

PT1, ASSIGNMENT-4

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PART A

[70 MARKS]

QUESTION 1

[4 Marks]

Program 1 is the program that is used by the parking attendant to calculate the fee for parking based on the hours and rates. The parking building consists of employee and non-employee car with different type of rates:

(a) Employee of the company: RM 1.50 per hour

(b) Non-employee: RM 3.00 per hour

Based on the comments given in **Program 1**, fill in the blank lines with appropriate C++ statements. The program should generate the output as shown in **Figure 1**. *Note: The bold texts in Figure 1 indicate input from the user.* (4 marks)

```
The number of cars: 2

Hours parked for car 1: 3
Hourly pay rate for car 1: 1.50

Hours parked for car 2: 5
Hourly pay rate for car 2: 3.00

Here is the total fee for each car:
Car [1] = RM4.50
Car [2] = RM15.00
```

Figure 1: Example runs of the Program 1

```
1  ff Program 1
2  #include<iostream>
3  #include<iomanip>
4  using namespace std;
5
6  int main()
7  {
8      const int no_cars = 2; //Constant for the array size
9
10     //Declare an array named hours and rate to allocate 2
11     //elements of type integer and double respectively.
12     //Use constant declared in line 8.
```

```

13     int hours[2];
14     double rate[2];
15
16     cout << "The number of cars: " << no_cars;
17     cout << endl;
18
19     for (int index = 0; index < no_cars; index++)
20     {
21         cout << "\nHours parked for car " << (index+1) << ": ";
22         //Read a value and assign it into array named hours
23         cin >> hours[index];
24         cout << "Hourly pay rate for car " << (index+1) << ": ";
25         //Read a value and assign it into array named rate
26         cin >> rate[index];
27     }
28     cout << "\nHere is the total fee for each car:\n";
29     cout << fixed << showpoint << setprecision(2);
30
31     for (int index = 0; index < no_cars; index++)
32     {
33         //Calculate a value of totalPay (fee for parking)
34         double totalPay = hours[index]*rate[index];
35         cout << "Car [" << (index + 1);
36         cout << "]" = RM" << totalPay <<endl;
37     }
38     return 0;
}

```

QUESTION 2

[16 Marks]

Given the declaration and initialization of some parallel arrays as in the following code segment:

```
string patients[] = {"Wendy", "Kumar", "Ros", "Mael"};
int age[] = {25, 43, 32, 54};
double averageSugarLevel[4];
```

Based on the concept of arrays and using loops, answer the following questions:

- (a) Define a two-dimensional array named **sugarLevel** which has large enough space to hold the data in the following table. Initialize the array with values from the table. (2 marks)

4.5	5.7	6.8
6.2	7.1	7.3
5.1	6.3	8.0
7.5	8.5	7.3

Answer:

```
double sugarLevel [][][3]={{4.5,5.7,6.8},{6.2,7.1,7.3},{5.1,6.3,8.0},{7.5,8.5,7.31}};
```

- (b) Write a **code segment** that prints the patient names along with their ages. The output should be as follows: (3 marks)

```
Age of Patients
-----
Wendy      25
Kumar      43
Ros        32
Mael       54
```

Answer:

```
#include<iostream>
using namespace std;
main( )
{
const int ROWS=4, COLS=2;
string arr[ROWS][COLS] = {
    { "Wendy", "25" },
    { "Kumar", "43" },
    { "Ros", "32" },
    { "Mael", "45" }
};

cout<<"Age of patients\n-----\n";
for(int i=0;i<ROWS;i++)
{
    for(int j=0;j<COLS;j++)
    {
        cout<<arr[i][j]<<"\t";
    }
    cout<<endl;
}
Return 0;
}
```

- (c) Write a **code segment** that produces the following output from the array named **sugarLevel** that you defined in (a). (4 marks)

Name	Breakfast	Lunch	Dinner
Wendy	4.5	5.7	6.8
Kumar	6.2	7.1	7.3
Rose	5.1	6.3	8.0
Mael	7.5	8.5	7.3

