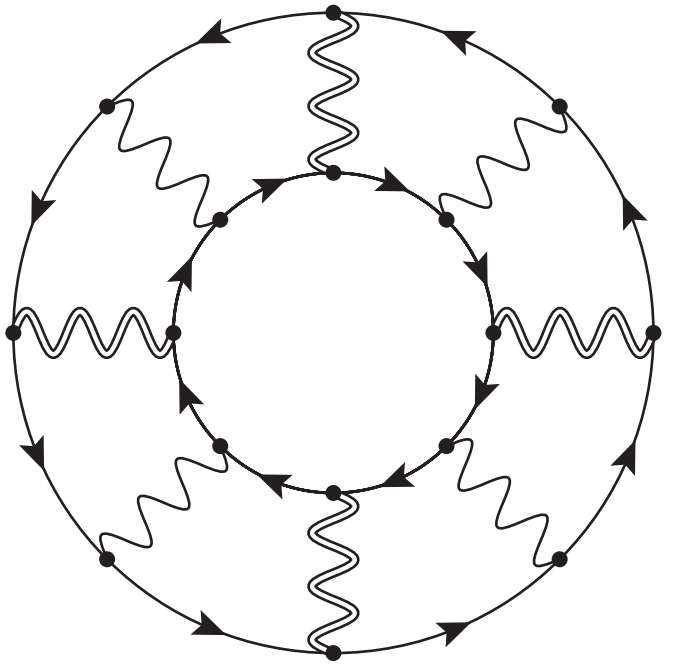
Problems

This file contains the various problems posed during the lectures. Their solutions can be found in the file answers.pdf. The solutions will only be provided after you have had some time to try solving the problems yourself. Some problems are solved during the lectures.

Problem 1: You are asked (provided you know a bit about gamma matrices and Feynman rules) to work out the following trace in 4 dimensions:



The double wiggles are W-bosons (with V-A coupling) and the normal wiggles are photons. Try to work out this trace in 4 dimensions (forget about the denominators).
Hint: use γ_7. Assume that photons do not change the mass of a particle, but W-bosons do. If you use also other systems, try this also on the other systems and explain the differences.

Problem 2: Although you have only a very basic knowledge of FORM, try to program the power series expansion of $\log(1-x)$ for a number of terms and substitute the expansion of $1-e^x$ in it. See how far you can go. (we will look at this in the next session). Try to figure out how to cut off the sequence.
For this assignment the sum_ function can be handy:

```
 Symbols x,y,j,n;
 Local F = sum_(j,1,5,x^j);
 Print;
 .sort
F =
   x + x^2 + x^3 + x^4 + x^5;
 id  x^n? = sum_(j,1,n,y^n);
 Print;
 .end
F =
   y + 2*y^2 + 3*y^3 + 4*y^4 + 5*y^5;
```

Problem 3: The problem is to evaluate

$$\Box_P^{10} P.p_1^{10} P.p_2^{10} P.p_3^{10}$$

Of course it may be better to start with lower powers. And the hint is to look in the manual for special functions that may be helpful.

For those who have experience with Maple or Mathematica it would be interesting to see what those programs do with this and how fast.