İSTANBUL TEKNİK ÜNİVERSİTESİ
BİLGİSAYAR VE BİLİŞİM FAKÜLTESİ
Date: 8.12.2020
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Student Id :	
Name Surname :	
Signature :	

DATA STRUCTURES
MIDTERM

Question	**1**	**2**	**3**	**4**	**Total**
Point					

This exam will be an online exam. You are supposed to prepare your solutions as running codes. All the exam questions will also be provided as running functions. You are supposed to run and change them by using a C++ compiler, and upload the answers as separate files (as .cpp and/or .h) to Ninova. Please be careful to upload the answers for relevant questions. Upload each of your answers as you complete them.

Question 1. (15 pts) The following function do not produce the expected results since it is storing only the final entry to the array. Please provide a solution using dynamic memory allocation techniques. You are NOT allowed to use c++ strings in your answer. Use either character arrays or pointers. You are not allowed to use any outside functions (such as STL methods)

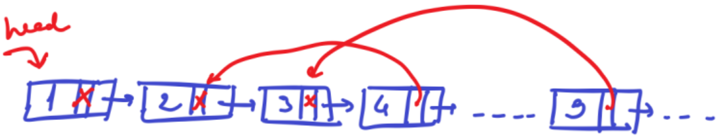
```
void question1(){
char* names[5];
char name[15];
for (int i = 0; i < 5; i++){
       cout << "Please enter " << i+1 << ". student name: ";
       cin >> name;
       names[i] = name;
}
cout << "Printing the array members:" << endl;
for (int i = 0; i < 5; i++){
       cout << names[i]<<endl;
}
}
```

Question 2. (15 pts) A palindrome is a word, number, phrase, or other sequence of characters which reads the same backward as forward, such as “madam”, “racecar”. Write a function "char* question2answer(char *instring)" which takes an argument string and turns it into a palindrome-like string but with a single difference from the classical definition. The input string will consist of numerical values and the first half of the produced string will consist of numbers -2 smaller than the second half numbers. For an n digit integer input such as “a_1a_2 a_3 ... a_n” you should produce (a_n-2) (a_{n-1}-2) ... (a_2-1) $\mathbf{a_1}$ a_2 a_3 ... a_n . Example input=1234 output=2101234. If you find a negative number as a result of the subtraction (-2) operation, put 0 instead of negative resylts. Example input=2002 should output=0002002 . You are not allowed to use c++ strings in your answer. Use either character arrays or pointers. The only function that you may use from string class is the "strlen" function. Please fill the provided question .cpp file in your answer.

Question 3. (35 pts) Write the necessary C++ data structures (one or more) and methods in order to execute question3. Please also keep in mind that your code must have no memory leaks. In this question, you should fill out both question3.h and question3.cpp files. Please keep in mind that the data structure declarations should be in question.h file.

```
void question3(){
       Linkedlist l;
       l.create();
       for (int i = 0; i < 4; i++)
              l.add2beginning(i);
       l.clear();
}
```

Question 4. (25 pts) Write the multilist struct where the node structure is given. Each node should have two pointers (named as ***next*** and ***root***). Each node's next pointer will point to the next integer in the list as usual. The list should be sorted in ascending order. If a number has an **INTEGER** root (e.g. 9's root is 3 which is an integer) its node's ***root*** pointer should point to its root's node otherwise it should be NULL. **Write the methods "returnadressof" and "add".** The add method should add n numbers from 1 to n (the function input argument) to the multilist. e.g. when the argument is 100 it will add 100 numbers with a single function call. You may assume that the multilist will always be empty when the add method is called. The root pointer of the node carrying "1" should always be NULL. Hint: you may use the sqrt and floor methods from <math.h>. question4.h file consists the necessary declarations. Upload both question.h and question.cpp file.



```
void question4(){
    Multilist l;
    l.create();
    l.add(10000);
    l.printroots(l.returnadressof(6561));//will print "6561 81 9 3 \n" accordingly
}
void Multilist::printroots(mnode *start){
    while (start != NULL){
        cout << start->data << " ";
        start = start->root;
    }
    cout << endl;
}
```

Question 5. (10 pts) Write a function (void change2linkedlist(....,....)) which takes two linked list as arguments and changes all their members (in other words at the end of the operations list1 will be same as list2 and list2 will be same as list1's earlier status) by making **as few operations as possible**. Use the Linkedlist codes (directly by including) that you have written in question 3. Do not upload the Linkedlist codes to the system.

```
void question5(){
    Linkedlist l1, l2;
    l1.create(); l2.create();
    for (int i = 0; i < 10; i++){
        l1.add2beginning(i);
        l2.add2beginning(i * 3);
    }
    change2linkedlist(……………, …………….);
}
```