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Problem Set 2 for 6.042

Problem 2

COLLABORATION: On problem 2 I collaborated with no one, and received help from no one.

a) $A=\{1,2\}$ $B=\{3,4\}$ $C=\{5,6\}$ $D=\{7,8\}$ does not work

L: $A\cup B=\{1,2,3,4\}$ $C\cup D=\{5,6,7,8\}$

$(A\cup B)\times(C\cup D)$:

	1	2	3	4
5	o	o	o	o
6	o	o	o	o
7	o	o	o	o
8	o	o	o	o

← 16 ordered pairs

R: $A\times C$ $B\times D$

	1	2
3	o	o
4	o	o

	5	6
7	o	o
8	o	o

⟸ 4 unique ordered pairs each so $(A\times C)\cup(B\times D)$ has 8 elements

The # of elements in L and R does not match, so the theorem fails because $L\neq R$.

b) The "either"s in "iff either $x\in A$ or $x\in B$, and either $y\in C$ or $y\in D$" are a mistake, because it is possible for x to exist in both A and B, and for y to exist in both C and D.

Also, the lines "iff $x\in A\cup B$ and $y\in C\cup D$" "iff $(x,y)\in L$" are a mistake due to the non-commutativity and non-associativity of the cartesian product. The commutativity and associativity of the union operator is transferred when it should not be.

c) For example, if x is in A then in R it will never have a chance to form a pair with a y from D because of the grouping in R. But in L an x in A can form a pair with D. This is why $R\subseteq L$ must be the case. ∎