



**UNIVERSITI TUN HUSSEIN ONN MALAYSIA**

**FINAL EXAMINATION  
SEMESTER I  
SESSION 2019/2020**

COURSE NAME : COMPUTER PROGRAMMING I  
COURSE CODE : BWA 10103  
PROGRAMME CODE : BWA  
EXAMINATION DATE : DECEMBER 2019/ JANUARY 2020  
DURATION : 3 HOURS  
INSTRUCTION : ANSWER ALL QUESTIONS

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THIS QUESTION PAPER CONSISTS OF **THIRTEEN (13)** PAGES

**PART A**

In Questions 1-10, only **ONE (1)** of the choices given (a), (b), (c) and (d) contain the correct answer. Write the correct choice in the answer sheet provided.

**Q1** Which of the following statements is **TRUE**?

- (a) Six steps needed to execute a C++ program are edit, preprocess, compile, load, link, and execute (in this order).
- (b) `new` is not a reserved word in C++.
- (c) The `%` operator can work with operands of type `double`.
- (d) When reading an input with the stream extraction operator `>>` and `cin`, blank spaces and carriage return will be ignored.

(2 marks)

**Q2** What is the output of the following program segment? (Hint: 'A' has the ASCII value of 65, 'a' has the ASCII value of 97).

```
int a = 11, b = 19, x, y;
double c = 2.5, w;
char d = 'd';
x = a % b + 1;
y = d / (b % x);
w = y / x;
d = toupper(++d);
c = (d-50) / c;
cout << x << " " << y << " " << d << " " << w << " " << c;
```

- (a) 12 14 E 1 7.6
- (b) 12 14 D 1 7.6
- (c) 12 14.2857 E 1.16667 7.6
- (d) syntax error, no output produced.

(2 marks)

**Q3** What is the output of the following program segment?

```
int a = 5, b = 4, c = 1;
a += b++ - --c;
b -= c - a--;
c = ++a + b++ + c++;
cout << a << b << c << endl;
```

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- (a) 91524
- (b) 91523
- (c) 4-31
- (d) 81421

(2 marks)



Q4 What is the output of the following program segment?

```
int i = -1;
while (i < 10) {
    i += 2;
    if (i < 5) {
        continue;
        i++;
    }
    else if (i > 8) {
        i = 4;
        break;
    }
    cout << --i;
}
cout << i;
```

- (a) 56785
- (b) 45674
- (c) infinitely many outputs because of infinite loops
- (d) 1345674

(2 marks)

Q5 Which of the following recursive function(s) might have infinite loop happen for a certain value of  $n$  when called?

(a)

```
int recursion1(int n) {
    return n > 1 ? 1 :
        (n == 1 ? recursion1(n - 1) : recursion1(n + 2));
}
```

(b)

```
int recursion2(int n) {
    switch (n) {
    case 0:
        return 1;
    case 1:
        return 2;
    default:
        return recursion2(n - 2);
    }
}
```

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(c)

```
int recursion3(int n) {
    if (n % 2)
        return recursion3(n - 1);
    return 1;
}
```

(d)

```
int recursion4(int n) {
    if (n > 1)
        return recursion4(n - 1) + recursion4(n - 2);
    else if (n < 0)
        return 1;
    return 0;
}
```

- (a) (ii) only
- (b) (i), (ii) and (iii) only
- (c) (i), (iii) and (iv) only
- (d) All (i), (ii), (iii) and (iv)

(2 marks)

**Q6** A function `fun` accepts two inputs; the first argument is a two-dimensional array (size  $2 \times 4$ ) and the second argument is a single dimensional array (size 4). Both arrays are passed by reference. Which of the following is the correct function prototype of `fun`?

- (i) `void fun(int a[][], int b[])`
  - (ii) `void fun(int a[][4], int b[4])`
  - (iii) `void fun(int &a[2][4], int &b[4])`
  - (iv) `void fun(int[][4], int[])`
- (a) (i) and (ii) only
  - (b) (ii) and (iv) only
  - (c) (i), (ii) and (iii) only
  - (d) (ii), (iii) and (iv) only

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(2 marks)

**Q7** Consider the following function.

```
void function(int x, int &y, int z = 1) {
    static int w = 1;
    if (x % y) {
        x = 1; y++;
    }
    if (y == 3) {
        y = w; z++; return;
    }
    w++;
}
```

What is the output of the following program segment?

```
int x = 2, y = 3, z = 1;
function(x, y);
cout << "x = " << x << ", y = " << y << ", z = " << z <<
endl;
function(y, x, z);
cout << "x = " << x << ", y = " << y << ", z = " << z <<
endl;
function(z, x, y);
cout << "x = " << x << ", y = " << y << ", z = " << z <<
endl;
```

(a)

```
x = 2, y = 4, z = 1
x = 2, y = 4, z = 1
x = 3, y = 4, z = 1
```

(b)

```
x = 2, y = 3, z = 1
x = 2, y = 3, z = 1
x = 2, y = 3, z = 1
```

(c)

```
x = 2, y = 4, z = 4
x = 2, y = 5, z = 4
x = 2, y = 6, z = 4
```

(d)

```
x = 2, y = 4, z = 1
x = 2, y = 4, z = 1
x = 1, y = 4, z = 1
```

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(2 marks)

**Q8** Consider the following program segment.

```
int a = 11, b = 25, c = 37;
int *ptr = &a;
*ptr = 22;
ptr = &b;
b = 31;
c = b++;
b -= 10;
a = 2 * *ptr;
```

What is the value of a, b and c after the program executes?

- (a) a = 44, b = 22, c = 32
- (b) a = 62, b = 16, c = 25
- (c) syntax error, the program will not execute
- (d) a = 44, b = 22, c = 31

(2 marks)

**Q9** Consider the following program segment.

```
int* a = new int[5];
int* ptr = a;
for (int i = 0; i < 5; i++) {
    *a = 2 * i;
    a++;
}
a = ptr;
*(ptr + 1) = 5;
ptr += 2;
*ptr = 7;
ptr[2] = 4;
```

After the program executes, what are the values stored in the array a?

- (a) a[0] = 0, a[1] = 2, a[2] = 4, a[3] = 6, a[4] = 8
- (b) a[0] = 0, a[1] = 5, a[2] = 4, a[3] = 6, a[4] = 8
- (c) a[0] = 0, a[1] = 5, a[2] = 4, a[3] = 7, a[4] = 8
- (d) a[0] = 0, a[1] = 5, a[2] = 7, a[3] = 6, a[4] = 4

(2 marks)

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**Q10** Which of the following statement(s) is(are) **TRUE**?

- (i) A pointer is a variable that contains as its value the address of another variable.
- (ii) The null pointer can be dereferenced.



- (iii) The dereferencing operator \* has higher precedence than the arithmetic + and -.
- (iv) In C++, arrays can be passed in as input arguments to a function that receives a pointer as an input.
- (a) (i), (ii) and (iii) only.
- (b) (i), (iii) and (iv) only.
- (c) (ii), (iii) and (iv) only.
- (d) All (i), (ii), (iii) and (iv).

(2 marks)

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## PART B

Answer **all** questions in the answer sheet provided.

- Q11 (a)** The program in **Figure Q11 (a)** is intended to swap the three integers x, y and z in descending order. However, some statements are in the wrong order. Rearrange the program such that the output is correct **without adding or removing** any existing code.

```
int main()
{
    if (y > x) {
        x = y;
        temp = x;
        y = temp;
    }
    if (y > x) {
        x = y;
        y = temp;
        temp = x;
    }
    if (z > y) {
        temp = y;
        z = temp;
        y = z;
    }
    int x = 31, y = 12, z = 43, temp;
    cout << "x = " << x << ", y = " << y
        << ", z = " << z << endl;
}
```

**Figure Q11 (a)**

(5 marks)

- (b) The program in **Figure Q11 (b)** is intended to find the following sum

$$1 - \frac{1}{2} + \frac{1}{3} - \frac{1}{4} + \frac{1}{5} - \frac{1}{6} + \dots - \frac{1}{100}$$

and store the result in the variable `sum` but is incomplete and have several variable declaration and initialization missing. Complete the program.

```
i = 1;
double sum;
while (i <= 100) {
    if (
        else
    }
}
```

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**Figure Q11 (b)**

(6 marks)





- (c) Use the conditional operator to find the maximum between three integers a, b, and c. (5 marks)
- (d) Write the program that displays the output in **Figure Q11 (d)**.

```
Amy           : "Good morning everyone"
Students      : "Good morning madam."
This is a line comment \\
This is a block comment \**\
```

**Figure Q11 (d)**

(4 marks)

- Q12 (a)** Write the output of the program in **Figure Q12 (a)**.

```
#include <iostream >
int a = 1;
void function1(int a) {
    a = 4;
    a--;
}
void function2(int &a) { a--; }
void function3() {
    static int a = 5;
    cout << "a = " << a << endl;
    a++;
}

int main ()
{
    int a = 2;
    {
        int a = 3;
        function1(a);
        cout << "a = " << a << endl;
        function2(a);
        cout << "a = " << a << endl;
        function3();
        cout << "a = " << a << endl;
    }
    cout << "a = " << a << endl;
    function3();
    cout << "a = " << ::a << endl;
    function2(::a);
    cout << "a = " << ::a << endl;
}
```

**Figure Q12 (a)**

(8 marks)

- (b) Write the function `multiply` that computes the product of two complex numbers  $x_1 + y_1i$  and  $x_2 + y_2i$ , which is defined as follows

$$(x_1 + y_1i)(x_2 + y_2i) = x_1x_2 - y_1y_2 + (x_1y_2 + x_2y_1)i$$

See the sample program in **Figure Q12 (b)**. In the program,  $x_1 + y_1i$  and  $x_2 + y_2i$  are the complex numbers to be multiplied and  $a + bi$  is the product. In addition, let the function sets the value of  $y_1$  and  $y_2$  to be 0 if the function call does not supply these values. Write the prototype of the function as well.

```
int main()
{
    double a = 0, b = 0, x1 = -2.2, y1 = 4,
           x2 = 1.2, y2 = 3.5;
    multiply(a, b, x1, x2, y1, y2);
    cout << "(" << x1 << " + " << y1 << "i) * "
         << "(" << x2 << " + " << y2 << "i) = "
         << a << " + " << b << "i" << endl;
}
```

**Figure Q12 (b)**

(8 marks)

- (c) Consider the function in **Figure Q12 (c)**.

```
int secret(int x, int y) {
    if (y == 0)
        return x;
    else
        return secret(y, x % y);
}
```

**Figure Q12 (c)**

What is the value return by the function call `secret(96,144)` and `secret(136,255)`? Explain mathematically the value returned by the function represents.

(4 marks)

- Q13** (a) Write a function, `mean` that finds and returns the mean of an array data. The function accepts data as its only input. Assume that the size of data is declared as a global constant size.

(6 marks)

- (b) Write a function, `standardDeviation` that finds and returns the standard deviation of an array data. The standard deviation,  $\sigma$ , of an array  $\vec{x} = [x_1, x_2, x_3, \dots, x_n]$  of size  $n$  is given by

$$\sigma = \sqrt{\sum_{i=1}^n \frac{(x_i - \bar{x})^2}{n}}$$

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where  $\bar{x}$  is the mean of the array  $\vec{x}$ . Call the function written in Q13 (a) to find  $\bar{x}$ .

(7 marks)

- (c) **Figure Q13 (c)** is a sorting program that sorts an array `list` in ascending order. Write the output of the program and name the sorting algorithm used.

```
#include <iostream>

void sort(int list[], int length){
    int loc, minIndex;
    for (loc = 0; loc < length; loc++){
        minIndex = minLocation(list, loc, length - 1);
        swap(list, loc, minIndex);
        printArray(list, length);
    }
}

void swap(int list[], int first, int second){
    int temp;
    temp = list[first];
    list[first] = list[second];
    list[second] = temp;
}

int minLocation(int list[], int first, int last){
    int loc, minIndex;
    minIndex = first;
    for (loc = first + 1; loc <= last; loc++){
        if (list[loc] < list[minIndex])
            minIndex = loc;
    }
    return minIndex;
}

void printArray(int list[], int length) {
    for (int i = 0; i < length; i++) {
        cout << list[i] << " ";
    }
    cout << endl;
}

int main()
{
    int data1[7] = { 40, 6, 19, -11, -2, 13, 5 };
    printArray(list, length);
    sort(data1, 7);
}
```

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**Figure Q13 (c)**

(7 marks)

**Q14** Suppose a text file, `Input.txt` in **Figure Q14 (a)** contains the amount spend by four students for their lunch and dinner.

Adam	1.2	6.0
Ben	4.5	12.6
Colin	3.7	5.3
Danny	6.2	6.8

**Figure Q14 (a)**

The first column of this file represents the name of the students. The second column and the column are the amount spend for lunch and dinner respectively. Complete the C++ program in **Figure Q14 (b)** to read data from the file `Input.txt` and prints the output shown in a text file `output.txt` as shown in **Figure Q14 (c)**.

```
#include <iostream>
#include ...
...
using ...

int main()
{
    const int size = 4;
    string name[size];
    double amountSpent[size][2];
    double total[size] = {};
    double average[size];

    //to declare file objects and open files
    ifstream ...
    ofstream ...

    //to check if input/ output file is opened
    //successfully
    if (...

    //to read data from the input file and store them
    //in the variables declared
    //find the total and average of the amount spend by
    //each student
    for ...

    //to print the header of the output file
    outfile << ...

    //to print the names, total and average of amount
    //spend by each student
    for ...

}
```

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**Figure Q14 (b)**

Name	Total	Average
Adam	7.20	3.60
Ben	17.10	8.55
Colin	9.00	4.50
Danny	13.00	6.50

**Figure Q14 (c)**

The parts that has " . . . " in **Figure Q14 (b)** must be filled by complete code. Write the full program in the answer sheet given. Make sure that your program has the exact formatting as in **Figure Q14 (c)** (the item names must be left aligned; amount must be displayed with 2-digit precision and right aligned).

(20 marks)

– END OF QUESTIONS –

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