This talk concerns the cancellation problem for the direct product $A \times B$ of digraphs. Given digraphs $A$, $B$ and $C$, we say that cancellation holds if $A \times C \cong B \times C$ implies $A \cong B$.

A classic result by Lovász gives exact conditions on $C$ that guarantee whether cancellation holds or fails: If $C$ admits a homomorphism into a disjoint union of directed cycles of prime lengths, then there exist non-isomorphic digraphs $A$ and $B$ for which $A \times C \cong B \times C$. Conversely, if no such homomorphism exists, then $A \times C \cong B \times C$ implies $A \cong B$.

However, this does not entirely resolve the cancellation problem. If $C$ is arbitrary, we might reasonably ask what conditions on $A$ (or $B$) guarantee that $A \times C \cong B \times C$ implies $A \cong B$. This talk spells out those exact conditions. Moreover, for arbitrary $A$ and $C$ we enumerate and describe all digraphs $B$ for which $A \times C \cong B \times C$. The solution involves a new construction called the factorial of a digraph. (Received July 28, 2011)