

Indian Institute of Technology Bombay, Mumbai
Department of Computer Science and Engineering
CS 101: Computer Programming - Endsem: 23 Apr 2014, 17:30 – 20:30
One sheet of handwritten notes permitted. No photocopies. Weightage: 35%, Max Marks – 70

NOTE: Answer in the space provided. Extra pages will not be provided. In case of any doubts, make assumptions, state these with justification and proceed. Clarifications are not possible.

Write your Roll Number here: _____

Write your Lab Batch here: _____

Question	1a	1b	1c	2a	2b	3a	3b	4a	4b	Total
Marks										

Q1a: What is the output of the following program? [3 Marks]

<pre>int a[5] = {10,3,5,1,2}; for (int i=4; i>0; i--) { a[i] += a[i-1]; cout << a[i] << " "; }</pre>	Space for Rough Work:
	Output:

Q1b: What is the output of the following program? [3 Marks]

<pre>string c = "hi"; while (c.length() < 6) { c += c; cout << c << "\n"; }</pre>	Space for Rough Work:
	Output:

Q1c: What is the output of the following program? [4 Marks]

<pre>void something(int* p, int* &q) { *p = 5; p += 3; *p += *q; cout << *p << " " << *q << "\n"; q--; return; } int main() { int a[4] = {10,20,30,40}; int* b = a; int* c = &a[2]; something(b, c); cout << *b << " " << *c; return 0; }</pre>	Space for Rough Work:
	Output:

Q2a: We know that: $e^x = 1 + x + \frac{x^2}{2} + \frac{x^3}{3!} + \frac{x^4}{4!} + \dots$

Write a program that takes n and x as input, and outputs an estimate of e^x using first n terms of this formula.

[10 Marks]

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Q2b: Two words, $w1$ and $w2$, are said to be anagrams of each other if word $w2$ can be formed by rearranging letters of word $w1$. For example, “pan” and “nap” are anagrams, and so are “listen” and “silent”. Write a function *isanagram()* which checks if $w1$ and $w2$ are anagrams of each other. You may use the C++ string class or the C strings library functions. **[10 Marks]**

(If you do not know how to do this in either way, you may write pseudo-code, for 50% reduced marks.)

Q3a: Write a program to open a text file called "xyz.txt" and output the longest word in the file. If the longest word is not unique, i.e., the file has many words that have same 'longest' length, output **all** these words, in the order in which they appear in the file. **[10 Marks]**

You may assume that the file contains only characters and adjacent words are separated by blank-spaces. You must use the C++ #include<fstream> library.

(If you do not know how to do this in C++, you may write pseudo-code, for 50% reduced marks.)

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Q3b: Write a function *merge()* that takes two linked lists, each of which is sorted in increasing order, merges them into one list which is in increasing order, and returns this merged list. You should reuse the nodes in the input lists to create the merged list. **[10 Marks]**
(If you do not know how to do this in C++, you may write pseudo-code, for 50% reduced marks.)

Q4a: Recall (from Lab 11) that a Stack is a Last-in-First-out (LIFO) structure. Implement a Stack class that provides the methods shown below. (No partial marks for writing only psuedo-code.) **[10 Marks]**

```
class Stack {
private:
    int store[MAX]; // Stack can hold MAX number of items. Assume each item is a postive integer.
    int nltems; // Number of items currently in the stack.

public:
    Stack(); // Constructor - initializes variables when a stack object is created.
    bool push(int); // Pushes an item onto the top of the stack, returns false if stack is full.
    int pop(); // Removes (and returns) the item that is currently at the top the stack, returns -1 if stack is empty.
    void top(); // Prints the item at the top of the stack, without removing it.
    int status(); // Returns the number of items currently in the stack.
};
```

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Q4b: A company has three levels of employees – Workers, Managers, and Directors. The annual increment for each level is 20%, 10% and 5%, respectively. Employees may join at different starting salaries and their current salary is calculated by considering their level and number of year's of service. For example, a Worker who joined at salary is X, and has completed one year in the company, will have a current salary of 1.2X. Another Worker who joined at salary Y, and has completed two years, will have a current salary of 1.44Y. Write a class Employee that stores information about an employee and provides functions that can be called from the main program as shown below. **[10 Marks]**

```
#include <iostream>
#include <string>
#include <math.h>
using namespace std;

class Employee {
private:
    string name;
    int currentLevel; // Assume 1 for Worker, 2 for Manager, 3 for Director
    int yearsCompleted;
    float joiningSalary;
public:
    // You need to identify the functions required here to make the main program work
    // You may directly write your function definitions immediately after the main program below
};

int main() {
    Employee empA;
    empA.setName("personA");
    empA.setYears(5); //personA joined 5 years ago (completed 5 years in the company)
    empA.setLevel(1); // personA is a Worker
    empA.setSalary(10); //personA joined at a salary of 10
    float x = empA.getCurrentSalary();

    Employee empB("personB", 3, 2, 20); // personB joined three years ago as a Manager at a salary of 20
    float y = empB.getCurrentSalary();

    if (x > y) cout << empA.getName() << " current Salary is greater than " << empB.getName() << endl;
    else cout << empB.getName() << " current Salary is greater than " << empA.getName() << endl;

    return 0;
}
```

// continue your answer on the next page

Use this space to continue your answer to Q4b (or any other Question, for which you need more space).

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Both sides of this sheet are blank. Use it to continue your answer to any Question, if you need more space.