

**EXP NO:5**

**DATE:**

## **DIFFIE-HELLMAN KEY EXCHANGE**

**Aim:** To implement Diffie-Hellman key exchange using C.

### **Algorithm:**

- Step 1: Choose a large prime number  $P$  and a primitive root modulo ( $P$ ), denoted as ( $G$ ). Both parties agree on these values.
- Step 2: Alice chooses a private key ( $a$ ), while Bob chooses a private key ( $b$ ). These private keys are kept secret.
- Step 3: Alice calculates her public key ( $x$ ) using ( $x = G^a \bmod P$ ), and Bob calculates his public key ( $y$ ) using ( $y = G^b \bmod P$ ).
- Step 4: Alice sends her public key ( $x$ ) to Bob, and Bob sends his public key ( $y$ ) to Alice.
- Step 5: Using the received public keys, Alice computes the secret key ( $k_a$ ) using ( $k_a = y^a \bmod P$ ), and Bob computes the secret key ( $k_b$ ) using ( $k_b = x^b \bmod P$ ).
- Step 6: Both Alice and Bob now have the same shared secret key.
- Step 7: They can now communicate securely using the shared secret key for encryption and decryption.
- Step 8: The security of the Diffie-Hellman Key Exchange relies on the difficulty of calculating discrete logarithms in finite fields.

### **Program:**

```
#include <math.h>
#include <stdio.h>
long long int power(long long int a, long long int b, long long int P)
{
    if (b == 1)
        return a;
    else
        return (((long long int)pow(a, b)) % P);
}
```

```
int main()
{
    long long int P, G, x, a, y, b, ka, kb;
    P = 23;
    printf("The value of P : %lld\n", P);
    G = 9;
    printf("The value of G : %lld\n\n", G);
    a = 4;
    printf("The private key a for Alice : %lld\n", a);
    x = power(G, a, P);
    b = 3;
    printf("The private key b for Bob : %lld\n\n", b);
    y = power(G, b, P);
    ka = power(y, a, P);
    kb = power(x, b, P);
    printf("Secret key for the Alice is : %lld\n", ka);
    printf("Secret Key for the Bob is : %lld\n", kb);
    return 0;
}
```

### Output:

```
/tmp/j5iJLwey0s.o
The value of P : 23
The value of G : 9

The private key a for Alice : 4
The private key b for Bob : 3

Secret key for the Alice is : 9
Secret Key for the Bob is : 9

=== Code Execution Successful ===
```

### Result: