(Knowledge for Development)

KIBABII UNIVERSITY

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UNIVERSITY EXAMINATIONS
2016/2017 ACADEMIC YEAR

SPECIAL/SUPPLEMENTARY EXAMINATIONS
YEAR FOUR SEMESTER TWO

FOR THE DEGREE OF BACHELOR OF SCIENCE (COMPUTER SCIENCE)

COURSE CODE : CSC 363E

COURSE TITLE : GENERIC PROGRAMMING USING C++

DATE: 28/09/2017 TIME: 08:00 A.M – 10:00 A.M

INSTRUCTIONS TO CANDIDATES

ANSWER QUESTIONS ONE AND ANY OTHER TWO

Question 1 (Compulsory) (30 marks)

a) Explain what a destructor does? **[2 marks]**

b) What is a default constructor and when does a class *not* have a default constructor? **[2 marks]**

c) Explain what a friend function is and how is it used **[2 marks]**

d) Briefly explain the following terms as used in Object Oriented.

i. Inheritance **[2 marks]**
ii. abstraction **[2 marks]**
iii. Polymorphism **[2 marks]**

e) Write a definition for a `struct` type for personnel records for hourly employees. The structure contains an hourly wage rate, accrued vacation in an integer number of days, and employee status (use 'T' for temporary and 'P' for permanent). Part of the problem is appropriate choices of type and member names. **[3 marks]**

f) Carefully distinguish between the scope resolution operator, and the dot operator as used in C++. **[2 marks]**

g) Give the syntax for a function template. **[2 marks]**

h) Write a function template for a function named `minimum`. The function will have two parameters of the same type. It returns the larger of these (either if they are equal.). In carrying this out, give: a prototype (declaration) for the function template, a definition for this function, as a part of your answer, remark on the restriction of this function template to types for which `operator >` is not defined. **[7 marks]**

i) Suppose you have a class whose objects are very, very large. Briefly, describe the advantages and drawbacks of call-by-value and call-by-reference for large objects. **[4 marks]**

Question 2 (20 marks)

a) Consider the class definition:

```
class IntPair
{
  int first;
  int second;
public:
  IntPair(int firstValue, int secondValue);
// prefix operator++ here
// postfix operator ++ here
  int getFirst( ) const;
  int getSecond( ) const;
};
```

i. Give declarations for prefix and postfix versions of operator++ [3 marks]

ii. Give definitions for prefix and postfix versions of operator++ [7 marks]

b) Show how to overload the operators << and >> to create stream output for this class. Make these functions friends of the class Pair. The expected form of a pair is (2,3) for both input and output. You should only provide to accept and discard the parentheses and comma, but you should not check that these particular characters were typed. Output should be the expected form. [10 marks]

```
class IntPair
{
  int first;
  int second;
public:
  IntPair(int firstValue, int secondValue);

  int getFirst( ) const;
  int getSecond( ) const;
};
```

Question 3 **(20 marks)**

a) Design a class named QuadraticEquation for a quadratic equation $ax^2 + bx + x = 0$. The class contains:

- Data fields a, b, and c that represents three coefficients.
- A constructor for the arguments for a, b, and c.
- Three get functions for a, b, and c.
- A function named getDiscriminant() that returns the discriminant, which is $b^2 - 4ac$.
- The functions named getRoot1() and getRoot2() for returning two roots of the equation

$$r_1 = \frac{-b + \sqrt{b^2 - 4ac}}{2a} \quad \text{and} \quad r_2 = \frac{-b - \sqrt{b^2 - 4ac}}{2a}$$

These functions are useful only if the discriminant is non-negative. Let these functions return 0 if the discriminant is negative. **[12marks]**

b) Draw the UML diagram for the class. **[3 marks]**

c) Write a test program that prompts the user to enter values for a, b, and c, and displays the result based on the discriminant. If the discriminant is positive, display the two roots. If the

discriminant is 0, display the one root. Otherwise, display "The equation has no roots"

[5 marks]

Question 4 (20 marks)

a) Your program creates a dynamically allocated array as follows:

```
int *entry;
entry = new int[10];
```

so that the pointer variable `entry` is pointing to the dynamically allocated array. Write code to fill this array with 10 numbers typed in at the keyboard. [6 marks]

b) Give the sequence of steps for creating and using a dynamic array. [4 marks]

c) Here is the first line of the copy constructor for PFArrayD. The identifier PFArrayD is the name of the class, but in the header it is used three times with different meaning each time. Give the meaning for each use: [5 marks]

PFArrayD::PFArrayD(const PFArrayD& pfaObject)

d) Answer these questions about destructors [5 marks]

i. What is a destructor and what must the name of a destructor be?

ii. When is a destructor called?

iii. What does a destructor actually do?

iv. What *should* a destructor do?

Question 5 (20 marks)

a) Explain the difference between virtual functions, late binding, and polymorphism. **[3 marks]**

b) Give some recommendation for when a destructor should be declared virtual. **[3 marks]**

c) Which functions in class D are virtual? **[5 marks]**

```
class B
{
public:
  virtual void f();
  virtual void g();
  // . . .
private:
  //. . .
};
class D : public B
{
public:
  void f();
  void g(int);
private:
  // . . .
};
```

d) Write a class having a public pure virtual method. You need not put any other members in the class. **[5 marks]**

e) Suppose each of the base class and the derived class has a member function with the same signature. Suppose you have a base class pointer to a derived class object and call the common function member through the pointer. Discuss what determines which function is actually called, whether the one from the base class or the one from the derived class. Consider both the situations where the base class function is declared virtual and where it is not. **[4 marks]**