UNIVERSITI SAINS MALAYSIA

First Semester Examination
2009/2010 Academic Session

November 2009

MAT 181 – Programming For Scientific Applications
[*Pengaturcaraan Untuk Penggunaan Sains*]

Duration : 3 hours
[*Masa : 3 jam*]

Please check that this examination paper consists of **SIXTEEN [16]** pages of printed material before you begin the examination.

[*Sila pastikan bahawa kertas peperiksaan ini mengandungi **ENAM BELAS [16]** muka surat yang bercetak sebelum anda memulakan peperiksaan ini.*]

Instructions: Answer all **TWENTY [20]** questions in Section I using the objective answer paper (OMR answer paper) provided. For this section, answers should be written in pencil only. **The OMR answer paper together with the question paper of Section I** will be collected 1½ hours after the examination starts.

Answer all **THREE [3]** questions in Section II. All answers in this section must be written on the answer script papers provided.

[***Arahan:*** *Jawab semua **DUA PULUH [20]** soalan dalam Bahagian I dengan menggunakan kertas jawapan soalan objektif (kertas jawapan OMR) yang disediakan. Bagi bahagian ini, jawapan perlu dituliskan dengan pensel sahaja. **Kertas jawapan OMR ini berserta kertas soalan Bahagian I** akan dikutip 1½ jam setelah peperiksaan bermula.*

*Jawab semua **TIGA [3]** soalan dalam Bahagian II. Semua jawapan dalam bahagian ini mestilah dituliskan pada kertas skrip jawapan yang disediakan.*]

In the event of any discrepancies, the English version shall be used.

[*Sekiranya terdapat sebarang percanggahan pada soalan peperiksaan, versi Bahasa Inggeris hendaklah diguna pakai.*]

SECTION I (100 points) Choose one answer only for each question.
BAHAGIAN I (100 markah) Pilih hanya satu jawapan untuk setiap soalan.

1. Which of the following is a valid C++ statement?
Yang manakah di antara berikut adalah pernyataan C++ yang sah?

A.
```
float m-n;
```

B.
```
float xyz;
```

C.
```
int saiz = 5;
int input[saiz];
```

D.
```
a + b = c;
```

E. All of the above are not valid.
Semua yang disebut di atas tidak sah.

2. Consider the following program.
Pertimbangkan program berikut.

```
#include <iostream.h>

void main {
  int x=6, y=8;
  char z = B;
  ++y;
  cout << z << "  "  >> x << " " << y }
```

How many syntax errors are there in the program?
Berapakah ralak sintaks dalam program tersebut?

A. 2 B. 3 C. 4

D. 5 E. 6

3. Given the following array initialization, what is the value stored in `A[1][2]`?
Berpandukan pengawalan tatasusunan berikut, apakah nilai yang disimpan dalam `A[1][2]`?

```
int A[][3] = {5,1,2,6,8,3,4,7,9,0};
```

A. `1` B. `3` C. `4`

D. `7` E. `8`

4. Which of the following is not a reserved word in C++?
Yang manakah di antara berikut bukan perkataan simpanan dalam C++?

A. `do`

B. `long`

C. `case`

D. `format`

E. All of the above are reserved words.
Semua yang disebut di atas adalah perkataan simpanan.

5. How many times the following loop is executed if n = 0 initially?
Berapa kalikah gelung berikut dilaksanakan jika n = 0 pada awalnya?

```
while (n<50)
  n=3+n++;
```

A. 10 B. 11 C. 12

D. 13 E. 15

6. Which of the following function headers are valid?

I. `void Mult(int a[][])`

II. `int Copy(int value[])`

III. `float Fungsi(int)`

IV. `double Calc()`

V. `int Kira(int nilai[10])`

A. I, II and III only.

B. I, II and IV only.

C. II, III and IV only.

D. II, IV and V only.

E. III, IV and V only.

6. *Yang manakah di antara pengepala fungsi berikut adalah sah?*

I. `void Mult(int a[][])`

II. `int Copy(int value[])`

III. `float Fungsi(int)`

IV. `double Calc()`

V. `int Kira(int nilai[10])`

A. *I, II dan III sahaja.*

B. *I, II dan IV sahaja.*

C. *II, III dan IV sahaja.*

D. *II, IV dan V sahaja.*

E. *III, IV dan V sahaja.*

7. What is the output of the following statements?
Apakah output pernyataan-pernyataan berikut?

```
enum Vehicle {car, bike=-1, truck};
enum Color {blue, red, black};

cout << car << " " << bike  << " " << truck << endl;
cout << blue << " " << red  << " " << black;
```