Answer:

```
#include<iostream>
using namespace std;
main( )
{
const int ROWS=4, COLS=3;
string patients[]={ "Wendy", "Kumar", "Ros", "Mael" };
double sugarLevel[ROWS][COLS]={ {4.5, 5.7, 6.8},
```

```

        {6.2, 7.1, 7.3},
        {5.1, 6.3, 8.0},
        {7.5, 8.5, 7.3}}};

    cout<<"Name\t\tBreakfast\tLunch\t\tDinner\n";

    for(int i=0;i<ROWS;i++)
    {
        cout<<patients[i]<<"\t\t";

        for(int j=0;j<COLS;j++)
        {
            cout<<sugarLevel[i][j]<<"\t\t";
        }
        cout<<endl;
    }

    return 0;
}

```

- (d) Write a **code segment** to calculate the average sugar level of the patient. The code also store the average sugar level value in the array **averageSugarLevel** and print the list of the patients' average sugar level value as follows. (7 marks)

Sugar Level of Patients	

Wendy	25
Kumar	43
Ros	32
Mael	54

Answer:

```

for(int i=0;i<4;i++)
{
    averageSugarLevel[i]=0;
    for(int j=0;j<3;j++)
    averageSugarLevel[i]+=sugarLevel[i][j];
    averageSugarLevel[i]/=3;
}
cout<<"\n\nSugar Level of Patients\n";
cout<<"-----\n";
for(int i=0;i<4;i++)

```

```

{
cout<<patients[i]<<"\t"<<averageSugarLevel[i]<<endl;
}
return 0;
}

```

QUESTION 3

[11 Marks]

- (a) Name at least two member functions associated with **iostream** object. (2 marks)

Answer:

clog(for streaming logs),cout(output to monitor)

- (b) Suppose two file stream objects named **f_{in}** and **f_{out}** have been declared in the code as follows:

```

ifstream fin;
ofstream fout;

```

Complete the code so that the program can copy 10 numbers from a file named **file1.dat** and save the numbers to another file named **file2.dat** (copy 10 numbers between files). The program should also include an error checking for opening the files. (9 marks)

Answer:

```

#include<iostream.h>
#include<fstream.h>
int main(){
ifstream fin;
fin.open("file1.dat");
if(fin.fail()){
cout<<"Couldn't open the file
1!"<<endl;
return0;
}
ofstream fout;
fout.open("file2.dat");
if (fout.fail()){
cout<<"Couldn't open the file2!"<<endl;
return 0;
}
int data;
for(int i=0;i<10;i++){
fin>>data;

```

```

fout<<data;
}
fin.close();
fout.close();
return0;
}

```

QUESTION 4

[4 Marks]

Based on the **Program 2**, write the output into **Table 1**. *Note:* one cell represents one space per digit or character. (4 marks)

1	ff Program 2
2	ffThis program write three rows of numbers to a file
3	#include <iostream>
4	#include <fstream>
5	#include <iomanip>
6	using namespace std;
7	
8	int main ()
9	{
10	const int ROWS = 3;
11	const int COLS = 3;
12	double nums [ROWS][COLS] = {1501, 3.579, 984,
13	5.3, 91, 1979,
14	24, 606, 11.0287};
15	fstream outFile ("Jadual.txt", ios::out);
16	
17	for (int row = 0; row < ROWS; row++)
18	{
19	for (int col = 0; col < COLS; col++)

```

20      {
21          outFile << setprecision (1) << fixed << showpoint;
22          outFile << setw(6) << nums [row][col];
23      }
24      outFile << endl;
25  }
26  outFile.close();
27  return 0;
28  }

```

Table 1: Output file named **Jadual.txt**

1	5	0	1	.	0	3	.	6	9	8	4	.	0				
			5	.	3	9	1	.	0	1	9	7	9	.	0		
		2	4	.	0	6	0	6	.	0	1	1	.	0			

QUESTION 5

[4 Marks]

As you are travelling to the United States, it is important to know the temperature for you to be able to prepare what to wear for the day. Apparently in the United States, they use Fahrenheit and not Celsius. A conversion program that will ask for a temperature in Fahrenheit, convert that value to Celsius, and display the result, would definitely become handy. Complete the **Program 3**. You need to write the function **convert**. *Note: $C = 5 / 9 \times (F - 32)$* . Do not modify the function **main**.

(4 marks)

```
1 // Program 3
2 #include <iostream>
3 #include <iomanip>
4 using namespace std;
5
6
7
8
9
10

```

```
//Write the function prototype

void convert(double *temperature)
{
    *temperature=(*temperature-32.0)*5.0/9.0;
}

int main ()
{
    double temperature;
```

11	
12	cout << "Enter a temperature in Fahrenheit, and I will
13	<< convert it to Celsius:";
14	cin >> temperature;
15	convert (&temperature);
16	cout << fixed << setprecision(4);
17	cout << "Value in Celsius: " << temperature << endl;
18	
19	return 0;
20	}
21	
22	<i>//Write the function convert here</i>
23	_____
24	_____
25	_____
26	_____
27	_____

QUESTION 6

[10 Marks]

- (a) Determine the output and draw a memory layout (or memory allocation) of the pointers and variables for code segment below: (7 marks)

Note: Draw a memory layout that represents C++ statement line by line.

```

int  x = 10, y = 20, z = 30;
int *ptr;

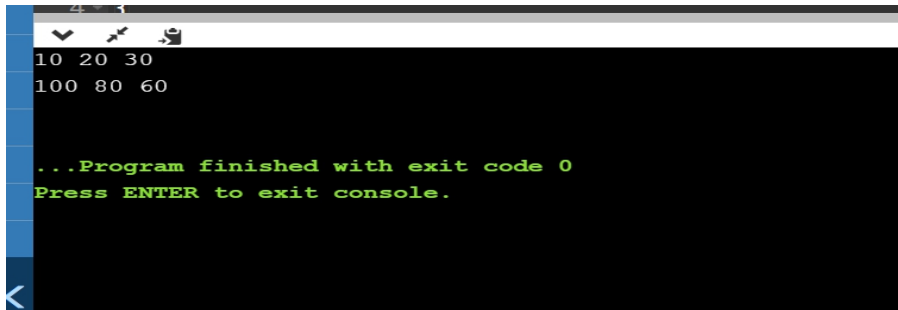
cout << x << " " << y << " " << z << endl;
ptr = &x;
*ptr *= 10;
ptr = &y;
*ptr *= 4;
ptr = &z;
*ptr *= 2;

cout << x << " " << y << " " << z << endl;

```

Answer:

Output:



```
10 20 30
100 80 60

...Program finished with exit code 0
Press ENTER to exit console.
```

Memory layout:

```
int x = 10, y = 20, z = 30; //DS
```

- Initialize local variables (x,y,z)

```
int *ptr; //stack
```

- Create an pointer variable

```
cout << x << " " << y << " " << z << endl; //text
```

- Display the values (x, y, z)
- Output

```
Output: 10 20 30
```

```
ptr = &x; //sorted in heap
```

- Store memory address of the x variable.

```
*ptr *= 10;
```

- Initialize the ptr variable to change the value of x variable.

```
ptr = &y; //sorted in heap
```

- Store memory address of the y variable.

```
*ptr *= 4;
```

- Initialize the ptr variable to change the value of y variable.

```
ptr = &z; //sorted in heap
```

- Store memory address of the z variable.

```
*ptr *= 2;
```

- Initialize the ptr variable to change the value of z variable.

```
cout << x << " " << y << " " << z << endl; //text
```

- Display the values (x, y, z)
- Output

```
Output: 100 80 60
```

(b) Determine the output for code segment below:

(3 marks)

```
int numbers[5] = {2,4,6,8,10};
int *numPtr;

numPtr = numbers;
cout << *(numbers + 3) << endl;
cout << *(numbers) << endl;

for (int count=0; count < 2; count++)
{
    cout << *numPtr << "\\t";
    numPtr++;
}
cout << endl;

for (int count=0; count < 2; count++)
{
    numPtr--;
    cout << *numPtr << "\\t";
}
```

Answer:



```
8
2
2      4
6      4

...Program finished with exit code 0
Press ENTER to exit console.
```

QUESTION 7**[5 Marks]**

The code segment below has five (5) syntax and/ or logical errors. Identify and describe each of the errors. (5 marks)

```
struct TwoLoc
{
    int x = 10;
    int y = 15;
}

int main()
{
    TwoLoc point[10];
    point.x[0] = 1;
    point.y[0] = 1;
    cout << point << endl;
    return 0;
}
```

Answer:

```
#include <iostream>
using namespace std;
struct TwoLoc
{
    int x=10;
    int y=15;
}; //End of a struct need semicolon
int main()
{
    TwoLoc point[10];
    point[0].x=1; //Asigning value to a struct array use index value
    point[0].y=1; //Asigning value to a struct array usie index value
    cout<<point[0].x<<endl; //Print value of x using the index value
    cout<<point[0].y<<endl; //Print value of y using the index value
    return 0;
}
```

QUESTION 8

[16 Marks]

Meteorological Department is responsible to keep the information about weather forecast in Malaysia and display the information through the website. Write the code segment for each of the following tasks:

- (a) i) Declare a structure type named **TempScale**, with the following members:

fahrenheit : a double value

celsius : a double value

- ii) Declare a structure type named **Reading**, with the following members:

windSpeed : an integer value

humidity : a double value

temperature: a **TempScale** structure variable

- iii) Declare a variable of structure type **Reading** named **today**. (6 marks)

Answer:

```
I)struct Tempscale
{
double fahrenheit;
double celcius;
};
```

```
ii)struct Reading
{
int windSpeed;
double humidity;
Tempscale
temperature;
};
```

```
iii)struct Reading
{
int windSpeed;
double humidity;
```

```
Tempscale
temperature;
}today;
Or struct Reading
{
int windspeed;
double humidity;
Tempscale
temperature;
};
main()
{
struct Reading today;
}
```

- (b) Write statements that will store the following data into the variable you declared in (a).

Wind speed: 8 km/h

Humidity: 53%

Fahrenheit temperature: 80.2 degrees

Celsius temperature: 26.8 degrees

(3 marks)

Answer:

```
struct Reading
{
int windspeed;
double humidity;
Tempscale temperature;
};
main()
{
struct Reading today;
today .Windspeed=8;
today.temperature.fahrenheit=80.2;
today.temerature.celcius=26.8;
}
```

- (c) Define a function named **showReading**. It should accept a **Reading** structure variable as its argument. The function should display the contents of the variable onto the screen.

(7 marks)

Answer:

```
void showReading(Reading r)
{
Cout <<"Wind speed is :"<<r.windSpeed;
cout<<"Humidity is :"<<<r.humidity;
cout<<"Fahrenheit temperature is
:"<<r.temperature.fahrenheit;
cout<<"Celcius temperature is
:"<<r.temperature.celcius;
```

Ministry of Transport Malaysia is required to prepare a report of the total road accidents by states in Malaysia from the year, 2006 to 2015.

