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Master de Théorie des Nombres

Semestre 2

PROGRAMMATION PARI/GP I

Corrigé des quatre TP de programmation PARI/GP I

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PREMIER TP

Exercice 1 :

```
forprime ( k=2,607,if(isprime(2^k-1), print([k,2^k-1]) ) )
```

Exercice 2 :

```
forprime ( k=2,19,for(a=1,19, print( (a^k-a)%k ) ) )
```

Exercice 3 :

- 1) for(m=2,144,if(polisirreducible(X^3-m*X^2+(m^2-1)*X+1),print(m)))
- 2) pour m=5
factormod(X^3-5*X^2+(5^2-1)*X+1, 7)
pour m=11
factormod(X^3-11*X^2+(11^2-1)*X+1, 7)
pour m=13
factormod(X^3-13*X^2+(13^2-1)*X+1, 7)

Exercice 4 :

- 1) forprime(p=5,397,b=0;if((p-1)%9==0,for(a=1,p-1,if((3-a^3)%p!=0,b++)));
if(b==p-1,print(p))
- 2) forprime(p=5,397,b=0;if((p-1)%9==0,for(a=1,p-1,if((3-a^3)%p!=0,b++)));
if(b==p-1,print([p , bnfinit(X^3-3*p).clgp.no]))

Exercice 5 :

- 1) for(a=1,50,if(issquarefree(a),for(b=1,50,if(issquarefree(b)&&gcd(a,b)==1,
if((a+b)%9!=0&&(a-b)%9!=0&&gcd(a*b,3)==1,
print([a,b,poldisc(X^3- a*b^3)]))))))
- 2) for(a=1,50,if(issquarefree(a),for(b=1,50,if(issquarefree(b)&&gcd(a,b)==1,
if((a+b)%9!=0&&(a-b)%9!=0&&gcd(a*b,3)!=1,print([a,b,poldisc(X^3- a*b^3)]))))))
- 3) for(a=1,50,if(issquarefree(a),for(b=1,50,if(issquarefree(b)&&
gcd(a,b)==1,if(((a+b)%9 == 0||(a-
b)%9==0)&&gcd(a*b,3)==1,print([a,b,poldisc(X^3-a*b^3)]))))))

DEUXIEME TP

Exercice 1 :

- 1) for (n=2,600,if(isprime(n)==0,b=0;forprime (p=2,n,if (n%p==0&&(n-1)%(p-1)==0,b++)) ;if(b==bigomega(n),print([n,factor(n)]))))
- 2) for (n=2,600,if(isprime(n)==0,b=0;forprime (p=2,n,if (n%p==0&&(n-1)%(p-1)==0,b++)) ;if(b==bigomega(n),print([n,factor(n)])) ;for(a=1,n,if(gcd(a,n)==1,print((a^(n-1)-1)%n)))))

Exercice 2 :

- 1) for(d=2,101,if(issquarefree(d),print([d,quadunit(quaddisc(d)),(bnfinit(x^2-d).clgp.no)])))
- 2) a)

for(d=2,1130,if((issquarefree(d)&&valuation(bnfinit(x^2-d).clgp.no,2)==1),print([(bnfinit(x^2-d).fu),(bnfinit(x^2-d).clgp.no)])))

b) for(d=2,1130,if((issquarefree(d)&&valuation(bnfinit(x^2-d).clgp.no,3)==1),print([(bnfinit(x^2-d).fu),(bnfinit(x^2-d).clgp.no)])))

Exercice 3 :

- 1) for(n=2,100,if(polisirreducible(x^3-n),print([n,bnfinit(X^3-n).clgp.no,bnfinit(polcompositum(X^3-n),(X^2+X+1))[1]).clgp.no])))
- 2) forprime(p=5,397,m=0;for(k=1,p,if((k^3-3)%p==0,m++));if((m==0&&(p-1)%9==0),print([p,valuation(bnfinit(X^3-3*p).clgp.no,3),valuation(bnfinit(polcompositum(X^3-3*p),(X^2+X+1))[1]).clgp.no,3])))

TROISIEME TP

Exercice 1 :

- 1) `forprime(p=2,100,if(bnfinit(x^2-p).clgp.no==1,print(p)))`
- 2) `forprime(p=2,2000,m=bnfinit(x^2-p).clgp.no;
if((m==3||m==5||m==7||m==9||m==11),print([p,m])))`

Exercice 2 :

- 1)
{
a=Mod(T,T^2-5);
lift((1+a)^10)
}
- 2)
{
a=Mod(T,T^3-19);
lift((19+2*a+a^2)^5)
}
- 3)
{
a=Mod(T,T^2+3);
lift(((1+a)/2)^3)
}

Exercice 3 :

- ```
{
a=Mod(T,T^4+5*T^2+5);
lift(((((-3-a^2)+a)/2)^5)
}
```

## QUATRIEME TP

### **Exercice 1 :**

```
{
V=rnfequation(T^2-5,x^2-Mod((-T-5)/2,T^2-5),1);
a=V[2];
b=x-V[3]*a;
lift(((a-1+2*b)/4)^5)
}
```

### **Exercice 2 :**

```
1) forprime(p=5,397,if((p-1)%3==0,b=0;for(a=1,p-1,
if((3-a^3)%p!=0,b++));if(b!=p-1,print([p,3^((p-1)/3)%p])))
2) forprime(p=5,397,if((p-1)%3==0,b=0;for(a=1,p-1,
if((3-a^3)%p!=0,b++));if(b==p-1,print([p,3^((p-1)/3)%p])))
```

### **Exercice 3 :**

- 1) for(n=2,50,b=0;fordiv(n,p,if(isprime(p) && valuation(n,p)<3,b++));if(b==omega(n),print(n)))
- 2) for(n=2,50,b=0;fordiv(n,p,if(isprime(p) && valuation(n,p)<3,b++));if(b==omega(n), print(rnfequation(T^3- n,x^2+x+1,1)[1])))
- 3) for(n=2,99,b=0;fordiv(n,p,if(isprime(p) && valuation(n,p)<3,b++));if(b==omega(n), k=bnfinit(rnfequation(T^3- n,x^2+x+1,1)[1]).clgp.no; h=bnfinit(X^3-n).clgp.no;print([k,3\*k,h^2]) ) )
- 4) for(n=2,99,b=0;fordiv(n,p,if(isprime(p) && valuation(n,p)<3,b++));if(b==omega(n), k=bnfinit(rnfequation(T^3- n,x^2+x+1,1)[1]).clgp.no; h=bnfinit(X^3- n).clgp.no;if(3\*k==h^2,print([bnfinit(X^3-n).fu[1], bnfinit( rnfequation(T^3- n,x^2+x+1,1)[1]).fu[1] ])) ) )

### **Exercice 4 :**

```
forprime(p=5,523,b=0;if((p-1)%9==0,for(a=1,p-1,if((3-a^3)%p!=0,b++)));
if(b==p- 1, print([p, valuation(bnfinit(x^3-3*p).clgp.no,3),
valuation(bnfinit(polcompositum(x^2+x+1,x^3-3*p)[1]).clgp.no,3),
valuation(bnfinit(rnfequation(T^3-p,
polcompositum(x^2+x+1,x^3- 3*p)[1],1)[1]).clgp.no,3)])))
```