A.
```
0 -1 0
0 1 2
```

B.
```
0 -1 0
1 2 3
```

C.
```
-2 -1 0
0 1 2
```

D.
```
-2 -1 0
1 2 3
```

E.
```
0 -1 1
2 3 4
```

8. Consider the following `struct` declaration.
Pertimbangkan deklarasi `struct` berikut.

```
struct FOOD  {
 float weight;
 int price;

 int cost()
  {return (price > 10 && weight > 1 ? 1 : 0);}
};

FOOD Rice;
```

Based upon the above `struct` declaration, which of the following is the correct way to access the `struct` members?
Berdasarkan pengisytiharan `struct` di atas, yang manakah di antara berikut merupakan cara yang betul untuk mencapai ahli `struct` tersebut?

A. `Rice->weight`

B. `(*Rice).price`

C. `Rice.cost`

D. `Rice.cost()`

E. `Rice.cost(weight, price)`

9. What will be printed by the following statement?
Apakah yang akan dicetak oleh pernyataan berikut?

```
cout << setiosflags(ios::fixed)
     << setw(10) << setprecision(3) << 12.32 << "\n"
     << setw(10) << setfill('*') << 12.32 << "\n"
     << setw(10) << 12.32 << "\n"
     << setfill('$') << 12.32;
```

A.
```
     12.32
*****12.32
     12.32
$$$$$12.32
```

B.
```
     12.32
*****12.32
*****12.32
$$$$$12.32
```

C.
```
    12.320
****12.320
    12.320
$$$$12.320
```

D.
```
    12.320
****12.320
****12.320
$$$$12.320
```

E.
```
    12.320
****12.320
****12.320
12.320
```

10. Which of the following is not true about the basic graphical symbols used in flowchart?

A. Terminal (⬭) marks the start and the end of an algorithm.

B. Continuity (○) denotes that there are more statements before or after the flowchart.

C. Flow lines (→) show the sequence of logical execution in an algorithm.

D. Process (▭) depicts an operation.

E. All of the above is true.

10 Yang manakah di antara berikut tidak benar mengenai simbol grafik asas yang digunakan dalam carta alir?

A. Terminal (⬭) menandakan permulaan dan penamatan suatu algoritma.

B. Kesinambungan (○) menandakan bahawa terdapat pernyataan-pernyataan lain sebelum atau selepas carta alir tersebut.

C. Garisan alir (→) menunjukkan turutan pelaksanaan logik dalam suatu algoritma.

D. Proses (▭) menandakan suatu operasi.

E. Semua yang disebut di atas adalah benar.

11. Find the output of the following program segment.
Cari output segmen program berikut.

```
int kes = 0;
cout << "A";
if(!kes) goto out;
cout << "B";
out: cout << "O";
cout << "AB";
```

A. AOAB B. ABAB C. ABOAB

D. AOABB E. AOBAB

12. Find the output of the program below.
Cari output program di bawah.

```
#include <iostream.h>

void main(){
 for(int index=0; index<3; index++)
   switch(index) {
    case 1: cout << "\nI hear and I forget.";
    case 2: cout << "\nI see and I remember.";
    case 3: cout << "\nI do and I understand."; } }
```

A.
```
I hear and I forget.
I see and I remember.
I do and I understand.
```

B.
```
I do and I understand.
I hear and I forget.
I see and I remember.
```

C.
```
I hear and I forget.
I see and I remember.
I do and I understand.
I see and I remember.
I do and I understand.
```

D.
```
I hear and I forget.
I see and I remember.
I do and I understand.
I hear and I forget.
I see and I remember.
I do and I understand.
```

E.
```
I do and I understand.
I hear and I forget.
I see and I remember.
I do and I understand.
I see and I remember.
I do and I understand.
```

13. What will be printed by the following statements?
Apakah yang akan dicetak oleh pernyataan-pernyataan berikut?

```
int a = 7;
if(a < 1)
  cout << --a;
else if (a-- < 3)
  cout << 2*--a;
else if (a-- < 5)
  cout << 3*--a;
else
  cout << 4*--a;
```

A. 12 B. 14 C. 16

D. 20 E. 28

14. Consider the following statements.
Pertimbangkan pernyataan-pernyataan berikut.

```
for(int k=0; k<4; k++)
 for(int j=0; j<k; j++)
  if(j*j%2 == 1)
    cout << "X";
  else
    cout << "O";
```

What is the output displayed on the screen?
Apakah output yang dipaparkan pada skrin?

A. XOXOOX B. XOXOXX C. XXOXOX

D. OXOXOO E. OOXOXO

15. What will be printed by the following statements?
Apakah yang akan dicetak oleh pernyataan- pernyataan berikut?

```
int a,b,c;
int *p,*q,*r;
a=6; b=2; p=&b;
q=p; r=&c;
p=&a; *q=8; *r=*p;
*r=a+*q+*&c;

cout << a << b << c << endl;
```

A. 6820 B. 6822 C. 8622

D. 8224 E. None of the above.
Bukan yang disebut di atas.

16. What will be printed by the following program?
Apakah yang akan dicetak oleh program berikut?

```
#include <iostream.h>

int x = 1, y = 2;
void main() {
  void Func();
  cout << x << y;
  Func();
  cout << x << y; }

void Func() {
  int y = 3;
  x++; y++;
  cout << x << y; }
```

A. 122323

B. 122412

C. 122422

D. 122424

E. None of the above.
Bukan yang disebut di atas.

17. What will be displayed by the following program segment?
Apakah yang akan dipaparkan oleh segmen program berikut?

```
for(int i=0; i<3; i++)
{
  cout <<endl;
  for(int j=2; j>0; j--)
    for(int k=0; k<1; k++)
      cout << "$"; }
```

A.
```
$$$$
$$$$
$$$$
```

B.
```
$$
$$
$$
```

C.
```
$
$
$
```

D. `$$$$$$`

E. `$$$$$$$$$$$$`

18. Determine the output of the following `if` statements.
Tentukan output pernyataan-pernyataan `if` berikut.

```
int x=8, y=7, z=9, w=5;

if(x>=y)
  if(x>=z)
    if(x>=w)
      cout << "#";
    else
      cout << "$";
  else
    if (z>=y)
      cout << "%";
    else
      cout << "&";
```

A. `#` B. `$` C. `%`

D. `&` E. `#%`

19. Consider the following program.
Pertimbangkan program berikut.

```
#include <iostream.h>
#include <conio.h>

void Func(int &y1, int *y2, int y3[4])
{
 y1 = 3 * y1;
 y2 = y3 + 1;
 for(int i=0; i<3; i++)
  y3[i] = y1 * *y2 + i;
}

void main()
{
 int x1 = 1, x2 = 1, x3[] = {1,1,2,3};
 Func(x1,&x2,x3);
 cout << x1 << " " << x2 << " ";

 for(int i=0; i<4; i++)
  cout << x3[++i] << " ";
 getch();
}
```

What is the output printed on the screen?
Apakah output yang dicetak pada skrin?

A. `3 2 6 8`

B. `3 2 7 3`

C. `3 1 4 3`

D. `3 4 5 3`

E. None of the above.
Bukan yang disebut di atas.

20. Find the output of the program below.
Cari output program di bawah.

```
#include <iostream.h>
#include <string.h>

void main()
{
  char string1[10]="ABC";
  char string2[10]="MNO";

  strncat(string1,string2,2);
  strncat(string2,string1,3);

  cout << string1 << endl;
  cout << string2 << endl;
}
```

A.
```
ABCMN
MNOABC
```

B.
```
ABCMNO
MNOAB
```

C.
```
MNOAB
ABCMNO
```

D.
```
MNABC
ABCMNO
```

E.
```
MNOABC
ABCMN
```

SECTION II (100 points)
BAHAGIAN II (100 markah)

1. Write a C++ program that reads the height (m) and weight (kg) of a user as input and then calculates the Body Mass Index (BMI) of the user. Note that

$$\text{BMI} = \frac{\text{weight}}{\text{height} \times \text{height}}.$$

The program should also print the body weight status of the user based upon the calculated BMI. The body weight status can be determined by referring to the table below.