INSTRUCTIONS:

Write a C++ program to calculate the average number of road accidents for each state and find the highest number of road accidents from 2006 to 2015. Your program should be able to do the following tasks:

- (a) The program should use the following **struct** definition:

```
struct dataAcc
{
    int numAcc[10]; //number of road accidents from 2006-2015
    string state; //states in Malaysia
    float avg; //average number of road accidents for 2006-2015
}
```

- (b) The program should use an array of **struct** defined in (a) to store the total road accidents by states in Malaysia from 2006 to 2015.
- (c) The program will read input data from an input file named “input.txt” into the array of **struct** declared in (b). Example of input data in “input.txt” is shown in **Figure 2**.
- (d) The program should have two (2) global constants and one (1) global variable as follows:

Global constants:

NUM_STATE = 14 ✎ Number of states

NUM_YEAR = 10 ✎ Number of years

Global variable:

out ✎ Variable to point to output file named “output.txt”

- (e) Besides the function **main()**, the program has three (3) other functions as described in **Table 2**. One of the functions is given below:

```
void displayLine()
{
    for (int i = 0; i < 98; i++)
```

```

        out << "-";
        out << endl;
    }

```

Based on the description given in **Table 2**, the program needs to define two (2) more functions. You should use appropriate argument(s) (if necessary) for each function.

Table 2: Description of functions

Function	Description
displayLine()	To display lines using 98 characters of '-' in the output file using a loop.
cal_Avg()	To calculate the average number of road accidents for each state. The function should accept a 1D array of the number of road accidents for 10 years for each state as its argument. The function should return the average number of road accidents for each state.
find_HighLow()	To find and display the highest number of road accidents from 2006 to 2015. The function should accept a 1D array of structures as its argument.

- (f) The program needs to display the following information. **Figure 3** shows the output of the successful program.
- Name of state.
 - Number of road accidents for 2006-2015 in each state.
 - Average number of road accidents for 10 years in each state.
 - The highest number of road accidents for 10 years with the name of state and year.

The assessment criteria are shown in **Table 3**.

1160	1364	1417	1633	1548	1791	1881	1895	1888	1861	PERLIS
15505	16172	16520	17701	17966	19699	19935	20228	20159	22016	KEDAH
32573	33881	34049	33719	34306	37158	37851	39361	38747	39856	PULAU PINANG
27432	29203	30539	32327	32072	33506	34714	35408	35131	36736	PERAK
92632	99157	100380	107429	115565	128876	129106	135024	137809	140957	SELANGOR
46254	49454	48671	51942	53493	58795	61872	64527	63535	64664	KUALA LUMPUR
15197	16079	17362	18369	19407	21157	22146	23066	23748	22939	NEGERI SEMBILAN
10707	11720	12105	13275	14110	14720	15195	16083	16375	17069	MELAKA
43757	46584	48667	51747	55381	59501	62316	64600	64473	67112	JOHOR
13242	13982	15629	17068	17315	19001	20554	20130	19071	19635	PAHANG
7337	8116	8842	9549	9707	9603	9968	9748	10326	9960	KELANTAN
7098	8155	8814	10118	10106	10684	10861	10996	9383	10381	TERENGGANU
13550	14256	14588	15798	16192	16585	17446	17438	17858	17290	SABAH
14808	15196	15488	16655	17253	17964	18578	18700	17693	19130	SARAWAK

Figure 2: Input file named “input.txt”

STATE	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	AVERAGE
PERLIS	1160	1364	1417	1633	1548	1791	1881	1895	1888	1861	1643.8
KEDAH	15505	16172	16520	17701	17966	19699	19935	20228	20159	22016	18590.1
PULAU PINANG	32573	33881	34049	33719	34306	37158	37851	39361	38747	39856	36150.1
PERAK	27432	29203	30539	32327	32072	33506	34714	35408	35131	36736	32706.8
SELANGOR	92632	99157	100380	107429	115565	128876	129106	135024	137809	140957	118693.5
KUALA LUMPUR	46254	49454	48671	51942	53493	58795	61872	64527	63535	64664	56320.7
NEGERI SEMBILAN	15197	16079	17362	18369	19407	21157	22146	23066	23748	22939	19947.0
MELAKA	10707	11720	12105	13275	14110	14720	15195	16083	16375	17069	14135.9
JOHOR	43757	46584	48667	51747	55381	59501	62316	64600	64473	67112	56413.8
PAHANG	13242	13982	15629	17068	17315	19001	20554	20130	19071	19635	17562.7
KELANTAN	7337	8116	8842	9549	9707	9603	9968	9748	10326	9960	9315.6
TERENGGANU	7098	8155	8814	10118	10106	10684	10861	10996	9383	10381	9659.6
SABAH	13550	14256	14588	15798	16192	16585	17446	17438	17858	17290	16100.1
SARAWAK	14808	15196	15488	16655	17253	17964	18578	18700	17693	19130	17146.5
The highest number of road accidents = 140957 at SELANGOR on 2015											

Figure 3: Example output in output file named “**output.txt**”

Table 3: Assessment criteria

Item	Criteria	Marks
A	Using an appropriate structure for the program (<i>e.g.</i> all required header files are included, the function main is properly written, <i>etc.</i>).	3
B	Define a global constants, global variable and array of structures	2
	Reading the input data from input file.	4
C	Definition of function cal_Avg() .	4
	Definition of function find_HighLow() .	7
D	Printing the output as requested in (f), Figure 3 and in a proper format.	10
Total		30

Answer spaces for Part B

```
#include<iostream>
#include<fstream>
#include<iomanip>
using namespace std;

//Global constants
const int NUM_STATE = 14;
const int NUM_YEAR = 10;
//global variable
ofstream out("output.txt");

//struct defined in part (a)
struct dataAcc{
int numAcc[10];
string state;
float avg;
};

//displayLine function
void displayLine(){
for(int i=0;i<98;i++)
out<<"-";
out<<endl;
}

float cal_Avg(int arr[10]){
float sum=0,avg;
for(int i=0;i<10;i++)
sum+=arr[i]; //calculate sum of 10 elements in array
avg = sum/10; //average = sum/10
return avg; //return average
}

void find_HighLow(struct dataAcc data[50],int size){
//variables for highest and lowest accidents, thier years and states
int high=0,low=999999;
int high_year,low_year;
string high_state,low_state;
//calculate highest and lowest accidents
for(int i=0;i<size;i++){
for(int j=0;j<10;j++){
//if it is lower than the current lowest
if(data[i].numAcc[j]<low){
//update the data
low = data[i].numAcc[j];
low_state = data[i].state;
```

```

low_year = i+2006;
}
//if it is higher than the current highest
if(data[i].numAcc[j]>high){
//update the data
high = data[i].numAcc[j];
high_state = data[i].state;
high_year = i+2006;
}
}
}
//print the lines and the highest and lowest data
displayLine();
out<<"The highest number of road accidents = "<<high<<" at "<<high_state<<" on
"<<high_year<<endl;
displayLine();
out<<"The lowest number of road accidents = "<<low<<" at "<<low_state<<" on
"<<low_year<<endl;
displayLine();
}

```

```

int main(){
struct dataAcc data[50]; //array of struct
//read input from input.txt
ifstream in("input.txt");
int size=0;//variable to contain the size of array
while(!in.eof()){//until End of File is encountered
for(int i=0;i<10;i++)//read accidents for the 10 years
in>>data[size].numAcc[i];
getline(in,data[size].state);//read name of state
size++;//increase array size by 1
}
//print the top row
displayLine();
out<<setw(16)<<"STATE";
for(int i=0;i<10;i++)
out<<setw(7)<<2006+i;
out<<setw(10)<<"AVERAGE"<<endl;
displayLine();
//display the content
for(int i=0;i<size;i++){//for each state
out<<setw(16)<<data[i].state;
for(int j=0;j<10;j++)
out<<setw(7)<<data[i].numAcc[j];
out<<setw(10)<<cal_Avg(data[i].numAcc)<<endl;
}
find_HighLow(data,size);
}

```

```
return 0;  
}
```

Answer spaces for Part B

You need to complete the assignment in group and submit before/on 2 February 2021. The answers only will affect the related items as stated in Rubric of Assignment