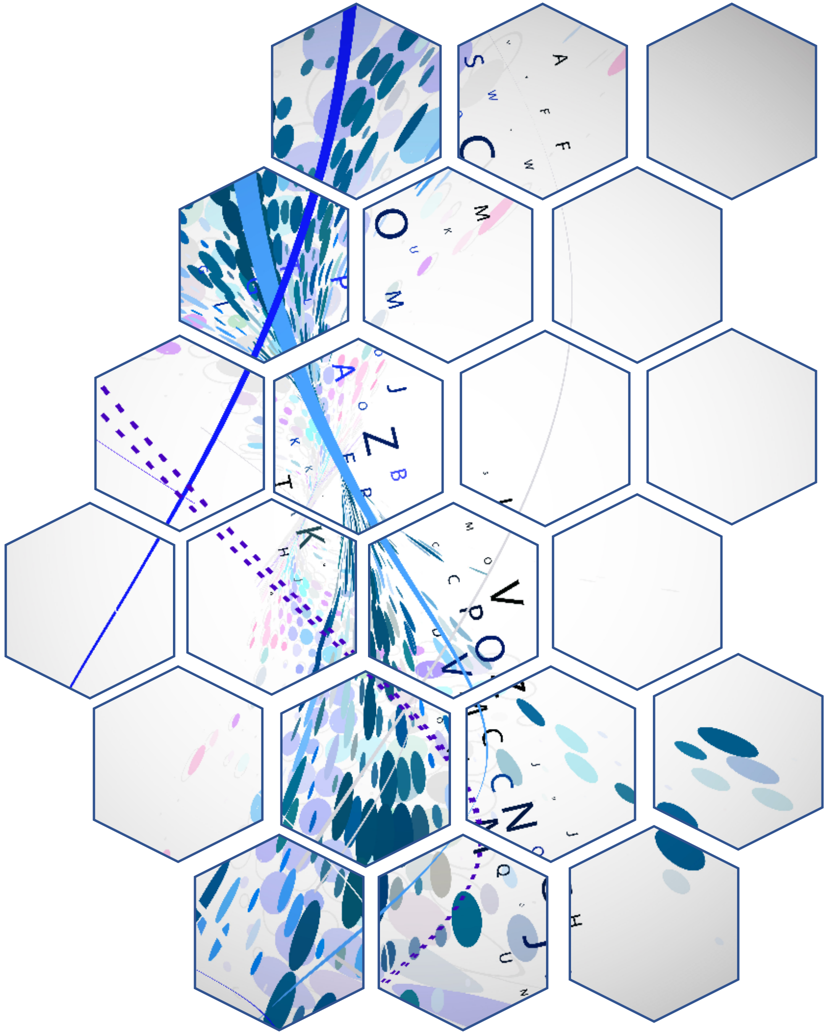
POLYNOMIAL

Abstract Algebra



Submitted by

Kh. Tahera Mehjabin
IT 23604

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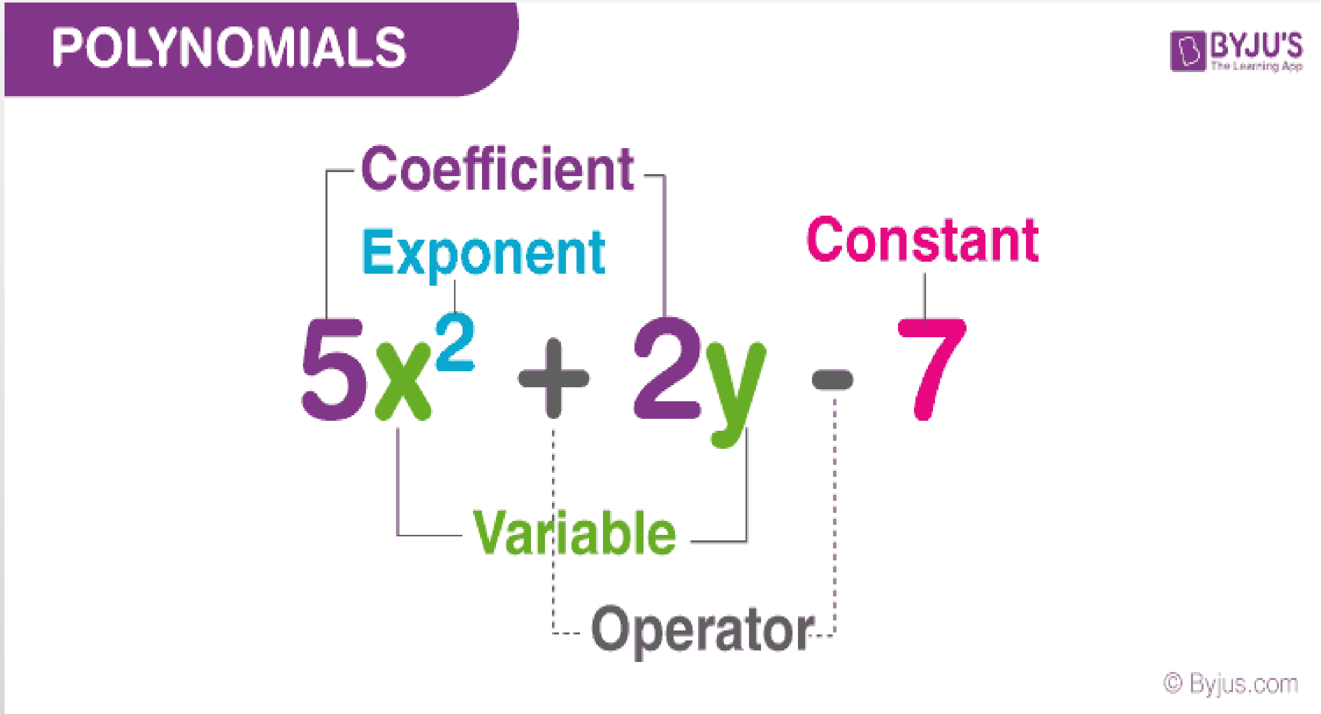
OUTLINE :

