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The Lie groups $SL(n, K)$ and $SU(n, K)$ are well understood over the reals and complexes. Over the octonions, the constructions of $SL(3, K)$ and $SU(3, K)$ can be generalized to give a real representation of the exceptional Lie groups E_6 and F_4 . The nonassociativity of the octonions plays an essential role in this construction. E_6 contains a tower of interesting subgroups, obtained by restricting the field K to the other division algebras (e.g. $SU(3)$), by decomposing the group into vector and spinor representations of the Lorentz group in higher dimensions (e.g. $SO(9, 1)$), or via triality (e.g. $SO(8)$ and G_2). While these identifications are well known, they are usually discussed at the Lie algebra level; our explicit description of the groups is new. (Received September 26, 2006)