Exercises on Symbolical Programming

Dirac-Equation

Write a FORM procedure/program which applies the Dirac equation. Introduce (noncommuting) functions for the spinors and the Dirac matrices. Use the Clifford algebra

\[ \gamma_\mu \gamma_\nu + \gamma_\nu \gamma_\mu = 2g_{\mu \nu} \]

to rearrange Dirac chains and apply the Dirac equation

\[ \psi u(p, m) = +mu(p, m), \quad \psi v(p, m) = -mv(p, m), \]

as often as possible. Use the Clifford algebra together with FORM’s disorder statement to canonically order the Dirac chains.

MathLink with LHAPDF

The LHAPDF library, http://cedar.hepforge.co.uk/LHAPDF, is the one-stop resource for all things hadronic, PDFs, \( \alpha_s(q^2) \), etc.

Write a program to access the \( \alpha_s(q^2) \) calculation of the LHAPDF library within Mathematica. The routine to compute \( \alpha_s(q^2) \) in LHAPDF is

\[
\text{double precision function alphas2(scale)}
\]

\[
\text{double precision scale}
\]