B)**,we need to calculate all possibilities related to other variables. However first, we should use joint probability formula as below.

$$P(E|-B) = \frac{P(E,-B)}{P(-B)} = \frac{P(E,-B)}{P(+E,-B)+P(-E,-B)}$$

$$P(+E,-B) = P(+E,-B,A,C,D) = \sum_{A,C,D} = P(A)*P(-B|A)*P(C|A)*P(D|-B,C)*P(E|C)$$

$$= P(A)*P(-B|A)*P(C|A)*P(D|-B,C)*P(E|C)+P(A)*P(-B|A)*P(C|A)*P(-D|-B,C)*P(E|C)$$
$$= P(A)*P(-B|A)*P(-C|A)*P(D|-B,-C)*P(E|-C)+P(A)*P(-B|A)*P(-C|A)*P(-D|-B,-C)*P(E|-C)$$
$$= P(-A)*P(-B|-A)*P(C|-A)*P(D|-B,C)*P(E|C)+P(-A)*P(-B|-A)*P(C|-A)*P(-D|-B,C)*P(E|C)$$
$$= P(-A)*P(-B|-A)*P(-C|-A)*P(D|-B,-C)*P(E|-C)+P(-A)*P(-B|-A)*P(-C|-A)*P(-D|-B,-C)*P(E|-C)$$

Now, we can place numbers corresponding them.

$$= (0.2)*(0.2)*(0.2)*(0.8)*(0.8)+(0.2)*(0.2)*(0.2)*(0.2)*(0.8)$$
$$= (0.2)*(0.2)*(0.8)*(0.05)*(0.6)+(0.2)*(0.2)*(0.8)*(0.95)*(0.6)$$
$$= (0.8)*(0.8)*(0.05)*(0.8)*(0.8)+(0.8)*(0.8)*(0.05)*(0.2)*(0.8)$$
$$= (0.8)*(0.8)*(0.95)*(0.05)*(0.6)+(0.8)*(0.8)*(0.95)*(0.95)*(0.6)$$
$$= \mathbf{0.416}$$

$$P(-E,-B) = P(-E,-B,A,C,D) = \sum_{A,C,D} = P(A)*P(-B|A)*P(C|A)*P(D|-B,C)*P(-E|C)$$

$$= P(A)*P(-B|A)*P(C|A)*P(D|-B,C)*P(-E|C)+P(A)*P(-B|A)*P(C|A)*P(-D|-B,C)*P(-E|C)$$
$$= P(A)*P(-B|A)*P(-C|A)*P(D|-B,-C)*P(-E|-C)+P(A)*P(-B|A)*P(-C|A)*P(-D|-B,-C)*P(-E|-C)$$
$$= P(-A)*P(-B|-A)*P(C|-A)*P(D|-B,C)*P(-E|C)+P(-A)*P(-B|-A)*P(C|-A)*P(-D|-B,C)*P(-E|C)$$
$$= P(-A)*P(-B|-A)*P(-C|-A)*P(D|-B,-C)*P(-E|-C)+P(-A)*P(-B|-A)*P(-C|-A)*P(-D|-B,-C)*P(-E|-$$

Now, we can place numbers corresponding them.

$$= (0.2)*(0.2)*(0.2)*(0.8)*(0.2)+(0.2)*(0.2)*(0.2)*(0.2)*(0.2)$$

$$= (0.2) * (0.2) * (0.8) * (0.05) * (0.4) + (0.2) * (0.2) * (0.8) * (0.95) * (0.4)$$
$$= (0.8) * (0.8) * (0.05) * (0.8) * (0.2) + (0.8) * (0.8) * (0.05) * (0.2) * (0.2)$$
$$= (0.8) * (0.8) * (0.95) * (0.05) * (0.4) + (0.8) * (0.8) * (0.95) * (0.95) * (0.4)$$
$$= \mathbf{0.264}$$

$$P(E|-B) = \frac{P(E,-B)}{P(-B)} = \frac{P(E,-B)}{P(+E,-B) + P(-E,-B)} = \frac{0.416}{0.416 + 0.264)} = \mathbf{0.612} \ \checkmark\checkmark$$

A1.4 **For P(+A |+D,-E)**,we need to calculate all possibilities related to other variables. However first, we should use joint probability formula as below.

