Cryptography & Network Security

PRN - 2019BTECS00026

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Batch - B1

Assignment - 10

Title: Chinese Remainder Theorem

Aim: To Demonstrate Chinese Remainder Theorem

Theory:

In mathematics, the Chinese remainder theorem states that if one knows the remainders of the Euclidean division of an integer n by several integers, then one can determine uniquely the remainder of the division of n by the product of these integers, under the condition that the divisors are pair wise co-prime.

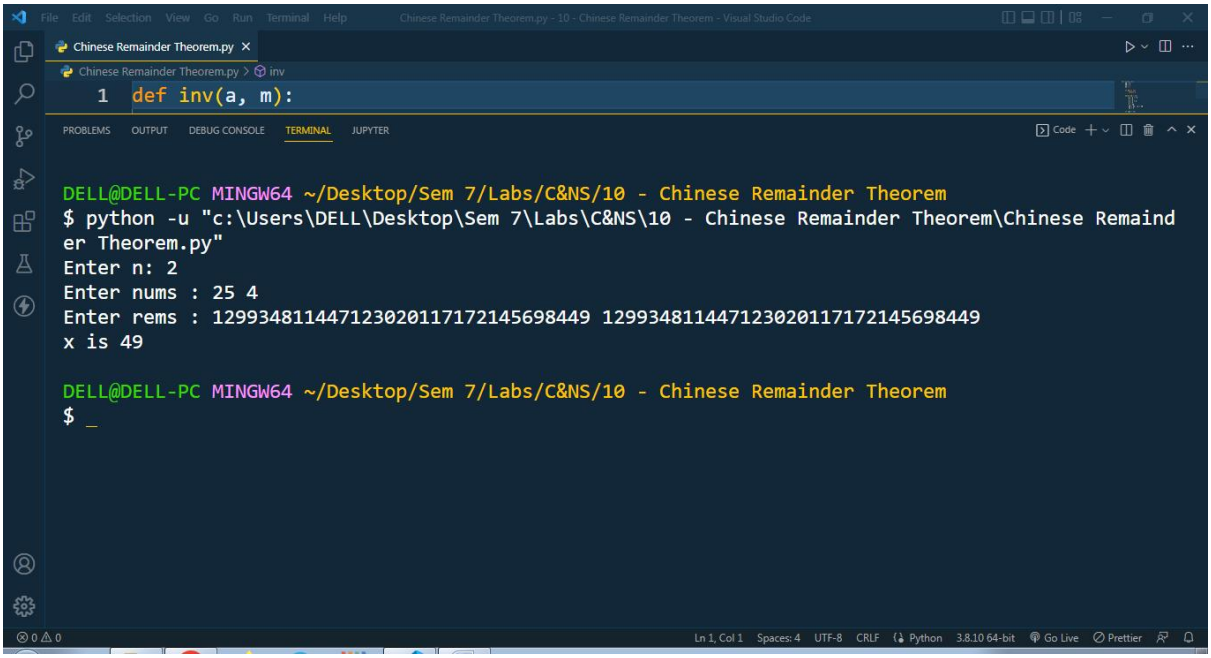
Code:

```
def inv(a, m):
    m0 = m
    x0 = 0
    x1 = 1

    if (m == 1):
        return 0

    while (a > 1):
        q = a // m
        t = m
```

```
        m = a % m
        a = t
        t = x0
        x0 = x1 - q * x0
        x1 = t

    if (x1 < 0):
        x1 = x1 + m0

    return x1


def findMinX(num, rem, k):
    prod = 1
    for i in range(0, k):
        prod = prod * num[i]

    result = 0

    for i in range(0, k):
        pp = prod // num[i]
        result = result + rem[i] * inv(pp, num[i]) * pp

    return result % prod
# num = [25, 4]
# rem = [1299348114471230201171721456984449, 1299348114471230201171721456984449]
# x = 1299348114471230201171721456984449(mod 25)
# x = 1299348114471230201171721456984449(mod 4)
n = int(input("Enter n: "))
```

```
rem = []


num = list(map(int, input("Enter nums : ").strip().split()))[:n]
rem = list(map(int, input("Enter rems : ").strip().split()))[:n]


print("x is", findMinX(num, rem, n))
```

Output:



Conclusion:

The Chinese remainder theorem is widely used for computing with large integers, as it allows replacing a computation for which one knows a bound on the size of the result by several similar computations on small integers.