Ahmad Ali Ahmad Othman - Section 1 - Sheet 4

Question (1) : problems about C++ arrays :

a) Write a C++ program to find the sum and average of one dimensional integer array.

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

int main() {
  array<int, 5> nums = {50, 10, 30, 70, 25};

  int sum = 0;

  for (int i = 0; i < 5; i++) sum += nums[i];

  float average = sum / 5.0;

  cout << "Sum: " << sum << ", Average: " << avg << endl;
  return 0;
}
```

b) Write a C++ program to swap first and last element of an integer 1-d array.

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

int main() {
  array<int, 5> nums = {50, 10, 30, 70, 25};

  int temp = nums[4];
  nums[4] = nums[0];
  nums[0] = temp;

  // Easier solution:
  // swap(nums[0], nums[4]);

  for (int i = 0; i < nums.size(); i++) cout << nums[i] << " ";
  cout << endl;

  return 0;
}
```

c) Write a C++ program to reverse the element of an integer 1-D array.

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

int main() {
  array<int, 5> reversed, nums = {50, 10, 30, 70, 25};

  for (int i = 0; i < 5; i++) reversed[4 - i] = nums[i];

  // Easier solution:
  reverse(nums.rbegin(), nums.rend());

  for (int i = 0; i < nums.size(); i++) cout << nums[i] << " ";
  cout << endl;

  for (int i = 0; i < reversed.size(); i++) cout << reversed[i] << " ";
  cout << endl;

  return 0;
}
```

d) Write a C++ program to find the largest and smallest element

of an array.

```cpp
#include <iostream>
#include <array>

using namespace std;

template<typename T, size_t N>
void bubbleSort(std::array<T, N> &arr) {
  size_t len = arr.size();

  for (size_t i = 0; i < len; i++) {
    bool swapped = false;

    for (size_t j = 0; j < len - i - 1; j++) {
      T temp;

      if (arr[j + 1] < arr[j]) {
        temp = arr[j + 1];
        arr[j + 1] = arr[j];
        arr[j] = temp;
        swapped = true; // Set the flag if a swap happened
      }
    }

    // If no swaps occurred in this iteration, the array is sorted
    if (!swapped) break;
  }
}


int main() {
  array<int, 5> nums = {50, 10, 30, 70, 25};

  bubbleSort(nums);
  printf("Smallest: %d, Biggest: %d\n", nums[0], nums[4]);

  for (int i = 0; i < nums.size(); i++) cout << nums[i] << " ";
  cout << endl;
```

```
  return 0;
}
```

Question (2) : Find the output of the following program:

```
#include <iostream>
using namespace std;
void Changethecontent(int Arr[], int Count){
for (int C=1;C<Count;C++)
Arr[C-1]+=Arr[C];
}
int main(){
int A[]={3,4,5},B[]={10,20,30,40},C[]={900,1200};
Changethecontent(A,3);
Changethecontent(B,4);
Changethecontent(C,2);
for (int L=0;L<3;L++){
cout<<A[L]<< "#";
cout<<endl; }
for (int L=0;L<4;L++){
cout<<B[L] << "#" ;
cout<<endl; }
for (int L=0;L<2;L++){
cout<<C[L] << "#" ;
cout<<endl;}
return 0;
```

```
7#9#5
30#50#70#40
2100#1200
```

Question (3) : problems about C++ functions :

a) Write a function to calculate the factorial value of any integer as an argument. Call this function from `main()` and print the results in `main()` .

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

int factorial(int n) {
  int result = 1;
  for (int i = 1; i <= n; i++) result *= i;
  return result;
}


int main() {
  int n;
  cin >> n;
  cout << factorial(n) << endl;
  return 0;
}
```

b) Write a function called `smaller()` that has two integer arguments being passed by reference and sets the smaller of

the two numbers to 0. Write the main program to access the function.