$$P(A|D,-E) = \frac{P(A,D,-E)}{P(D,-E)} = \frac{P(A,D,-E)}{P(A,D,-E) + P(-A,D,-E)}$$

$$P(A,D,-E) = P(A,D,-E,B,C) = \sum_{B,C} = P(A) * P(B|A) * P(C|A) * P(D|B,C) * P(-E|C)$$

$$= P(A)*P(B|A)*P(C|A)*P(D|B,C)*P(-E|C)+P(A)*P(B|A)*P(-C|A)*P(-D|B,-C)*P(-E|C)$$
$$= P(A)*P(-B|A)*P(C|A)*P(D|-B,C)*P(-E|C)+P(A)*P(-B|A)*P(-C|A)*P(-D|-B,-C)*P(-E|C)$$

Now, we can place numbers corresponding them.

$$= (0.2) * (0.8) * (0.2) * (0.8) * (0.2) + (0.2) * (0.8) * (0.8) * (0.8) * (0.4)$$
$$= (0.2) * (0.2) * (0.2) * (0.8) * (0.2) + (0.2) * (0.2) * (0.8) * (0.05) * (0.4)$$
$$= \mathbf{0.048}$$

$$P(-A,D,-E) = P(-A,D,-E,B,C) = \sum_{B,C} = P(-A) * P(B|-A) * P(C|-A) * P(D|B,C) * P(-E|C)$$

$$= P(-A)*P(B|-A)*P(C|-A)*P(D|B,C)*P(-E|C)+P(-A)*P(B|-A)*P(-C|-A)*P(-D|B,-C)*P(-E|C)$$
$$= P(-A)*P(-B|-A)*P(C|-A)*P(D|-B,C)*P(-E|C)+P(-A)*P(-B|-A)*P(-C|-A)*P(-D|-B,-C)*P(-E|C)$$

Now, we can place numbers corresponding them.

$$= (0.8) * (0.2) * (0.05) * (0.8) * (0.2) + (0.8) * (0.2) * (0.95) * (0.8) * (0.4)$$
$$= (0.8) * (0.8) * (0.05) * (0.8) * (0.2) + (0.8) * (0.8) * (0.95) * (0.05) * (0.4)$$
$$= \mathbf{0.0672}$$

$$P(A|D,-E) = \frac{P(A,D,-E)}{P(D,-E)} = \frac{P(A,D,-E)}{P(A,D,-E) + P(-A,D,-E)} = \frac{0.048}{0.048 + 0.0672} = \mathbf{0.417} \ \checkmark\checkmark$$

A1.5 **For P(+B,-E |A)**,we need to calculate all possibilities related to other variables. However first, we should use joint probability formula as below.

$$P(B,-E|A) = \frac{P(B,-E,A)}{P(A)} = \frac{P(B,-E,A)}{P(B,E,A) + P(B,-E,A) + P(-B,E,A) + P(-B,-E,A)}$$

$$P(B,E,A) = P(B,E,A,C,D) = \sum_{C,D} = P(A) * P(B|A) * P(C|A) * P(D|B,C) * P(E|C)$$

$$= P(A) * P(B|A) * P(C|A) * P(D|B,C) * P(E|C) + P(A) * P(B|A) * P(C|A) * P(-D|B,C) * P(E|C)$$
$$= P(A)*P(B|A)*P(-C|A)*P(D|B,-C)*P(E|-C)+P(A)*P(B|A)*P(-C|A)*P(-D|B,-C)*P(E|-C)$$

Now, we can place numbers corresponding them.

$$= (0.2) * (0.8) * (0.2) * (0.8) * (0.8) + (0.2) * (0.8) * (0.2) * (0.2) * (0.8)$$
$$= (0.2) * (0.8) * (0.8) * (0.8) * (0.6) + (0.2) * (0.8) * (0.8) * (0.2) * (0.6)$$
$$= \mathbf{0.1024}$$

$$P(B,-E,A) = P(B,-E,A,C,D) = \sum_{C,D} = P(A) * P(B|A) * P(C|A) * P(D|B,C) * P(-E|C)$$

$$= P(A) * P(B|A) * P(C|A) * P(D|B,C) * P(-E|C) + P(A) * P(B|A) * P(C|A) * P(-D|B,C) * P(-E|C)$$
$$= P(A)*P(B|A)*P(-C|A)*P(D|B,-C)*P(-E|-C)+P(A)*P(B|A)*P(-C|A)*P(-D|B,-C)*P(-E|-C)$$

Now, we can place numbers corresponding them.

