CONFIDENTIAL

UNIVERSITI TEKNOLOGI MALAYSIA

FINAL EXAMINATION

SEMESTER I 2016/2017

SUBJECT CODE	**: SCSJ1013**
SUBJECT NAME	**: PROGRAMMING TECHNIQUE I**
YEAR/COURSE	**: 1 (SCSJ / SCSV / SCSB / SCSR /SCSD)**
TIME	**: 3 HOURS**
DATE	**:**
VENUE	**:**

INSTRUCTIONS TO THE STUDENTS:

Please answer all questions in the answer booklet.

SECTION A: 6 [STRUCTURED] QUESTIONS	(70 MARKS)
SECTION B: 1 [PROGRAMMING] QUESTION	(30 MARKS)
TOTAL	(100 MARKS)

ANSWER ALL QUESTIONS IN THIS BOOKLET IN THE SPACES PROVIDED.

Additional answer sheets will be given upon request.

Name	
I/C No.	
Year/Course	
Section	
Lecturer's Name	

This question booklet consists of **19 pages** inclusive of the cover page.

PART A **[70 marks]**

Question 1 (**9 Marks**)

Write C++ statements to perform each of the following:

a) Declare and initialize an array of strings named **`students`** to store the following names: Amir Ali, Rania, Syamim, Thomas Ang, and Aidura. (2 marks)

b) Print the **`students`** array. (2 marks)

c) Write a function named **`changeName`** to change the students' names in the array by user input. The function takes the array of strings as argument and does not return a value. (4 marks)

d) Write a statement to call the **`changeName`** function. (1 mark)

Question 2 (**4 Marks**)

Given two overloaded functions below.

```
int f(int &a, int b)
{
     int c = a + b;
     a = a+1;
     b = b+1;
     return c;
}

int f(int a)
{
     return a*a;
}
```

Determine the values of *x* and *y* after the execution of each of the following function calls. Note that, each question is independent. Assume the original values of the variables for each question are *x*=2 and *y*=2.

Answers:

	Answers	
	x	***y***
(a). `f(x, y);`		
(b). `y = f(x, 2);`		
(c). `y = f(x);`		
(d). `y = f (x, f(2) );`		

Question 3 (**12 Marks**)

A program will be developed to calculate the product of all the integer numbers from *s* to *e*, where *s* and *e* are positive numbers specified by the user. You have to complete user defined functions described in (a) and main function as described in (b).

(a). You have to write the code for three user defined functions named **`readPositive`**, **`swap`** and **`multiply`**. Table 1 gives the prototypes of the functions as well as their descriptions. Figure 1 shows some example runs of the program.

Table 1

Function prototypes	Description
`int readPositive(void);`	This function is used to obtain a positive integer from the keyboard. If the user enters a non-positive integer, he or she will be asked to enter another integer number until it is positive. The return value from this function is the positive integer. (2 marks)
`void swap(int&, int&);`	This function is used to swap or exchange values between two variables specified as the first and second parameters, respectively. (2 marks)
`int multiply(int, int);`	This function is used to multiply all the integer numbers from the starting number (the first parameter) to the ending number (the second parameter). The starting number must be less than or equal to the ending number, so that the multiplication can be done ascendingly. (3 marks)

Run 1

```
The starting number:
Enter an integer => 3
```

```
The ending number:
Enter an integer => 5

The product of the integers from 3 to 5 is 60
```

Run 2

```
The starting number:
Enter an integer => 5

The ending number:
Enter an integer => 3

The product of the integers from 3 to 5 is 60
```

Run 3

```
The starting number:
Enter an integer => 0
Enter an integer => -1
Enter an integer => -2
Enter an integer => -3
Enter an integer => 3

The ending number:
Enter an integer => 0
Enter an integer => 0
Enter an integer => 0
Enter an integer => -9
Enter an integer => 3

The product of the integers from 3 to 3 is 3
```

Figure 1: Example runs of the program

Answers:

// Function definition for **`readPositive`**

```
// Function definition for swap
```

```
// Function definition for multiply
```

(b). Using the functions defined in (a), fill in the blank lines in the main function of the program below with appropriate function calls according to the tasks stated. Figure 1 shows some example runs of the program.

```
int main()
{
      int s;  // The starting integer number.
      int e;  // The ending integer number.
      int p;  // The product of the integers from s to e.

      //Task 1: Read the starting integer number. It must be positive.  (1 mark)
      cout <<"The starting number:" << endl;

      _____________________________________________
      cout << endl;
```

```
        //Task 2: Read the ending integer number.  It must be positive.  (1 mark)
        cout <<"The ending number:" << endl;

        _____________________________________________

        // Task 3: Make sure that  s ≤ e, otherwise swap their values. (2 marks)

        _____________________________________________


        _____________________________________________

        // Task 4: Find the product of integer numbers from s  to e.   (1 mark)

        _____________________________________________

        cout << endl;

       cout << "The product of the integers"
            << " from " << s
            << " to " << e
            << " is " << p << endl;

     return 0;
}
```

Question 4 (**8 Marks**)

Based on the output generated in **Output** column in Table 3, complete the blank space with correct **`cmath`** predefined functions and additional C++ statement (if necessary). Table 2 shows list of predefined functions.

Table 2

Predefined functions:		
abs(x)	abs(x)	log(x)
ceil(x)	fabs(x)	log10(x)
exp(x)	floor(x)	pow(x,y)
sqrt(x)	sin(x)	tan(x)

Table 3

Line	**C++ Statements**	**Output**
1	`#include <iostream>`	-
2	`#include <iomanip>`	-
3	`#include <cmath>`	-
4	`using namespace std;`	-
5	`int main() {`	-
6	`float num1 = -6.25;`	-
7	`cout << showpoint << fixed;`	-
8	`cout <<` _____ `<< endl;`	6.250000
9	`cout <<` _____ `<< endl;`	-6.000000
10	`cout <<` _____ `<< endl;`	-7.000000
11	`cout <<` _____ `<< endl;`	39.062500
12	`int num2 =` _____`;`	-
13	`cout << num2 << endl;`	6
14	`cout <<` _____ `<< endl;`	2.449490
15	`cout <<` _____ `<< endl;`	0.778151
16	`return 0; }`	-

Question 5 (**18 Marks**)

Given three functions named **f**, **g** and **h**, and three arrays, named **p**, **q** and **r**, in the program segment given in Figure 2.

```
void f(const int a[][5], int n)
{
     for (int i=0; i<5;i++){
          cout << a[n][i] <<" ";
     }
}
void g(const int a[][5], int n)
{
     for (int i=0; i<4;i++){
          cout << a[i][n] <<" ";
     }
}
void h(const int a[][5], int n)
{
     for (int i=0; i<n;i++){
          for (int j=0; j<=i; j++){
               cout << a[i][j] <<" ";
          }
     }
}
int p[4][5] = { {11, 12, 13, 14, 15},
                {25, 26, 27, 28, 29},
                {33, 34, 35, 36, 37},
                {41, 42, 43, 44, 45} };
int q[4][5];
int r[5];
```

Figure 2

(a). Determine the output for each function call below: (6 marks)

	Answers:
i. `f(p,2);`	
ii. `g(p,2);`	
iii. `h(p,2);`	

(b). Using the same arrays from the program segment in Figure 2 and appropriate loops, write the code segment to accomplish each of the following tasks:

i. print the sum of all the elements of array **`p`**. (5 marks)

ii. copy all the elements of **`p`** to **`q`** accordingly. (3 marks)

iii. find the total of elements for each column in array **`p`** and put the result into array **`r`** accordingly. (4 marks)

Answers:

i.	
ii.	
iii.	

Question 6 (19 **Marks**)

The management of a shopping complex keeps track of its shop-lot tenants to assist them in the collection of monthly rentals. Among records kept are: lot number, lot status, tenant's name, telephone number, lot size: length and width (in meters), and rental rate per square meter. From these records the monthly rent will be calculated. (5 Marks)

(a). Create a structure declaration called **`Tenants`** that holds the information stated above.

`lotNumber:`	an integer value.
`lotStatus:`	a character (**`O`**-*ordinary*, **`P`**-*prime*).
`tenantName:`	string.
`phoneNum:`	string.
`lotLength:`	a double value.
`lotWidth:`	a double value.
`rentalRate:`	a double value.
`mthlyRent:`	a double value.

Answers:

(b). Assuming that it is a newly opened complex and only has 3 tenants; 2 prime and 1 ordinary. Write a C++ statement to create a variable ***tenant*** of **Tenants** type to hold the information of these 3 tenants. Initialize the the first and second tenant with the information given in Table 3. (3 marks)

Table 3

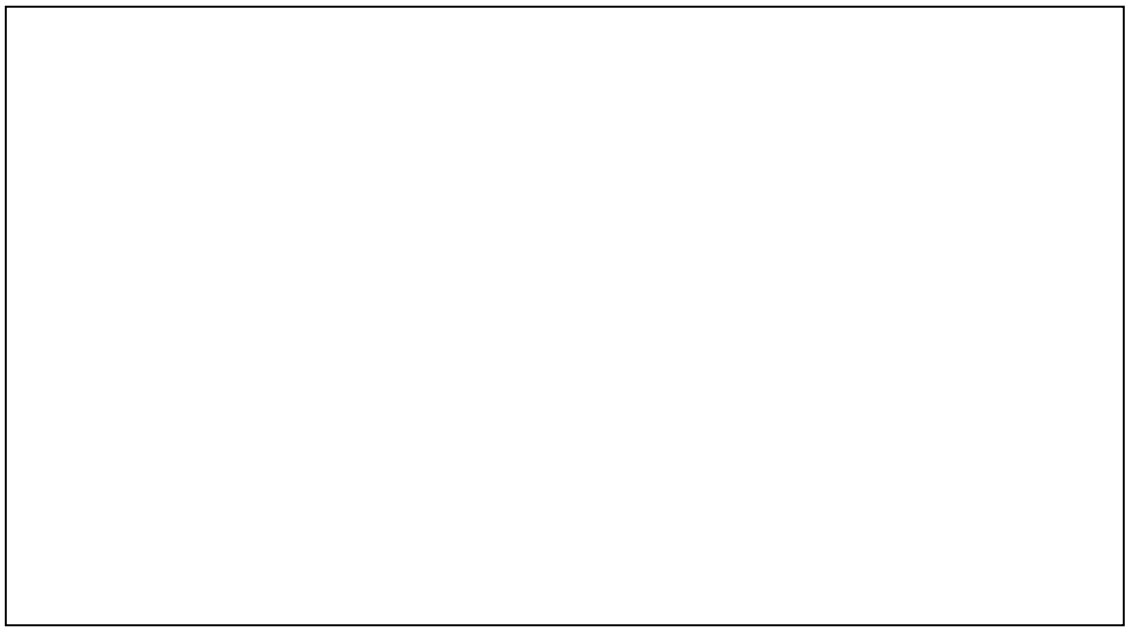
Tenant	**Lot number**	**Lot status**	**Tenant's name**	**Telephone number**	**Lot length**	**Lot width**
1st tenant	2317	prime	Shafie Afdal	0173323477	12 meters	15
2nd tenant	1224	ordinary	Linda Malek	0113211212	5 meters	12

Answers:

(c). The third tenant's information came late and was added later. Write C++ statements to read values of the last tenant from the keyboard. (3 marks)

(d). The monthly rental rate for an ordinary shop-lot is RM100 per square meter. However, the rental rate for a prime lot is doubled that of an ordinary lot. Using a loop write C++ statements to identify the lot status and assign the monthly rent of each shoplot.
(5 marks)

(e). Using a loop write C++ statements to calculate the monthly rentals for all tenants based on the shop-lot's size. (3 marks)



PART B **[30 Marks]**

A pet shop named OwnAPet wants to have a computerized system to calculate and print payroll information for its 5 employees.

INSTRUCTIONS:

Write a C++ payroll program for the pet shop owner. Your program should be able to do the following tasks:

(a) The program should define two arrays:
- A 1D array which is used to store the list of employee IDs.
- A 2D array which consists of four columns. The first column is used to store the list of hours worked, second column for storing the list of rates of pay, third column is for storing the list of regular pays, the fourth column for storing the list of overtime pays and the fifth column is for storing the list of total pays.

(b) The program will read the data of the employees consisting of the employee *IDs*, *hours worked* and *rates of pay* from the keyboard.

(c) The program will display the payroll information of the employees onto the screen.

(d) Besides function **`main()`**, the program needs to define four (4) other functions as described in Table 4. You should use appropriate arguments (based on Table 4) for each function.

(e) Figure 3 shows an example run of the program with the keyboard inputs whereas Table 5 shows the assessment criteria.

Write your full program in the blank space provided in page 18.

Table 4: Description for functions

Function	Description
`displayLine()`	To display lines using 105 characters of '-' onto the screen using a loop.
`getData()`	To get the data of the employees from the keyboard. For each employee, the user needs to enter the *ID, hours worked* and *the rate of pay* of the employee. The function should accept a 1D array of *empID* and 2D array *empRecord* as its arguments.
`calculatePayroll()`	To calculate the regular pays, overtime pays and total pays of the employees. For each employee, the calculation is done as follows: i) Regular pay = hour x rate ii) The overtime will be given if the employee hours worked exceeds 40 hours and calculated based on: Overtime = exceed hours x 1.5 x rate iii) Total pay = regular pay + overtime The function should accept a 1D array of *empID* and 2D array *empRecord* as its arguments.
`printData()`	To print the payroll information of the employees onto the screen. The function should accept a 1D array of *empID* and 2D array *empRecord* as its arguments.
`highestOvertime()`	To search for the employee who has the highest overtime pay. The function should display the highest overtime pay, employee ID and the employee overtime pay onto the screen. The function should accept a 1D array of *empID* and 2D array *empRecord* as its arguments

```
Payroll Program
ID: 1
Hours worked:45
Rate of Pay (RM per hour):3
ID: 2
Hours worked:40
Rate of Pay (RM per hour):2
ID: 3
Hours worked:20
Rate of Pay (RM per hour):1
ID: 4
Hours worked:55
Rate of Pay (RM per hour):3
ID: 5
Hours worked:41
Rate of Pay (RM per hour):2

Payroll Final Report
--------------------------------------------------------------------------
ID      HOURS   RATE(RM)    REGULAR PAY (RM)    OVERTIME (RM)       TOTAL (RM)
--------------------------------------------------------------------------
1       45      3           120                   22.5                142.5
2       40      2           80                    0                   80
3       20      1           20                    0                   20
 4       55      3           120                   67.5                187.5
5       41      2           80                    3                   83

Staff 5 have the highest pay overtime of RM67.5

--------------------------------
Press any key to continue . . .
```

Figure 3: Example run on screen

Table 5: Assessment criteria

Item	Criteria	Marks
A	Using an appropriate structure for the program (*e.g.* all required header files are included, the function main is properly written, *etc.*)	2
B	Use #define to define any global variable especially the number of employee, over time rate and other global variable which are important in the program	2
	Reading the input data from keyboard: *ID, hours worked* and *the rate of pay*	1.5
C	Declaration of function **`displayLine(), getData(), calculatePayrol(), printData`** and **`highestOvertime()`**.	5
	Code for the function displayLine **`()`**: displaying lines using the 52 characters of '-'. The function should use loop to display the line.	2
	Code for the function **`getData()`**: ID, hours work and the rate of pay for each employee.	3.5
	Code for the function **`calculatePayroll()`**: for calculating the regular pay, overtime and total pay of each employee.	3.5
	Code for the function **`printData()`**: for calculating the regular pay, overtime and total pay of each employee.	3.0
	Code for the function **`highestOvertime()`**: to search for the staff with highest overtime pay. The function should accept the 1D array of *empID* and 2D array *empRecord* as its arguments	4
D	Printing the information of each employee	1.5
	Printing the output in a proper format.	2
Total		**30**

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(please request for more papers for answering this question)