Problem 1 Write the best title lines for the functions that are called by the following main program. Do not supply blocks for the functions.

```cpp
int main() {
    int i = 2;
    int x[5] = {3, 1, 4, 1, 5};
    cout << max(2.1, i, 1.5) << endl; // (a) prints 2.1
    cout << min(x[2], x[3]) << endl; // (b) prints 1
    negateIt(i); cout << i + 1 << endl; // (c) prints -1
    printArray(x, 5); // (d) prints 31415
    if (sum(sum(2.1, 6), 1) > 0) cout << "big\n"; // (e) prints big
    return 0;
}
```

(a) Title line for `max`.
(b) Title line for `min`.
(c) Title line for `negateIt`.
(d) Title line for `printArray`.
(e) Title line for `sum`.

Problem 2 Consider the following C++ program.

```cpp
#include <iostream>
using namespace std;

double sum(int x[], int cap, int jump) {
    double ans = 0.0;
    for (int i = 0; i < cap; i+= jump)
        ans += x[i];
    return ans / 10.0;
}

int main() {
    int x[6] = {2, 1, 3, 0, 4, 9};
    cout << x[2] << endl; // line (a)
    cout << x[5/3] << endl; // line (b)
    cout << x[x[2]] << endl; // line (c)
    cout << sum(x, 6, 1) << endl; // line (d)
    cout << sum(x, 4, 2) << endl; // line (e)
    return 0;
}
```

(a) What is the output at line (a)?
(b) What is the output at line (b)?
(c) What is the output at line (c)?
(d) What is the output at line (d)?
(e) What is the output at line (e)?

Problem 3 Write a function called `maxGap` that calculates the largest gap between adjacent entries of an array. (A gap between two numbers is the absolute value of their difference.) For example, a program that uses the function `maxGap` follows.

```cpp
int main() {
    int x[5] = {2, 9, 1, 6, 3};
    cout << maxGap(x, 5) << endl; // prints 8 corresponding to the gap from 1 to 9.
    return 0;
}
```
Problem 4 Write a function called sumGaps that calculates the sum of the gaps between adjacent entries of an array. (A gap between two numbers is the absolute value of their difference.) For example, a program that uses the function sumGaps follows.

```cpp
int main() {
    int x[5] = {3, 1, 4, 1, 5};
    cout << sumGaps(x, 5) << endl; // prints 12 corresponding to the sum of gaps 2 + 3 + 3 + 4.
    return 0;
}
```

Problem 5 Write a function called subtractFirst that subtracts the value of the first element from every element in an array. For example, a program that uses the function subtractFirst follows.

```cpp
int main() {
    int array[6] = {3,1,4,1,5,9};
    subtractFirst(array, 6);
    for (int i = 0; i < 6; i++)
        cout << array[i] << " "; // Output will be 0 -2 1 -2 2 6
    return 0;
}
```

Problem 6 Write a function called evenLessOdd that returns the sum of the even valued entries minus the sum of the odd valued entries in an array of integers. For example, a program that uses the function evenLessOdd follows. The first output is 2 = 8−1−5 and the second is −10 =−1−1−5−3.

```cpp
int main() {
    int x[3] = {8, 1, 5};
    int y[4] = {1, 1, 5, 3};
    cout << evenLessOdd(x, 3) << endl; // prints 2
    cout << evenLessOdd(y, 4) << endl; // prints −10
    return 0;
}
```

Problem 7 Consider the following C++ program.

```cpp
#include <iostream>
using namespace std;

void mystery(int data[], int p, int q) {
    data[p] = data[q];
    data[q] = data[p];
}

void m2(int &p, int q) {
    int temp = p;
    p = q;
    q = temp;
}

void print(int data[], int p) {
    for (int i = 0; i < p; i++)
        cout << data[i] << " ";
    cout << endl;
}

main() {
    int x[8] = {0, 1, 2, 3, 4, 5, 6, 7};
    int y[7] = {0, 1, 2, 3, 4, 5, 6};
    int a = 3, b = 4;
    print(x, 3); // line (a)
    mystery(x, 1, 2); print(x, 5); // line (b)
    for (int i = 1; i <= 7; i++) mystery(x, 0, i);
    print(x, 8); // line (c)
    m2(a, b); cout << a << b << endl; // line (d)
    m2(y[3], 7); print(y, 6); // line (e)
}
Problem 8 Consider the following C++ program.

```cpp
#include <iostream>
using namespace std;

void rec(int a[], int start, int stop) {
    if (stop <= start) return;
    a[start] = a[stop];
    rec(a, start + 1, stop -1);
}

void printA(int a[], int cap) {
    for (int c = cap - 1; c >= 0; c--) cout << a[c] << " ";
    cout << endl;
}

int main() {
    int x[6] = {0, 1, 2, 3, 4, 5};
    printA(x, 6); // line (a)
    printA(x, 4); // line (b)
    rec(x, 3, 3); printA(x, 4); // line (c)
    rec(x, 3, 4); printA(x, 6); // line (d)
    rec(x, 0, 5); printA(x, 6); // line (e)
    return 0;
}
```

What is the output at each of the following lines?

(a) line (a)
(b) line (b)
(c) line (c)
(d) line (d)
(e) line (e)

Problem 9 Write a function called smallestProduct that returns the smallest product formed by two adjacent elements of an array. For example, a program that uses the function smallestProduct follows, it prints 3 since the smallest product is between the 3 and the 1.

```cpp
int main() {
    int x[] = {3, 1, 4, 1, 5, 9, 2, 6};
    cout << smallestProduct(x, 8) << endl; // prints 3
    return 0;
}
```