**National University of Computer & Emerging Sciences, Karachi  
Fall-2019 (CS-Department)  
Mid-term I Exam**

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| **Course Code:** CS-217 | **Course Name:** Object-oriented Programming | |
| **Instructors:** Dr. Abdul Aziz & Syed Zain Ul Hassan | | |
| **Student ID:** | | **Section:** |
| **Date:** September 23, 2019 | | **Time:** 60 minutes |

**Max Points**: 35

**Question 1: (2+2+2+2+2)**

Give brief answers of the following:

a) How is ***this*** operator useful?

A: this operator refers to current object. It can be used to pass current object as parameter as well as for referring current class instance variables.   
b) List any three situations where inline functions do not work.

A: 1) When function contains loops.  
 2) When function is recursive.  
 3) When a function contains switch/goto statements.  
c) Why are member initialization lists useful?

A: It can be used to initialize constant instance variables with values taken at runtime.   
d) In the presence of a parameterized constructor, it is not necessary to have a setter function. Do you agree with this statement? Justify your answer.

A: A parameterized constructor can be used to initialize instance variables but to later modify them program it is necessary to provide mutator (setter) functions.  
e) How can we stop objects from being copied in our program?

A: By defining our own copy constructor in the class and making it private.

**Question 2: (10)**

Consider the following class definition:

***class course {  
 string c\_name, c\_id;  
 int c\_hours;  
 float course\_gpa;  
};***

***class student {  
 string s\_name, s\_id;  
 float s\_gpa;  
 private: void calculateSGPA() { }  
};***

a) Make **s\_id** constant and then implement constructors for **course** and **student** classes.  
b) Implement setter functions for class members that can be changed.  
c) Call **calculateSGPA**() from **main**() for a single student instance. Make any changes or add new class members if necessary to calculate the SGPA. The SGPA can be calculated as:

**SGPA = (Total GPA of all five courses in semester / Total Credit Hours attempted)**

**class course**

**{**

**string c\_name, c\_id;**

**int c\_hours;**

**float course\_gpa;**

**public:**

**course()**

**{**

**}**

**course(string c\_name, string c\_id, int c\_hours, float course\_gpa)**

**{**

**this->c\_name = c\_name;**

**this->c\_id = c\_id;**

**this->c\_hours = c\_hours;**

**this->course\_gpa = course\_gpa;**

**}**

**void setCname(string c\_name)**

**{**

**this->c\_name = c\_name;**

**}**

**void setCid(string c\_name)**

**{**

**this->c\_id = c\_id;**

**}**

**void setChours(string c\_name)**

**{**

**this->c\_hours = c\_hours;**

**}**

**int getChours()**

**{**

**return c\_hours;**

**}**

**float getCgpa()**

**{**

**return course\_gpa;**

**}**

**};**

**class student**

**{**

**string s\_name;**

**const string s\_id;**

**float s\_gpa;**

**private:**

**void calculateSGPA(course courses[])**

**{**

**float totalGPA = 0;**

**int totalHours = 0;**

**for(int i = 0; i < 5; i++)**

**{**

**totalGPA += courses[i].getCgpa();**

**totalHours += courses[i].getChours();**

**}**

**float s\_gpa = totalGPA / totalHours;**

**cout << "SGPA: " << s\_gpa;**

**}**

**public:**

**student(string s\_name, string id, float s\_gpa): s\_id(id)**

**{**

**this->s\_name = s\_name;**

**this->s\_gpa = s\_gpa;**

**}**

**void setSname(string s\_name)**

**{**

**this->s\_name = s\_name;**

**}**

**void callCalculateSGPA(course courses[])**

**{**

**calculateSGPA(courses);**

**}**

**};**

**int main()**

**{**

**student s1("Ali", "K163058", 4.5);**

**course c1("COAL", "ee213", 3, 2.6);**

**course c2("OOP", "cs217", 3, 3.3);**

**course c3("DB", "cs350", 3, 4.0);**

**course c4("DLD", "cs105", 3, 3.3);**

**course c5("ENGLISH", "cs101", 3, 4.0);**

**course c[] = {c1, c2, c3, c4, c5};**

**s1.callCalculateSGPA(c);**

**}**

**Question 3: (15)**

Consider the following scenario:

