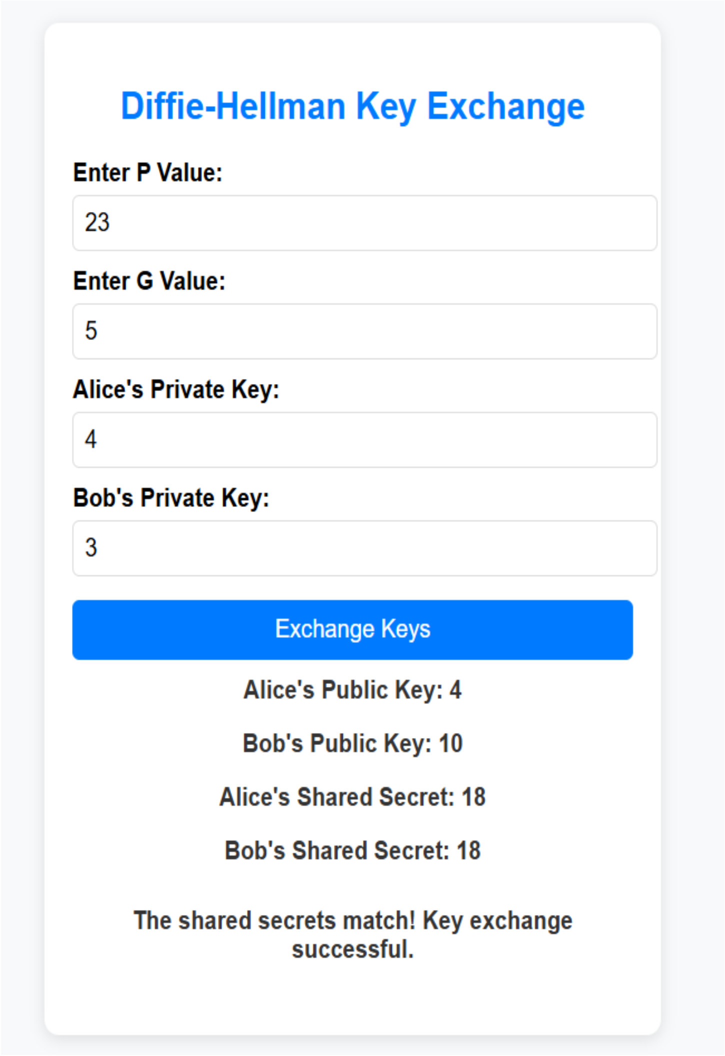
1. input.py

```
<!DOCTYPE html>
<html lang="en">
<head>
    <title>Diffie-Hellman Key Exchange</title>
    <style>

body {
            font-family: Arial, sans-serif;
            background-color: #f8f9fa;
            margin: 0;
            padding: 0;
            display: flex;
            justify-content: center;
            align-items: center;
            height: 100vh;
        }
        .container {
            background: #ffffff;
            padding: 20px;
            border-radius: 10px;
            box-shadow: 0 2px 10px rgba(0, 0, 0, 0.1);
            width: 100%;
            max-width: 400px;
            text-align: center;
        }
        h2 {
            color: #007bff;
        }
        label {
            display: block;
            font-weight: bold;
            margin-top: 10px;
            text-align: left;
        }
        input {
            width: 100%;
    padding: 8px;
    margin-top: 5px;
    border: 1px solid #ddd;
    border-radius: 5px;
    font-size: 1rem;
}
button {
    margin-top: 15px;
    width: 100%;
    padding: 10px;
    background: #007bff;
    color: white;
    border: none;
    border-radius: 5px;
    font-size: 1rem;
    cursor: pointer;
}
button:hover {
    background: #0056b3;
}
p {
    margin-top: 10px;
    font-weight: bold;
    color: #333;
}
#result {
    margin-top: 15px;
    padding: 10px;
    border-radius: 5px;
    font-weight: bold;
}
    </style>
</head>
<body>
```

```
<div class="container">
    <h2>Diffie-Hellman Key Exchange</h2>
    <label for="pKey">Enter P Value:</label>
    <input type="number" id="pKey" required>

    <label for="gKey">Enter G Value:</label>
    <input type="number" id="gKey" required>

    <label for="alicePrivateKey">Alice's Private Key:</label>
    <input type="number" id="alicePrivateKey" required>

    <label for="bobPrivateKey">Bob's Private Key:</label>
    <input type="number" id="bobPrivateKey" required>

    <button onclick="exchangeKeys()">Exchange Keys</button>

    <p>Alice's Public Key: <span id="alicePublicKey"></span></p>
    <p>Bob's Public Key: <span id="bobPublicKey"></span></p>
    <p>Alice's Shared Secret: <span id="sharedSecretAlice"></span></p>
    <p>Bob's Shared Secret: <span id="sharedSecretBob"></span></p>
    <p id="result"></p>
</div>

<script>
    function exchangeKeys() {
    const p = parseInt(document.getElementById("pKey").value);
    const g = parseInt(document.getElementById("gKey").value);

    function modExp(base, exponent, mod) {
        let result = 1;
        base = base % mod;
        while (exponent > 0) {
        if (exponent % 2 === 1) {
            result = (result * base) % mod;
        }
        exponent = Math.floor(exponent / 2);
        base = (base * base) % mod;
        }
        return result;
    }
    function isPrimitiveRoot(p, g) {
        if (p <= 1 || g <= 1 || g >= p) {
        return false;
```

```
            }

            let remainders = new Set();

            for (let k = 1; k < p; k++) {
            let remainder = modExp(g, k, p);
            if (remainders.has(remainder)) {
                return false;
            }
            remainders.add(remainder);
            }
            return true;
        }
        const result = isPrimitiveRoot(p, g);
        if (result) {
            document.getElementById("result").textContent = "The shared secrets match! Key
exchange successful.";

            let alicePrivateKey = parseInt(document.getElementById("alicePrivateKey").value);
            let bobPrivateKey = parseInt(document.getElementById("bobPrivateKey").value);
            let alicePublicKey = Math.pow(g, alicePrivateKey) % p;
            let bobPublicKey = Math.pow(g, bobPrivateKey) % p;
            document.getElementById("alicePublicKey").textContent = alicePublicKey;
            document.getElementById("bobPublicKey").textContent = bobPublicKey;
            let sharedSecretAlice = Math.pow(bobPublicKey, alicePrivateKey) % p;
            let sharedSecretBob = Math.pow(alicePublicKey, bobPrivateKey) % p;
            document.getElementById("sharedSecretAlice").textContent = sharedSecretAlice;
            document.getElementById("sharedSecretBob").textContent = sharedSecretBob;

            if (sharedSecretAlice === sharedSecretBob) {
                document.getElementById("result").textContent = "The shared secrets match! Key
exchange successful.";
            } else {
                document.getElementById("result").textContent = "Something went wrong. The shared
secrets do not match.";
            }
        } else {
            document.getElementById("result").textContent = "P is not a Primitive Root for G";
        }
        }
    </script>
</body>
</html>
```