$$= (0.2) * (0.8) * (0.2) * (0.8) * (0.2) + (0.2) * (0.8) * (0.2) * (0.2) * (0.2)$$
$$= (0.2) * (0.8) * (0.8) * (0.8) * (0.4) + (0.2) * (0.8) * (0.8) * (0.2) * (0.4)$$
$$= \mathbf{0.0576}$$

$$P(-B,E,A) = P(-B,E,A,C,D) = \sum_{C,D} = P(A) * P(-B|A) * P(C|A) * P(D|-B,C) * P(E|C)$$

$$= P(A)*P(-B|A)*P(C|A)*P(D|-B,C)*P(E|C)+P(A)*P(-B|A)*P(C|A)*P(-D|-B,C)*P(E|C)$$
$$= P(A)*P(-B|A)*P(-C|A)*P(D|-B,-C)*P(E|-C)+P(A)*P(-B|A)*P(-C|A)*P(-D|-B,-C)*P(E|-C)$$

Now, we can place numbers corresponding them.

$$= (0.2) * (0.2) * (0.2) * (0.8) * (0.8) + (0.2) * (0.2) * (0.2) * (0.2) * (0.8)$$
$$= (0.2) * (0.2) * (0.8) * (0.05) * (0.6) + (0.2) * (0.2) * (0.8) * (0.95) * (0.6)$$
$$= \mathbf{0.0256}$$

$$P(-B,-E,A) = P(-B,-E,A,C,D) = \sum_{C,D} = P(A) * P(-B|A) * P(C|A) * P(D|-B,C) * P(-E|C)$$

$$= P(A)*P(-B|A)*P(C|A)*P(D|-B,C)*P(-E|C)+P(A)*P(-B|A)*P(C|A)*P(-D|-B,C)*P(-E|C)$$
$$= P(A)*P(-B|A)*P(-C|A)*P(D|-B,-C)*P(-E|-C)+P(A)*P(-B|A)*P(-C|A)*P(-D|-B,-C)*P(-E|-C)$$

Now, we can place numbers corresponding them.

$$= (0.2) * (0.2) * (0.2) * (0.8) * (0.2) + (0.2) * (0.2) * (0.2) * (0.2) * (0.2)$$
$$= (0.2) * (0.2) * (0.8) * (0.05) * (0.4) + (0.2) * (0.2) * (0.8) * (0.95) * (0.4)$$
$$= \mathbf{0.0144}$$

$$P(B,-E|A) = \frac{P(B,-E,A)}{P(A)} = \frac{P(B,-E,A)}{P(B,E,A)+P(B,-E,A)+P(-B,E,A)+P(-B,-E,A)}$$

$$= \frac{0.0576}{0.1024+0.0576+0.0256+0.0144} = \mathbf{0.288}\ \checkmark\checkmark$$

Q2. Variable Elimination

A2.1 **For P(+D)** , After determining parents of it, we can eliminate variables if it is possible.

$$P(+D) = P(+D,A,B,C,E) = \sum_{A,B,C,E} = P(A)*P(B|A)*P(C|A)*P(D|B,C)*P(E|C)$$

Suppose that Y(B,C) is $\sum_A = P(A)*P(B|A)*P(C|A)$

Y(B,C)	$P(A)*P(B\|A)*P(C\|A)$	$P(-A)*P(B\|-A)*P(C\|-A)$
B,C	0.2*0.8*0.2	0.8*0.2*0.05
B,-C	0.2*0.8*0.8	0.8*0.2*0.95
-B,C	0.2*0.2*0.2	0.8*0.8*0.05
-B,-C	0.2*0.2*0.8	0.8*0.8*0.95

$$Y(B,C) = 0.032+0.008 = 0.04$$
$$Y(-B,C) = 0.008+0.032 = 0.04$$
$$Y(B,-C) = 0.128+0.152 = 0.28$$
$$Y(-B,-C) = 0.032+0.608 = 0.64$$