*"DreamCo is one of the leading IT companies of the country. The company has its head office located in Karachi, while it has other offices at Lahore, Islamabad & Hyderabad. The company provides three basic services namely Network Security Testing, Desktop Application Development and Website Development. There may also be other rival companies in the market that offer the same services as well.*

*For each of the three services, DreamCo has a separate department that has several employees and is managed by a Department Head. Although all of DreamCo employees get handsome salaries (Rs. 20,000 being minimum), the employees working in Network Security Testing are considered more valuable and are provided with an allowance apart from getting their monthly salary.*

*Keep in mind that each of the offices has these three departments.*

*In order to make business decisions, the owners sometimes like to see details about the three departments across all the offices i.e. the total number of employees working in each department and the entire amount being spent on salaries and allowances."*

a) Identify all the classes and objects that will be needed.  
b) Identify the key attributes and functionalities of each class.  
c) Draw an object relation/interaction model.  
d) Assume DreamCo inaugurates a new office in Faisalabad and wants it to initially follow the Lahore office as a blueprint. Add a copy constructor to create this duplicate office object.   
e) Explain how Object Oriented Programming approach can make your program more robust, secure and efficient with reference to the given scenario.

*#include <iostream>*

*using namespace std;*

*class Employee*

*{*

*string emp\_name;*

*int emp\_salary;*

*int emp\_allowance;*

*public:*

*Employee () { }*

*string getEmpName()*

*{*

*return emp\_name;*

*}*

*void setEmpName(string emp\_name)*

*{*

*this->emp\_name = emp\_name*

*;*

*}*

*};*

*class Department*

*{*

*int dept\_id; // ID: 1 for Network Security, 2 for Desktop apps & 3 for Web apps*

*int no\_of\_employees;*

*Employee dept\_head;*

*bool allowance\_applicable = false;*

*public:*

*static int empCount;*

*Department() { }*

*Department(int dept\_id)*

*{*

*if(dept\_id == 1)*

*{*

*this->dept\_id = dept\_id;*

*no\_of\_employees = 15;*

*dept\_head.setEmpName("Ali");*

*allowance\_applicable = true;*

*}*

*else if(dept\_id == 2)*

*{*

*this->dept\_id = dept\_id;*

*no\_of\_employees = 20;*

*dept\_head.setEmpName("Abid");*

*}*

*else*

*{*

*this->dept\_id = dept\_id;*

*no\_of\_employees = 25;*

*dept\_head.setEmpName("Asad");*

*}*

*empCount += no\_of\_employees;*

*}*

*void showDeptSummary()*

*{*

*cout << "Department ID: " << dept\_id << endl;*

*cout << no\_of\_employees << " work in this department." << endl;*

*// Do the same as no. of employees for salary*

*cout << "Mr/Ms. " << dept\_head.getEmpName() << " is the head of this department." << endl;*

*}*

*int getNoOfEmp()*

*{*

*return no\_of\_employees;*

*}*

*};*

*int Department::empCount = 0;*

*// another static variable for total salary*

*class Office*

*{*

*string loc\_city;*

*Department \* d;*

*public:*

*Office() { }*

*Office(string loc\_city)*

*{*

*this->loc\_city = loc\_city;*

*d = new Department(1); // a department for Network security*

*d = new Department(2); // a department for desktop apps*

*d = new Department(3); // a department for web apps*

*}*

*void showOfficeSummary()*

*{*

*cout << "The " << loc\_city << " has three departments." << endl;*

*cout << "The total no. of employees working in this office is " << d->empCount << endl;*

*// Do the same as total employees for total salary*

*}*

*};*

*int main()*

*{*

*Office o1("Karachi"); // ID: 1 for Network Security, 2 for Desktop apps & 3 for Web apps*

*o1.showOfficeSummary();*

*}*