- INTRODUCTION OF POLYNOMIALS
- TYPES OF POLYNOMIALS
- POLYNOMIAL RINGS
- IRREDUCIBLE POLYNOMIAL
- PSEUDO RANDOM GENERATOR FOR POLYNOMIAL
- POYNOMIAL PSEUDO-RANDOM NUMBER GENERATOR

  VIA CYCLIC PHASE

POLYNOMIALS :

- Polynomials are algebraic expressions that consist of variables and coefficients.
- Variables are also sometimes called indeterminates.
- Addition, subtraction, multiplication, and also positive integer exponents can be perfomed for polynomial expressions.


POLYNOMIALS
BYJU'S
The Learning App
Coefficient
Exponent
Constant
$5x^2 + 2y - 7$
Variable
Operator
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TYPES OF POLYNOMIALS

Monomials:

A monomial is a polynomial expression that contains only one term. For example 4t, 21x, 2y, 9pq.

Binomials:

A binomial is a polynomial with two, unlike terms. For example $3x + 4x^2$

Trinomial :

A trinomial is a polynomial with three, unlike terms. For example, $3x + 5x^2 – 6x^3$ and $12pq + 4x^2 – 10$.

DEGREES OF POLYNOMIAL

Zero or constant polynomial

Polynomials with 0 degree. Example : 3 or 3x0

Linear polynomial

Polynomials with 1 as the degree. Example : x + y - 4, 5m + 7n, 2p

Quadratic polynomial

Polynomials with 2 as the degree . Example : 8x2 + 7y - 9, m2 + mn - 6

Cubic polynomial

Polynomials with 3 as the degree. Example : 3x3, p3 + pq + 7

POLYNOMIAL RINGS

A polynomial ring or polynomial algebra is a ring formed from the set of polynomials in one or more indeterminates (traditionally also called variables) with coefficients in another ring, often a field.

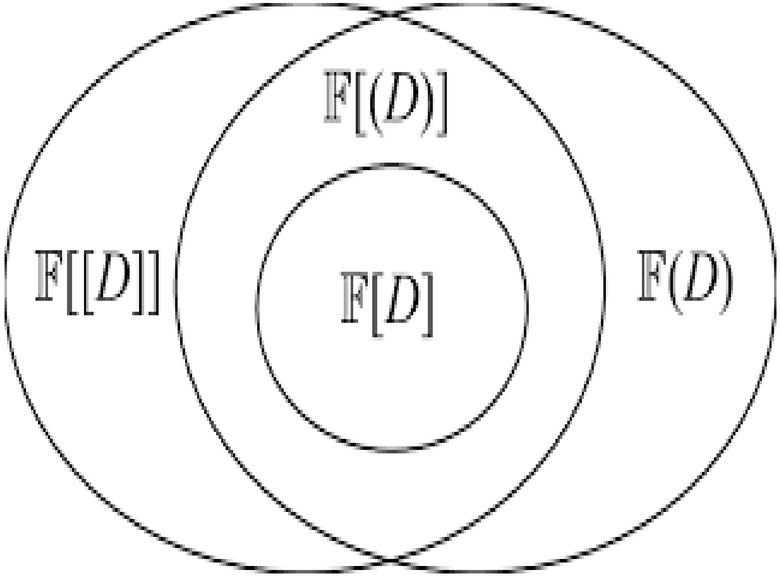

fig - Relationship among polynomial rings

IRREDUCIBLE POLYNOMIAL

- An irreducible polynomial is a polynomial that cannot be factored into the product of two non-constant polynomials.

