Description of Identity Checks.nb

Victor A. Meszaros

February 18, 2017

The Mathematica notebook Identity Checks.nb consists of 3 short sections of code constructed to prove true identities used in the by-hand calculation of the Complex Linear Supermultiplet. Each section is constructed in a similar fashion, taking advantage of Mathematica's *Equal* function, ==. The following is a description of the approach taken, and unique techniques used for the identity checks.

All three sections of this Mathematica notebook begin by clearing all associated variables using the $ClearAll["`*"]$ command, as is good practice when initializing any Mathematica routine. Each section then defines the objects that it will reference in the remainder of the computation. For example the gamma matrices, or the spinor metric. In general for each section, the left and right hand side of the identities are defined, and using Mathematica's *Equal* function, an additional function is constructed that outputs *True* if the right hand side and left hand sides indeed equal. For tensorial equations like these a Table loop is used to sum over and/or account for all the unique combinations of index values. The final result being a large array of True boolean conditions. If all the booleans in the table are $True$, then the identity holds.

Section "Identity Check 1" begins in a similar manner as described above. Here a useful approach to summing over gamma matrix index values in Mathematica can be seen. By defining the gamma matrices themselves as functions, in the form $\gamma[n]$, n from 0 to 3, and 5. Mathematica references each individual gamma matrix definition as it loops over it's functional form. Uniquely, in Identity Check 1 super derivative operators and the respective fields they act on, are carried through the *Equal* function loop unlike in Identity Check 2 or 3. Thus the output contains both the boolean result, as well as the various indexed super derivative operators and their fields. By using the $DeleteDuplicates[Flatten[\_]]$ function all the boolean results can be collated, resulting in only one boolean output, $True$, thus proving the identity.

Sections "Identity Check 2" and "Identity Check 3" likewise prove true identities amongst the gamma matrices using the same approach highlighted in paragraph two. In both cases arrays of boolean values are outputted, all equaling *true*.