UNIVERSITY OF JOHANNESBURG

PROGRAM	:	BACHELOR OF ENGINEERING TECHNOLOGY: *ELECTRICAL*
SUBJECT	:	**Algorithms/Programming 1B**
CODE	:	**ALGELB1**
DATE	:	16 NOVEMBER 2019 (**MAIN EXAM**)
DURATION	:	180 min (08:30 – 11:30)
WEIGHT	:	40:60
TOTAL MARKS	:	100

EXAMINER	:	DR. CHABALALA CHABALALA
MODERATOR	:	DR. AHMED ALI
NUMBER OF PAGES	:	4 PAGES

INSTRUCTIONS	:	CALCULATORS ARE PERMITTED (ONLY ONE PER STUDENT)

INSTRUCTIONS TO CANDIDATES:

1. ANSWER ALL THE QUESTIONS,
2. WRITING IS DONE IN PEN ONLY,
3. KEEP ANSWERS TO THE SPACE PROVIDED,
4. MARKS WILL BE DEDUCTED FOR WORK THAT IS POORLY PRESENTED,
5. REMEMBER TO USE GOOD PROGRAMMING PRACTICES,
6. DO NOT COMBINE ANSWERS TO DIFFERENT SUB-SECTIONS OF QUESTIONS,
7. YOU WILL BE GIVEN 3 HOURS TO COMPLETE THE EXAMINATION,
8. THERE ARE 6 QUESTIONS FOR 100 MARKS,
9. DON'T BE NERVOUS,
10. **THE QUESTION PAPER SHOULD RETURN WITH THE ANSWER SHEET.**

Question 1 [10 Marks]

Mark as **TRUE/FALSE.** If the answer is false, briefly explain.

a) The name of a class constructor may be different from the name of the class. [2 Marks]

b) The member variables of a class must be of the same type. [2 Marks]

c) C++ allows you to use fractional values for loop control variables. [2 Marks]

d) Value returning functions can be used in an assignment or output statement. [2 Marks]

e) Destructors automatically execute when a class object goes out of scope. [2 Marks]

Question 2 [10 Marks]

a) Identify and correct the syntax errors in the following program: [6 Marks]

```
class testClass {
   public;
      void set(int, int);
      void print() const;
      testClass();
      bool testClass(int, int);
   private:
      int x;
      int y;
}
```

a) Differentiate between `static` vs `automatic` variables. [2 Marks]

b) Explain why passing parameters by reference may be a good option in C++. [2 Marks]

Question 3 [20 Marks]

Design a program that outputs inflation rates for two successive years and determines whether the inflation is increasing or decreasing. Ask the user to input the current price of an item and its price one year and two years ago. To calculate the inflation rate for a year, subtract the price of the item for that year from the price of the item one year ago and then divide the result by the price a year ago. Your program must contain at least the following functions:

a) A function to get the input, [4 Marks]

b) A function to calculate the results, [4 Marks]

c) A function to output the results, [8 Marks]

d) The main function to illustrate to test your program. [4 Marks]

Use appropriate parameters to pass information in and out of the functions. Do not use any global variables in your program. (Note: you may have to pass parameters by reference

Question 4 [20 Marks]

a) Determine the values of a, b and c after the following lines of code are executed? [3 Marks]

```
line 1: int a = 9, b, c; line 2: b = a++; line 3: c = ++a;
```

b) Explain the main purpose of function prototypes in C++ programming, and give an example of a function prototype. [3 Marks]

c) Value-returning functions usually return only one value. Briefly explain how you would define a function in a case where the function is required to return more than one value. [4 Marks]

d) A palindrome is a word, phrase, sentence or sequence of characters that reads the same backward as forward, e.g. `pop`; `madam`; `rotator`; `level`; `racecar`; `919`; `101`; `52225`; etc. Write a C++ function called `Palindrome()` which takes as a parameter, any integer number and return true if the number is a palindrome, false otherwise. [10 Marks]

Question 5 [20 Marks]

a) In security, encryption is simply the process of protecting information by converting it into a form that cannot be understood by unauthorized people. You have been given a task to implement a simple encryption solution that replaces the vowels `{a,e,i,o,u}` in a message with following uppercase letters `{V,W,Z,Y,Z}` as shown below:

```
{ 'a'='V', 'e'='W', 'i'='X', 'o'='Y', 'u'='Z' }
```

If a letter is not a vowel, it must remain as is. The list of letters in a message can either be in lowercase or uppercase. For example, the message `{'c','o','u','r','s','e'}` would become `"cYZrsW"`. Implement the following encryption function according to the given specification:

```
void EncryptFunction(char msg[], const int length) {
   . . .
}
```

Assume the input message for the encryption function is always a single word comprising an array of characters. [14 Marks]

b) Write the `main()` function as the test driver to illustrate how the `EncryptFunction()` function above can be used. [6 Marks]

Question 6 [20 Marks]

Consider the definition of the following `class`:

```
class Point {
   private:
      int x;
      int y;
   public:
      Point();                        //default constructor
      Point(int, int);                //constructor with parameters
      double Distance(Point,Point); //returns distance between points
      void Print() const;             //prints the values of the private
};
```

a) Describe the purpose of the `const` keyword for the `Print()` member function. [2 Marks]

b) Write the definitions of the member functions as described in the definition of the class `Point`, *i.e.* implement the class member functions. [14 Marks]

c) Write a test program to test the various operations of the class `Point`. [4 Marks]

[END OF EXAM | ALL THE BEST]