- An irreducible polynomial is also called a prime polynomial.

The polynomial $x^2-2\in Q[x]$ is irreducible since

Solution :

it cannot be factored any further over the rational numbers.

x^2+1 is irreducible over the real numbers.

PSEUDO RANDOM GENERATOR FOR POLYNOMIAL

- Pseudorandom generators for low-degree polynomials are a particular instance of a Pseudo Random Number Generator (PRNG)

- In statistical tests, the tests are considered as evaluations of low degree polynomials.

- Efficient procedure that maps a short truly random seed to a longer pseudorandom string .

POLYNOMIAL PSEUDO-RANDOM NUMBER GENERATOR VIA CYCLIC PHASE

Polynomials f (x): $f(x) = fo+f_1x + f2x^2 + + fnx"; f; \in GF (p")$
are assigned to a Galois field GF (0).
If a generic algebra A (n) is defined in GF (0) and modular arithmetic modulo p [12] is used, the algebraic field Zip is the ring of quotients modulo the prime p (at least for the multiplication operator).

For example, addition of two polynomials in GF (2) and Z3 (2)
modulo $(x^3 + x + 1)$ is: $f(x) = x^2+1$; $f2 (x) = x^2+x$ $f(x) = \sum f (x)$
$= f (x) + f2 (x) = x + 1$
This is the polynomial equation .

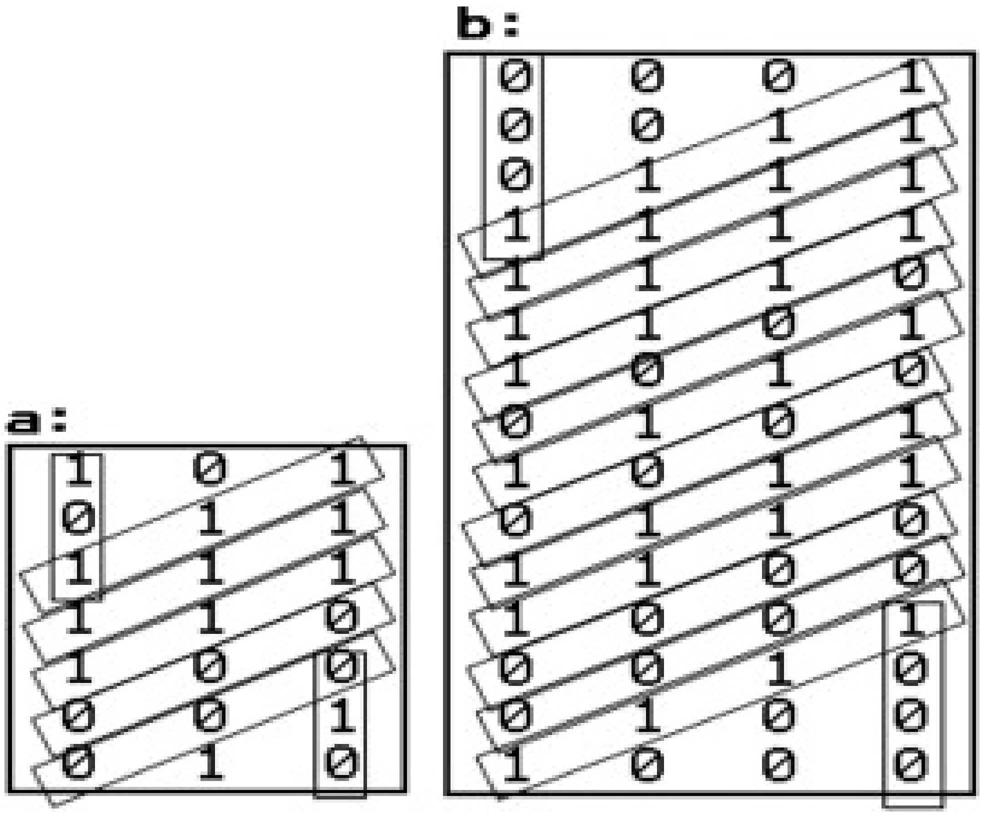

Figure : Pseudo random code generating

Reffenences :

1. Abstract Algebra : Theory and Applications
Thomas W. Judson
2. Polynomial pseudo random number generator via cyclic phase
Angelo Marchi, Alfonso Del Giudice, Antonio Liverani
Faculty of Economics

THANK YOU