LAB 1

Lưu ý:

- Làm bài vào file word bằng tiếng Việt hoặc tiếng Anh
- Những bài làm giống nhau sẽ bị 0 điểm
- Với những bài lập trình, cần phải copy mã nguồn và chụp màn hình kết quả, đưa vào file word
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- Hạn chót nộp bài: 23 giờ ngày 22/06/2023

Question 1: What is the output of the following code? Explain your answer.

```
char str[5] = "ABC";
cout << str[3] << str[4];
cout << str;
```

Question 2: What is the output of the following code? Explain your answer.

```
int a = 1, b = 2, c = 3;
int *arr[3] = { &a, &b, &c };
cout << *arr[(*arr[2])-- - 3];
cout << c;
```

Question 3:

(a) Declare a dynamic array of pointers (to integers) of size 10?

(b) What happens when delete is used with a NULL pointer? What if we call delete twice on the same pointer?

Question 4: Consider the following recursive function fun(x, y). What is the value of fun(3, 2) ? List the recursive function calls.

```
int fun(int x, int y) {
    if (x == 0) return y;
    return fun(x - 1, x + y);
}
```

Question 5: Given int x = 0 and the following functions:

```
void f(int x) {
    x++;
    return;
}
void g(int &x) {
    x++;
    return;
}
void h(const int &x) {
    x++;
    return;
}
```

What is the value of x after each function call f(x), g(x) and h(x)?

Question 6: "for" loops can always be re-written as "while" loops, and vice-versa. Are the following two codes equivalent, and what is their output? Explain your answer, and run the codes to check.

(a)

```
int count = 1;
for (; count <= 5 ; count++)
{
      int count = 1;
      cout << count << "\n";
}
return 0;
```

(b)

```
int count = 1;
while (count <= 5)
{
      int count = 1;
      cout << count << "\n";
      count++;
}
return 0;
```

Question 7: What is the output of the following program? Correct the program if there is any compile time error.

```
#include <iostream>
using namespace std;
class Test {
      int x;
      Test() { x = 5;}
};
int main() {
      Test *t = new Test();
      cout << t->x;
}
```

Question 8: What is the value of q[2] and p[1][2] after each call to **delete**?

```
#include <iostream>
using namespace std;
int main() {
      int **p = new int*[5];
      int *q = new int[5];
      for (int i = 0; i < 5; i++) {
            q[i] = i;
      }
      p[1] = q;
      delete p;
      delete q;
      delete [] q;
}
```

Question 9: Given an array of integers `arr` with length `n` and the following function:

```
bool isPrime(int num) {
      if (num < 2) {
            return false;
      }
      int i;
      for (i = 2; i*i <= num; i++) {
            if (num % i == 0) return false;
      }
      return true;
}
```

Complete the below tasks:

a) Write a recursive function that print out at most one prime number in the array.

```
void onePrime(int * arr, int n) {
    //YOUR CODE HERE
}
```

b) Write a recursive function that print out all prime numbers in the array.

```
void allPrime(int * arr, int n) {
    //YOUR CODE HERE
}
```

Question 10: Write a function to do the matrix multiplication of a pair of matrices with arbitrary dimension sizes by two ways:

a. Static memory allocation

b. Dynamic memory allocation

Hint: A[a][b] * B[b][c] = C[a][c]

Question 11: Write a function compute the power of one integer with the positive exponent by two ways:

a. Repetition

b. Recursion

Question 12: Write a ***candidate*** data structure which stores ***id***, ***name*** *(char *)*, ***math***, ***physics***, ***chemistry*** grades for HCMUT university entrance qualification, implements ***constructor***, ***destructor*** and method ***total grade*** (to sum up math, physics, chemistry grades). Afterwards, input the information of one given candidate and use the method to output the result. Assume that ***id***, ***name*** are *public* members and ***math***, ***physics***, ***chemistry*** are *private* members.

With the following struct:

```
struct node{
    int data;
    node* next = NULL;
};
```

Question 13: Write a function to convert a list to a linked list.

For example:

```
// Given a list with some values (data) in it
int List[5] = { 1, 2, 3, 4, 5};
int Size = 5;

// This function will retrieve all data from list
// and create a linked list from that data
// For example:
node* linkedList = ConvertToLinkedList(List, Size);//1->2->3->4->5
PrintLinkedList(linkedList);  // return 1 2 3 4 5
```

Question 14: Write a program having these following functions:

a. Traversal a linked list and print all data.
b. Sort the linked list.

For example:

```
// Initialize data
int List[5] = { 5, 8, 3, 2, 9 };
int Size = 5;
node* LinkedList = ConvertToLinkedList(List, Size);
// Question 2.a - Print all data
PrintLinkedList(LinkedList);  // return 5 8 3 2 9

// Question 2.b - Sort a linked list
SortLinkedList(LinkedList, Size);

PrintLinkedList(LinkedList);  // return 2 3 5 8 9
```

Question 15: Write a recursive function to find the max value of a linked list using node:

```
int myMaxFunc(node* head, int maxVal) {
      //YOUR CODE HERE
}
```

Question 16: Write a function to add (or subtract) two polymonials.

For example:

```
// Initialize data
int Poly1[5] = { 5, 8, 3, 2, 9 };
int Poly2[5] = { 2, 0, 0, 1, 5 };
node* PolyList1 = ConvertToLinkedList(Poly1, 5);
node* PolyList2 = ConvertToLinkedList(Poly2, 5);

// Question 4
node* addedPoly = AddPoly(PolyList1, PolyList2);
PrintLinkedList(addedPoly);  // return 7 8 3 3 14
```