Now, our equation is $P(+D) = \sum_{B,C,E} = Y(B,C)*P(D|B,C)*P(E|C)$

Suppose that Z(C) is $\sum_B = Y(B,C)*P(D|B,C)$

Z(C)	$Y(B,C)*P(D\|B,C)$	$Y(-B,C)*P(D\|-B,C)$
C	0.04*0.8	0.04*0.8
-C	0.28*0.8	0.64*0.05

$$Z(C) = 0.032 + 0.032 = 0.064$$
$$Z(-C) = 0.224 + 0.032 = 0.256$$

Now, our equation is $P(+D) = \sum_{C,E} = Z(C) * P(E|C)$

Suppose that X(E) is $\sum_C = Z(C) * P(E|C)$

X(E)	$Z(C) * P(E\|C)$	$Z(-C) * P(E\| - C)$
E	0.064*0.8	0.256*0.6
-E	0.064*0.2	0.256*0.4

$$X(E) = 0.0512 + 0.01536 = 0.2048$$
$$X(-E) = 0.224 + 0.1024 = 0.1152$$

Now, our equation is $P(+D) = \sum_E = X(E) = X(E) + X(-E) =$ **0.32** ✓✓

A2.2 **For P(+D |-A)**,After determining parents of it, we can eliminate variables if it is possible.

$$P(+D) = P(+D, -A, B, C, E) = \sum_{B,C,E} = P(-A) * P(B| - A) * P(C| - A) * P(D|B, C) * P(E|C)$$

Suppose that Y'(E,C) is $\sum_{E,C} = P(E|C)$

Y'(E,C)	$P(E\|C))$
E,C	0.8
E,-C	0.6
-E,C	0.2
-E,-C	0.4

$$Y(E, C) = 0.8 + 0.2 = 1$$
$$Y(E, -C) = 0.6 + 0.4 = 1$$

Suppose that Z'(-A,B,C,D) is $\sum_{B,C} = P(C|-A) * Y(C) * P(D|B,C)$

Z'(-A,B,C,D)	$P(C\|-A) * Y(C) * P(D\|B,C)$
-A,B,C,D	0.05* 0.8
-A,B,C,D	0.95* 0.8
-A,B,C,D	0.05*0.8
-A,B,C,D	0.95*0.05

$$Z(-A,B,D) = 0.76$$
$$Z(-A,-B,D) = 0,04$$

Suppose that X'(-A,B,D) is $\sum_{B} = Z(-A,B,D) * P(B|-A)$

X'(-A,B,D)	$Z(-A,B,D) * P(B\|-A)$
-A,B,D	0.2*0.76
-A,-B,D	0.8*0.04

$$X(-A,D) = 0.152 * 0.032 = 0.184$$

$$P(D,-A) = \mathbf{0.184}\ \checkmark\checkmark$$

A2.3 **For P(+E |-B)**,After determining parents of it, we can eliminate variables if it is possible.

$$P(E|-B) = \frac{P(E,-B)}{P(-B)} = \frac{P(E,-B)}{P(+E,-B) + P(-E,-B)}$$

$$P(+E|-B) = P(+E,-B,A,C,D) = \sum_{A,C,D} = P(A) * P(-B|A) * P(C|A) * P(D|-B,C) * P(E|C)$$

Suppose that Y'(A,-B,C) is $\sum_{A,C} = P(A) * P(-B|A) * P(C|A)$

Y'(A,-B,C)	$P(A) * P(-B\|A) * P(C\|A)$
A,-B,C	0.2*0.2*0.2
A,-B,-C	0.2*0.2*0.8
-A,-B,C	0.8*0.8*0.05
-A,-B,-C	0.8*0.8*0.95

$$Y(-B, C) = 0.008 + 0.032 = 0.04$$
$$Y(-B, -C) = 0.032 + 0.608 = 0.064$$

Suppose that Z'(-B,C,D) is $\sum_{C,D} = P(D| - B, C)$

Z'(-B,C,D)	$P(D\| - B, C)$
A,-B,C	0.8
A,-B,-C	0.2
-A,-B,C	0.05
-A,-B,-C	0.95

$$Z(-B, C) = 0.8 + 0.2 = 1$$
$$Z(-B, -C) = 0.95 + 0.05 = 1$$

Suppose that X'(-B,C,E) is $\sum_{A,C} = Y(-B, C) * Z(-B, C) * P(E|C)$

X'(-B,C,E)	$Y(-B, C) * Z(-B, C) * P(E\|C)$
A,-B,C	0.04*1*0.8
A,-B,-C	0.64*1*0.6
-A,-B,C	0.04*1*0.2
-A,-B,-C	0.64*1*0.4

$$X(-B, E) = 0.032 + 0.384 = 0.416$$
$$X(-B, -E) = 0.008 + 0.256 = 0.264$$

$$P(E| - B) = \frac{P(E, -B)}{P(-B)} = \frac{P(E, -B)}{P(+E, -B) + P(-E, -B)} = \frac{0,416}{0,264 + 0,416} = \textbf{0,612} \ \checkmark\checkmark$$

