Example 1:

Classic example (Sorry couldn't think of a better one):

Suppose U of T is looking to accept the new cohort of students this fall and are looking to accept qualified candidates with "equal opportunity" (separation) from both international (Group I) and domestic students (Group D) groups.

Y = Ground Truth (qualified for program: YES, NO)
C = Classification/Prediction (predicted qualification: YES, NO)
A = Protected Group (Origin: International, Domestic)

To simplify the example, consider 10 international and 10 domestic candidates.

International group

	Admitted	Rejected
Qualified	3	3
Unqualified	1	3

Domestic group

	Admitted	Rejected
Qualified	2	2
Unqualified	2	4

Separation Holds:

P(Prediction (C) =YES | Qualified (Y) = YES ; Origin (A) = International) =
P(Prediction (C) =YES | Qualified (Y) = YES)

½ = ½

While Sufficiency Does Not Hold:

P(Qualified (Y) = YES | Prediction (C) =YES ; Origin (A) = International) **! =**
P(Qualified (Y) = YES | Prediction (C) =YES)

¾ != 0.625

International (A)?	Qualified (Y)	Admission algorithm/ prediction (C)	P(A,Y,C)
Yes	Yes	Yes	3/20 = 0.15
Yes	Yes	No	3/20 = 0.15
Yes	No	Yes	1/20 = 0.05
Yes	No	No	3/20 = 0.15
No	Yes	Yes	2/20 = 0.1
No	Yes	No	2/20 = 0.1
No	No	Yes	2/20 = 0.1
No	No	No	4/20 = 0.2

Example 2:

The government of Ontario was developing a AI model to estimate the probability of an incoming passenger at pearson to have COVID 19 based on their departure country and cabin class during the flight. The model was testing the correlation of cabin class (Economy or Business) to the likelihood of holding COVID 19.

Economy Class (10 passengers)

	Model Prediction (COVID positive)	Model Prediction (COVID negative)
Covid positive	3	3
Covid negative	1	3

Business Class (10 passengers)

	Model Prediction (COVID positive)	Model Prediction (COVID negative)
Covid positive	3	2
Covid negative	1	4

Economy (A)?	Covid positive (Y)	algorithm/ prediction (C)	P(A,Y,C)
Yes	Yes	Yes	3/20 = 0.15
Yes	Yes	No	3/20 = 0.15
Yes	No	Yes	1/20 = 0.05
Yes	No	No	3/20 = 0.15
No	Yes	Yes	3/20 = 0.15
No	Yes	No	2/20 = 0.1
No	No	Yes	1/20 = 0.05
No	No	No	4/20 = 0.2

Separation Does not Hold:

P(Prediction (C) =YES | Qualified (Y) = YES ; Origin (A) = International) !=
P(Prediction (C) =YES | Qualified (Y) = YES)

½ = 6/11

While Sufficiency Holds:

P(Qualified (Y) = YES | Prediction (C) =YES ; Origin (A) = International) **=**
P(Qualified (Y) = YES | Prediction (C) =YES)

¾ = ¾

Turned out that the air circulation inside the airplane over a long 6 hours is shared inside the entire cabin, so don't travel.