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

void smaller(int &x, int &y) {
  if (x <= y) x = 0;
  else y = 0;
}

int main() {
  int x = 5, y = 7;

  cout << "x: " << x << ", y: " << y << endl;
  smaller(x, y);
  cout << "x: " << x << ", y: " << y << endl;

  return 0;
}
```

c) Raising a number to a power p is the same as multiplying n by itself p times. Write a function called power that takes two arguments, a double value for n and an int value for p, and return the result as double value. Use default argument of 2 for p, so that if this argument is omitted the number will be

squared. Write the main function that gets value from the user to test power function.

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

double power(double base, int p = 2) {
  double res = 1;
  for (int i = 0; i < p; i++) res *= base;
  return res;
}

int main() {
  double base;
  int p;
  cin >> base >> p;

  cout << power(base, p) << endl;
  return 0;
}
```

d) Write a program that lets the user perform arithmetic operations on two numbers. Your program must be menu driven, allowing the user to select the operation (+, -, *, or /) and input the numbers. Furthermore, your program must consist of following functions:

1. Function `showChoice()` : This function shows the options to the user and explains how to enter data.
2. Function `add()` : This function accepts two number as arguments and returns sum.
3. Function `subtract()` : This function accepts two number as arguments and returns their difference.
4. Function `multiply()` : This function accepts two number as arguments and returns product.
5. Function `divide()` : This function accepts two number as arguments and returns quotient.

```
double sum(double x, double y) { return x + y; };
double subtract(double x, double y) { return x - y; };
double multiply(double x, double y) { return x * y; };
double divide(double x, double y) {
  if (y == 0) {
    fprintf(stderr, "Error: Cannot divide by zero.\n");
    exit(1);
  }

  return x / y;
};

int showChoice() {
  static bool welcomeShowed = false;
  int choice;

  if (!welcomeShowed) {
    printf("### Welcome to Super Simple Calculator ###\n");
    welcomeShowed = true;
  }

  printf("Choose an operation\n");
  printf("(1) Addition\n");
  printf("(2) Subtraction\n");
  printf("(3) Multiplication\n");
  printf("(4) Division\n");
  printf("(0) Exit\n");
  printf("Enter your choice: ");
  cin >> choice;

  if (choice <= 4 && choice >= 0) return choice;

  return -1;
}

int main() {
  int choice = showChoice();

  while (choice != 0) {
    double x, y;
```

```
    switch (choice) {
      case 1:
        cout << "Enter x and y: "; cin >> x >> y;
        printf("%2.lf + %2.lf = %2.lf\n", x, y, sum(x, y));
        break;

      case 2:
        cout << "Enter x and y: "; cin >> x >> y;
        printf("%2.lf - %2.lf = %2.lf\n", x, y, subtract(x, y));
        break;

      case 3:
        cout << "Enter x and y: "; cin >> x >> y;
        printf("%2.lf * %2.lf = %2.lf\n", x, y, multiply(x, y));
        break;

      case 4:
        cout << "Enter x and y: "; cin >> x >> y;
        printf("%2.lf / %2.lf = %2.lf\n", x, y, divide(x, y));
        break;

      default:
        fprintf(stderr, "Invalid operation!\n");
        break;
    }

    printf("\n");
    choice = showChoice();
  }

  printf("Goodbye!\n");
  return 0;
}
```

Question (2) : Find the output of the following program:

A

```cpp
#include <iostream>
using namespace std;
void fun(int &A, int &B)
{
        A = A + B;
        B = A - B;
        A = A - B;
}
int main()
{
        int a = 4, b = 18;
        fun(a,b);
        cout << a << ", " << b;
        return 0;
}
```

```
18, 4
```

B

```cpp
#include <iostream>
using namespace std;
void implement (int &B, int C = 100){
     int temp = B + C;
     B += temp;
     if (C == 100)
          cout << temp << " " << B << " " << C << endl
}
int main(){
     int M = 90, N = 10;
     implement(M);
     cout << M << " " << N << endl;
     implement(M, N);
     cout << M << " " << N << endl;
     return 0;
}
```

```
280 10
290 570 10
570 10
```

C

```
using namespace std;
static int i = 100;
void ABC()
{
      static int i = 8;
      cout << "first = " << i++ << endl;
}
int main()
{
      static int i = 2;
      ABC();
      cout << "second = " << i << endl;
      ABC();
      return 0;
}
```

```
First = 8
Second = 2
First = 9
```

D

```
#include <iostream>
using namespace std;
int func(int &x, int y = 10){
      if (x % y == 0)
            return ++x;
      else
            return y--;}
int main(){
      int p = 20, q = 23;
      q = func(p, q);
      cout << p << " " << " " << q << endl;
      p = func (q);
      cout << p << " " << " " << q << endl;
      q = func (p);
      cout << p << " " << " " << q << endl;
      return 0;}
```

```
20  23
10  23
11  11
```