

Q3:

WTP cannot have sufficiency and separation.

Separation = A is independent of C given Y

Sufficiency = A is independent of Y given C

Consider a simple example of Separation.

A = Gender, C = Central Obesity, Y = Hyperlipidemia

We can see here that with our given table is not sufficient as A, our gender, is not independent of the value of Y, Hyperlipidemia. If it were, we would expect to see Hyperlipidemia, our Y variable have no effect on the probability of A, C, Y. However it is separate as our C value does not affect the probability

Gender	Central Obesity	Hyperlipidemia	P(A, C, Y)
Male	YES	YES	57.1%
Female	YES	YES	42.9%
Male	NO	YES	57.1%
Female	NO	YES	42.9%
Male	YES	NO	49.4%
Female	YES	NO	50.6%
Male	NO	NO	49.4%
Female	NO	NO	50.6%

Consider a simple example of Sufficiency.

A = Gender, C = Hyperlipidemia, Y = Central Obesity

Note how we have only changed the assignments of C and Y, as a result the probability tables are identical. Even though this is the case the table is sufficient. However, it is also now not separate for similar reasons as above.

Gender	Central Obesity	Hyperlipidemia	P(A, C, Y)
Male	YES	YES	57.1%
Female	YES	YES	42.9%
Male	NO	YES	57.1%
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What these two (really one) probability table shows us is that we cannot have a probability that is both separate and sufficient since if there is conditional independence relationship between the 3 variables at least two variables must affect the final probability.