A2.4 **For P(+A |+D,-E)**,After determining parents of it, we can eliminate variables if it is possible.

$$P(A, D, -E) = P(A, D, -E, B, C) = \sum_{B,C} = P(A) * P(B|A) * P(C|A) * P(D|B, C) * P(-E|C)$$

Suppose that Y'(A,B,C,D) is $\sum_{B,C} = P(-B|A) * P(D|B, C)$

Y'(A,B,C,D)	$P(-B\|A) * P(D\|B, C)$
A,B,C,D	0.8*0.8
A,B,-C,D	0.8*0.8
A,-B,C,D	0.2*0.8
A,-B,-C,D	0.2*0.05
-A,B,C,D	0.2*0.8
-A,B,-C,D	0.2*0.8
-A,-B,C,D	0.8*0.8
-A,-B,-C,D	0.8*0.05

$$Y(A, C, D) = 0.64 + 0.16 = 0.8$$
$$Y(A, -C, D) = 0.64 + 0.01 = 0.65$$
$$Y(A, C, D) = 0.16 + 0.64 = 0.8$$
$$Y(A, -C, D) = 0.16 + 0.04 = 0.25$$

Suppose that X'(A,C,D,-E) is $\sum_{C} = P(C|A) * P(-E|C) * Y(A, C, D)$

X'(A,C,D,-E)	$P(C\|A) * P(-E\|C) * Y(A, C, D)$
A,C,D,-E	0.2*0.2*0.8
A,-C,D,-E	0.8*0.4*0.208
-A,C,D,-E	0.05*0.2*0.8
-A,-C,D,-E	0.05*0.4*0.2

$$X(A, D, -E) = 0.032 + 0.208 = 0.24$$
$$X(-A, D, -E) = 0.008 + 0.076 = 0.084$$

$$P(A, D, -E) = \sum_{B,C} = P(A) * X(A, D, -E) = 0.2 * 0.24 = 0.048$$

$$P(-A, D, -E) = \sum_{B,C} = P(A) * X(A, D, -E) = 0.8 * 0.084 = 0.0672$$

$$P(A|D, -E) = \frac{P(A, D, -E)}{P(D, -E)} = \frac{P(A, D, -E)}{P(A, D, -E) + P(-A, D, -E)} = \frac{0.048}{0.048 + 0.067} = \mathbf{0.417} \ \checkmark\checkmark$$

A2.5 **For P(+B,-E |+A)**,After determining parents of it, we can eliminate variables if it is possible.

$$P(B, E, A) = P(B, E, A, C, D) = \sum_{C,D} = P(A) * P(B|A) * P(C|A) * P(D|B, C) * P(E|C)$$

Suppose that Y'(A,B,C,D,-E) is $\sum_{C,D} = P(C|A) * P(-E|C) * P(D|B, C)$

Y'(A,B,C,D,-E)	$P(C\|A) * P(-E\|C) * P(D\|B, C)$
A,B,C,D,-E	0.2*0.2*0.8
A,B,C,-D,-E	0.2*0.2*0.2
A,B,-C,D,-E	0.8*0.4*0.8
A,B,-C,-D,-E	0.8*0.4*0.2

$$Y(A, B, D, E) = 0.032 + 0.256 = 0.288$$
$$Y(A, B, -D, E) = 0.08 + 0.064 = 0.072$$

Suppose that X'(A,B,D,-E) is $\sum_{C} = P(C|A) * P(-E|C) * P(D|B, C)$

X'(A,B,D,-E)	$P(C\|A) * P(-E\|C) * P(D\|B, C)$
A,B,D,-E	0.288
A,B,-D,-E	0.072

$$X(A, B, -E) = 0.288 + 0.072 = 0.36$$

$$P(B, E, A) = P(B, E, A, C, D) = \sum_{C,D} = P(A) * P(B|A) * X(A, B, -E) = 0.2 * 0.8 * 0.36 = 0.0576$$

$$P(B, -E|A) = \frac{P(B, -E, A)}{P(A)} = \frac{P(B, -E, A)}{P(B, E, A) + P(B, -E, A) + P(-B, E, A) + P(-B, -E, A)} = \frac{0.0576}{0.2} = \mathbf{0.288} \ \checkmark\checkmark$$