

Aim:

To implement Digital Signature Algorithm (DSA) using C.

Algorithm:

1. Get the prime number p and its divisor q from the user.
2. Get the value of h from the user.
3. Compute the value of g.
4. Get the private key x from the user.
5. Compute the user's public key y.
6. Get the per-message secret key k and hash value of message M.
7. Compute the value of z using g, k & p
8. Compute $z \% q$ to get the value of r
9. Compute the multiplicative inverse.
10. Compute the value of s.
11. Print the signature (r, s).

Program Code:

```
#include <stdio.h>
#include <math.h>
int power(int,unsigned int,int);
int multiplicativeInverse(int,int,int);
int main()
{
    int p,q,h,g,r,s,t,x,y,z,k,inv,hash;

    printf("\nEnter prime number p and enter q prime divisor of (p-1): ");
    scanf("%d %d",&p,&q);
    printf("\nEnter h such that it greater than 1 and less than (p-1): ");
    scanf("%d",&h);

    //Compute g
    t = (p-1)/q;
    g = power(h,t,p);

    printf("\nEnter user's private key such that it is greater than 0 and less than q : ");
    scanf("%d",&x);

    //Computer user's public key
    y = power(g,x,p);
```

```

printf("\nEnter user's per-message secret key k such that it is greater than 0 and less than q :
"); scanf("%d",&k);
printf("\nEnter the hash(M) value : ");
scanf("%d",&hash);

//Signing. Compute r and s pair
z = power(g,k,p);
r = z % q;
inv = multiplicativeInverse(k,q,p);
s = inv * (hash + x * r) % q;

//Display
printf("\n*****Computed Values*****");
printf("\ng = %d",g);
printf("\ny = %d",y);
printf("\nGenerated Signature Sender = (%d, %d) \n",r,s);
}

int power(int x, unsigned int y, int p)
{
    int res = 1;    // Initialize result

    x = x % p; // Update x if it is more than or equal to p

    while (y > 0)
    {
        // If y is odd, multiply x with
        result if (y & 1)
            res = (res * x) % p;

        // y must be even now
        y = y >> 1;    // y = y/2
        x = (x * x) % p;
    }
    return res;
}

int multiplicativeInverse(int a, int b, int n)
{
    int sum,x,y;
    for(y=0;y<n;y++)
    {
        for(x=0;x<n;x++)
        {
            sum = a * x + b * (-y);
            if(sum == 1)
                return x;
        }
    }
}

```

Output:

```
student: bash — Konsole
File Edit View Bookmarks Settings Help
(student@localhost ~)$ vi dsa.c
(student@localhost ~)$ gcc dsa.c
dsa.c: In function 'main':
dsa.c:21:13: error: 'k' undeclared (first use in this function)
scanf("%d",&k);
           ^
dsa.c:21:13: note: each undeclared identifier is reported only once for each function it appears in
dsa.c:33:1: error: expected ';' before 'printf'
printf("\n generated signature sender=(%d,%d)\n",r,s);
^~~~~~
(student@localhost ~)$ vi dsa.c
(student@localhost ~)$ gcc dsa.c
dsa.c: In function 'main':
dsa.c:33:1: error: expected ';' before 'printf'
printf("\n generated signature sender=(%d,%d)\n",r,s);
^~~~~~
(student@localhost ~)$ vi dsa.c
(student@localhost ~)$ gcc dsa.c
(student@localhost ~)$ ./a.out
Enter number p and enter the number q prime divisor of(p-1):1279 71

Enter h such that it greater than 1 and less than (p-1):3

Enter user's private key such that it is greater than 0 and less than q:15

Enter user's message secret key k such that it is greater than q:10

Enter hash(M) value:123

+++++++computed values+++++++
g=1157
y=851
generated signature sender=(32,39)
(student@localhost ~)$
```

Result: