	A=0	
	Y=0	Y=1
C=0	a	b
C=1	e	f

	A=1	
	Y=0	Y=1
C=0	c	d
C=1	g	h

Seperation:

- $P(C=0 \mid Y=0, A=0) = P(C=0 \mid Y=0, A=1)$

$$\Rightarrow \frac{P(C=0, Y=0, A=0)}{P(Y=0, A=0)} = \frac{P(C=0, Y=0, A=1)}{P(Y=0, A=1)}$$

$$\Rightarrow \frac{a}{a+e} = \frac{c}{c+g} \Rightarrow ac+ag = ac+ae$$

$$\Rightarrow e = g$$

- $P(C=0 \mid Y=1, A=0) = P(C=0 \mid Y=1, A=1)$

$$\Rightarrow \frac{b}{b+f} = \frac{d}{d+h} \Rightarrow b = f$$

- $P(C=1 \mid Y=0, A=0) = P(R=1 \mid Y=0, A=1)$

$\Rightarrow \frac{e}{a+e} = \frac{g}{c+g} \Rightarrow a = c$

- $P(C=1 \mid Y=1, A=0) = P(C=1 \mid Y=1, A=1)$

$\Rightarrow \frac{f}{b+f} = \frac{h}{d+h} \Rightarrow d = h$

- With the following restrictions:
  - $e = g$
  - $a = c$
  - $b = f$
  - $d = h$.

Our joint table becomes:

	$A=0$	
	$Y=0$	$Y=1$
$C=0$	a	b
$C=1$	e	b

	$A=1$	
	$Y=0$	$Y=1$
$C=0$	a	d
$C=1$	e	d

Let's use:

$a = 0.1$
$b = 0.15$
$c = 0.2$
$d = 0.05$

Our table becomes:

	A=0		A=1	
	Y=0	Y=1	Y=0	Y=1
C=0	0.1	0.15	0.1	0.05
C=1	0.2	0.15	0.2	0.05

- Show it is seperale not sufficient:

Sufficiency implies:

$$P(Y=0|C=0, A=0) = P(Y=0|C=0, A=1)$$

$$\Rightarrow \frac{a}{a+b} = \frac{c}{c+d} \Rightarrow \frac{0.1}{0.1+0.2} = \frac{0.1}{0.1+0.05}$$

$$\Rightarrow 0.33 \neq 0.667$$

To create a sufficient distribution:

- $P(Y=0 \mid C=0, A=0) = P(Y=0 \mid C=0, A=1)$

$$\Rightarrow \frac{a}{a+b} = \frac{c}{c+d} \Rightarrow ad = bc$$

- $P(Y=1 \mid C=1, A=0) = P(Y=1 \mid C=1, A=1)$

$$\Rightarrow \frac{f}{e+f} = \frac{h}{g+h} \Rightarrow eh = fg$$

- Our restrictions are:

$ad = bc$ $\quad e \neq g \quad a \neq c$

$eh = fg$ $\quad b \neq f \quad d \neq h.$

lets set:

	A=0		A=1	
	Y=0	Y=1	Y=0	Y=1
C=0	0.05	0.15	0.1	0.3
C=1	0.05	0.05	0.15	0.15

Let's show it is ~~not~~ seperate:

$$P(C=0 \mid Y=0, A=0) = P(C=0 \mid Y=0, A=1)$$

$$\frac{a}{a+e} = \frac{c}{c+g}$$

$$\frac{0.05}{0.05+0.05} = \frac{0.1}{0.1+0.15}$$

$$0.5 \neq 0.4.$$

Not seperate.

As long as ~~~~ C $\not\perp$ Y ~~no~~, they cannot be seperate AND ~~is~~ sufficient.