2. Output



Diffie-Hellman Key Exchange

Enter P Value: 23

Enter G Value: 5

Alice's Private Key: 4

Bob's Private Key: 3

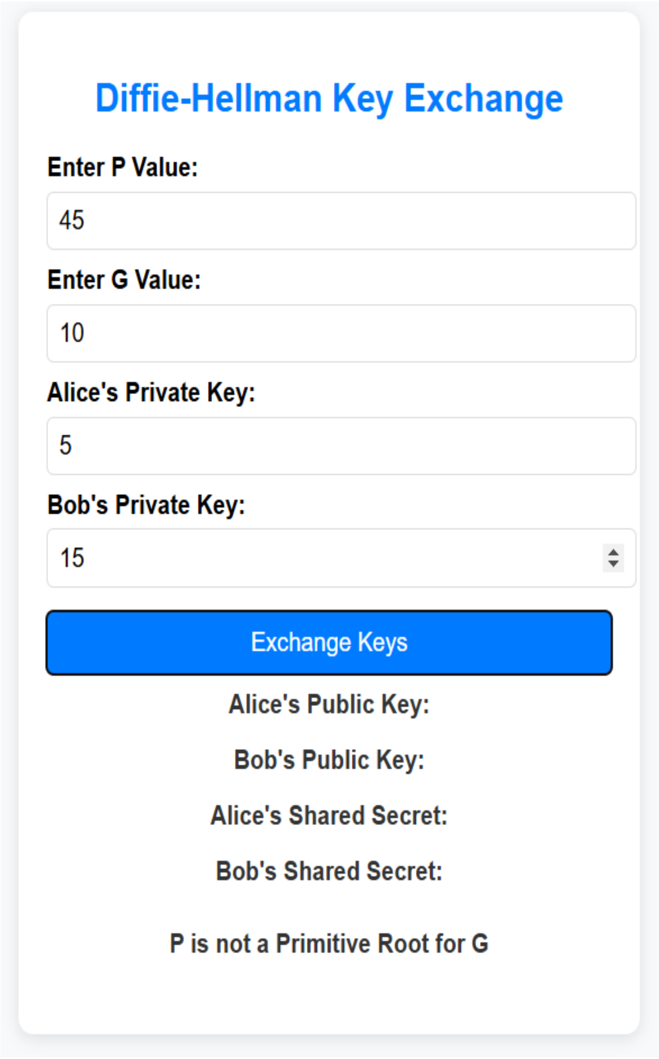
Alice's Public Key: 4

Bob's Public Key: 10

Alice's Shared Secret: 18

Bob's Shared Secret: 18

The shared secrets match! Key exchange successful.



Diffie-Hellman Key Exchange

Enter P Value: 45

Enter G Value: 10

Alice's Private Key: 5

Bob's Private Key: 15

Alice's Public Key:

Bob's Public Key:

Alice's Shared Secret:

Bob's Shared Secret:

P is not a Primitive Root for G