

EXP NO:5

DATE: 1/3/24

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:

```

The value of P : 57
The value of G : 3

The private key a for Alice : 2
The private key b for Bob : 8

Secret key for the Alice is : 36
Secret Key for the Bob is : 36

```

Result:

Thus Diffie-Hellman key exchange using C was implemented successfully.