As discussed in class, graphs and graph based models can conveniently be represented using objects from linear algebra: vectors and matrices. In the following, let us try to be as general as we can, so let's assume that we have N isotopes that decay into each other (and choose N=5 here), then the rest of the program should look like the following. I've added an alternative graph below that shows the various lines with different colors -- it uses the same idea of how we plotted the various trajectories in programs like the solar system plots.

\[ N := 5; \]

\[
k := \text{vector}(N, \left[ \ln(2), \frac{\ln(2)}{2}, \frac{\ln(2)}{3}, \ln(2), 0 \right]);
\]

\[
P := \text{matrix}(N, N, \left[ [0, 1, 0, 0, 0], [0, 0, 1, 0, 0], [0, 0, 0, 0, 1], [0, 0, 0, 0, 0], [0, 0, 0, 0, 0] \right]);
\]

\[
ode := \text{seq}(D(x[i])(t) = -k[i] \cdot x[i](t) + \text{sum}(P[j, i] \cdot k[j] \cdot x[j](t), j = 1..N), i = 1..N);
\]

\[
D(x_1)(t) = -\ln(2) x_1(t), D(x_2)(t) = -\frac{1}{2} \ln(2) x_2(t) + \ln(2) x_1(t), D(x_3)(t) =
\]

\[
-\frac{1}{3} \ln(2) x_3(t) + \frac{1}{2} \ln(2) x_2(t), D(x_4)(t) = -\ln(2) x_4(t)
\]

\[
+ 0.30000000000 \ln(2) x_3(t), D(x_5)(t) = 0.03333333333333 \ln(2) x_3(t)
\]

\[
+ \ln(2) x_4(t)
\]

\[
initialAmounts := \text{vector}(N, \left[ 1, 0, 0, 0, 0 \right]);
\]

\[
ic := \text{seq}(x[i](0) = initialAmounts[i], i = 1..N);
\]

\[
x_1(0) = 1, x_2(0) = 0, x_3(0) = 0, x_4(0) = 0, x_5(0) = 0
\]

\[
solution := \text{dsolve}\{ode, ic\}, \text{numeric};
\]

\[
proc(x_rkf45) \ldots \text{end proc}
\]

\[
myplots := \text{seq}(plots[odeplot](solution, \left[ t, x[i](t) \right], t = 0..0.50), i = 1..N);
\]

\[
PLOT(\ldots), PLOT(\ldots), PLOT(\ldots), PLOT(\ldots)
\]

\[
plots[display](\{myplots\});
\]
plots[odeplot](solution, [seq([t, x[i](t)], i = 1..N)], t = 0..50);