#include <stdio.h>

#include <stdlib.h>

// Function to print an element in tuple form

void print\_tuple(int num, int q, int p) {

int tuple[p];

for (int i = 0; i < p; i++) {

tuple[i] = num % q;

num /= q;

}

printf("(");

for (int i = p - 1; i >= 0; i--) {

printf("%d", tuple[i]);

if (i > 0) printf(", ");

}

printf(")");

}

// Function to print polynomial representation

void print\_polynomial(int num, int p) {

int first = 1;

for (int i = p - 1; i >= 0; i--) {

if ((num / (1 << i)) % 2) { // Extract coefficient

if (!first) printf(" + ");

if (i == 0) printf("1");

else if (i == 1) printf("x");

else printf("x^%d", i);

first = 0;

}

}

if (first) printf("0");

}

int main() {

int q, p;

printf("Enter base field size q: ");

scanf("%d", &q);

printf("Enter extension degree p: ");

scanf("%d", &p);

if (q < 2 || p < 1) {

printf("Invalid input. q must be >= 2 and p >= 1.\n");

return 1;

}

int total\_elements = 1;

for (int i = 0; i < p; i++) {

total\_elements \*= q;

}

printf("\nElements of GF(%d^%d):\n", q, p);

printf("--------------------------------------------------------\n");

printf("| Decimal | Tuple Form | Polynomial Form |\n");

printf("--------------------------------------------------------\n");

for (int num = 0; num < total\_elements; num++) {

printf("| %7d | ", num);

print\_tuple(num, q, p);

printf(" | ");

print\_polynomial(num, p);

printf(" |\n");

}

printf("--------------------------------------------------------\n");

return 0;

}