```
/* Monday's lectures */

Zx<x> := PolynomialRing(Integers());

f5 := x^5-2;
f6 := x^6-x-1;
f7a := x^7 - 7*x - 3;
f7b := x^7 - 7*x - 4;
f8 := x^8 - 16*x+28;

degrees := func<lis|Reverse(Sort([Degree(lis[i,1]):i in [1..#lis]]))>;

factpat :=
func<poly,p|degrees(Factorization(PolynomialRing(FiniteField(p))!poly))>;

factpats := func<poly,cut|[<i,NthPrime(i),factpat(poly,NthPrime(i))> : i in
[1..cut]]>;

tally := function(seq)
   set := Seqset(seq);
   return Sort([<s,Multiplicity(seq,s)> : s in set]);
end function;

factpatstats:=func<poly,cutoff|tally([factpat(poly,NthPrime(j)) : j in
[1..cutoff]])>;

untally := func<tallied|[tallied[i,1] : j in [1..tallied[i,2]], i in
[1..#tallied]]>;

grpstats := func<n,i|tally([untally(CycleStructure(g)) :
g in TransitiveGroup(n,i)])>;

galgrp := function(f)
G := GaloisGroup(f);
return <Degree(f),TransitiveGroupIdentification(G),
   TransitiveGroupDescription(G)>;
end function;

load galpols;

examp := func<n,i|Zx!PolynomialWithGaloisGroup(n,i)>;

cleanup :=
func<f|Zx!DefiningPolynomial(OptimizedRepresentation(NumberField(f)))>;

fielddisc := func<f|Discriminant(MaximalOrder(NumberField(f)))>;

factpatstats2:=function(poly1,poly2,cutoff)
ugly := tally([[factpat(poly1,NthPrime(j)),factpat(poly2,NthPrime(j))] : j in
[1..cutoff]]);
return [<u[1,1],u[1,2],u[2]> : u in ugly];
end function;

/* Wednesday's lectures */
```

```
Zxy<x1,y> := PolynomialRing(Integers(),2);

discpoly := function(poly)
     return
     Zx ! Evaluate(

Resultant(Evaluate(poly,y),Evaluate(poly,x1+y),y)/x1^Degree(poly),[x,0]);
end function;

discpolypat := function(f)
    dp := discpoly(f);
    return [<Degree(s[1]),s[2]>:s in Factorization(dp)];
end function;

messup := function(f)
compmat := CompanionMatrix(f);
return CharacteristicPolynomial(compmat + compmat*compmat);
end function;

half := function(f)
   coeffs := Eltseq(f);
   return &+[coeffs[i]*x^((i-1) div 2) : i in [1..#coeffs by 2]];
end function;

smalldiscpoly := func<f | half(discpoly(f))>;

smalldiscpolypat := function(f)
  sdp := smalldiscpoly(f);
  return [<Degree(s[1]),s[2]>:s in Factorization(sdp)];
end function;

coercedown := function(f)
   coeffs := Eltseq(f);
   return &+[Round(Real(coeffs[i]))*x^(i-1) : i in [1..#coeffs]];
end function;

resk := function(f,k,prec)
   Cprec := ComplexField(prec);
   Cprecz<z> := PolynomialRing(Cprec);
   fprecz := Cprecz ! f;
   rootpairs := Roots(fprecz);
   roots := {rp[1] : rp in rootpairs};
   newroots := {&+s : s in Subsets(roots,k)};
   resz := &*{z - n : n in newroots};
   return coercedown(resz);
end function;

resmid := func<f,prec |half(resk(f,Degree(f) div 2,prec))>;

f12 := x^12 - 6*x^10 - 10*x^9 - 90*x^8 - 150*x^7 + 430*x^6 - 720*x^5 +
900*x^4 +
1350*x^3 -1350*x^2 + 4050*x + 675;

sextictwin := function(f)
   G,r,S := GaloisGroup(f);
   H := Subgroups(G:IndexEqual:=6, IsTransitive:=true)[1]`subgroup;
   ans := GaloisSubgroup(S,H);
```

```
   return ans;
end function;

res := function(f,i,j)
   G,r,S := GaloisGroup(f);
   H := Subgroups(G:IndexEqual:=i)[j]`subgroup;
   ans := GaloisSubgroup(S,H);
   return ans;
end function;

/* Friday's exercises */

f22 := func<t|
(-4194304*Numerator(t)*(3 - x + x^2)^11 + Denominator(t)*(32 + 28*x - 12*x^2
+ 19*x^3)^2*
  (-164 + 212*x - 119*x^2 + 34*x^3 + 5*x^4)^4)>;

f24 :=
2786655204876088 - 1021047515459130*x - 228822955123883*x^2 +
 185843346182048*x^3 - 25203414653024*x^4 - 10606348053144*x^5 +
 4199550444457*x^6 - 88695572727*x^7 - 244688866763*x^8 + 48774919226*x^9 +
 4265317961*x^10 - 2612466661*x^11 + 109304533*x^12 + 99341324*x^13 -
 16380692*x^14 - 2490371*x^15 + 1170700*x^16 - 140737*x^17 - 7222*x^18 +
 6555*x^19 - 1127*x^20 + 46*x^22 - 11*x^23 + x^24;
```