# Polynomial from Roots (Assignment)

## ■ Problem Statement

We are given polynomial roots in **JSON format**, where each root is expressed in a specific base (binary, octal, decimal, hexadecimal, etc.).

The task is to:

1. Parse the JSON input.

2. Convert each root into a **decimal integer**.

3. Use exactly **k roots** (where k = degree + 1) to form the polynomial.

4. Expand the polynomial into standard form:

P(x) = a_m x^m + a_{m-1} x^{m-1} + … + a_0

5. Output the coefficients [a_m, a_{m-1}, …, a_0].

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## ■■ Approach

1. **Parse JSON Input**

- Extract n (total roots given) and k (minimum required).

- Collect the first k roots.

2. **Convert Roots**

- Each root has a "base" and "value".

- Convert to decimal using base conversion.

Example:

"2": { "base": "2", "value": "111" }

→ Decimal = 7.

3. **Form Polynomial**

- Build polynomial as:

(x - r1)(x - r2)...(x - rk)

4. **Expand Polynomial**

- Multiply step by step to compute coefficients.

- Handle large numbers using BigInteger (Java) or equivalent.

5. **Output**

- Print coefficients as a list.

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## ■■ Example

### *Input*


{
"keys": {
"n": 4,
"k": 3
},
"1": {
"base": "10",
"value": "4"
},
"2": {
"base": "2",
"value": "111"
},
"3": {
"base": "10",
"value": "12"
},
"6": {
"base": "4",
"value": "213"
}
}


### *Conversion*

- Root 1: 4
- Root 2: 7
- Root 3: 12

### *Polynomial*

(x - 4)(x - 7)(x - 12) = x^3 - 23x^2 + 160x - 336

***Output***

[1, -23, 160, -336]

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## ■ How to Run

1. Clone the repo:
git clone https://github.com/username/repo-name.git
cd repo-name

2. Compile and run (Java example):
javac PolynomialFromRoots.java
java PolynomialFromRoots input.json

3. The program will print polynomial coefficients.

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## ■ Repository Structure

repo-name
■ PolynomialFromRoots.java # Main source code
■ input.json # Sample test case input
■ README.md # Project documentation
■ output.txt # Output from program

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## ■ Deliverables

- Source code implementation.
- Sample input JSON.
- Output file/screenshot.
- README with explanation.