BMI	Body Weight Status
< 19	underweight
19 – 25	normal
26 – 29	overweight
≥ 30	obese

For example, if the calculated BMI for a user is between 19 and 25, then the body weight status of that user is normal. If the calculated BMI for a user is greater than or equals to 30, then the body weight status of that user is obese. Your program should give the user an option to continue with new input. An example of the input/output screen of your program is shown below. Underlined and bold items are input.

```
Enter height in meter: 1.7
Enter weight in kilogram: 65

You are normal!
Your Body Mass Index (BMI) is 22.49

Do you want to continue?
Type 'y' for yes and 'n' for no: y


Enter height in meter: 1.5
Enter weight in kilogram: 82

You are obese!
Your Body Mass Index (BMI) is 36.44

Do you want to continue?
Type 'y' for yes and 'n' for no: n
```

1. *Tulis satu program C++ yang membaca ketinggian (m) dan berat (kg) pengguna sebagai input dan seterusnya mengira Indeks Jisim Tubuh (BMI) pengguna tersebut. Perhatikan bahawa*

$$BMI = \frac{berat}{ketinggian \times ketinggian}.$$

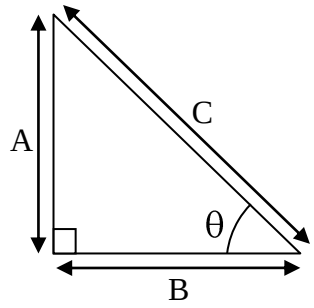
Program tersebut juga harus mencetak status berat badan pengguna tersebut berdasarkan BMI yang telah dikira. Status berat badan boleh ditentukan dengan merujuk kepada jadual di bawah.

BMI	***Status Berat Badan***
< 19	*underweight*
19 – 25	*normal*
26 – 29	*overweight*
≥ 30	*obese*

Sebagai contoh, jika BMI pengguna yang telah dikira bernilai di antara 19 dan 25, maka status berat badan pengguna tersebut ialah normal. Jika BMI pengguna yang telah dikira bernilai lebih daripada atau sama dengan 30, maka status berat badan pengguna tersebut ialah obese. Program anda harus memberi pengguna pilihan untuk teruskan lagi dengan input baru. Satu contoh skrin input/output program anda ditunjukkan di bawah. Perkara yang digariskan dan dihitamkan adalah input pengguna.

```
Enter height in meter: 1.7
Enter weight in kilogram: 65

You are normal!
Your Body Mass Index (BMI) is 22.49

Do you want to continue?
Type 'y' for yes and 'n' for no: y


Enter height in meter: 1.5
Enter weight in kilogram: 82

You are obese!
Your Body Mass Index (BMI) is 36.44

Do you want to continue?
Type 'y' for yes and 'n' for no: n
```

2. Write a C++ program to calculate the hypotenuse (C) and angle (θ) of a right triangle as shown below. The formula for the calculation is given below.



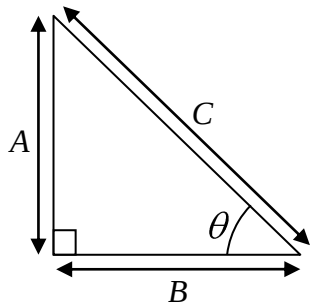
$$C = \sqrt{A^2 + B^2}$$

$$\theta = \tan^{-1}\left(\frac{A}{B}\right)$$

where
A = height of a right triangle (cm);
B = width of a right triangle (cm);
C = hypotenuse of a right triangle (cm);
θ = angle (radian).

The `main` program should read the values of A and B as user input from the keyboard/screen and display the calculated values C and θ on the computer screen. The `main` program should also call two functions, specifically `void Hypotenuse (...)` and `float Angle (...)` to calculate the hypotenuse C and the angle θ of a right triangle based upon the input values A and B. The function `void Hypotenuse (...)` should return the calculated value of C when called. The function `float Angle (...)` should return the calculated value of θ when called. Usage of global variables and global function prototypes is not allowed.

2. Tulis satu program C++ untuk mengira hipotenus (C) dan sudut (θ) suatu segi tiga bersudut tepat seperti yang ditunjukkan di bawah. Rumus untuk pengiraan tersebut diberikan di bawah.



$$C = \sqrt{A^2 + B^2}$$

$$\theta = \tan^{-1}\left(\frac{A}{B}\right)$$

di mana
A = tinggi segi tiga bersudut tepat (cm);
B = lebar segi tiga bersudut tepat (cm);
C = hipotenus segi tiga bersudut tepat (cm);
θ *= sudut (radian).*

Program `main` harus membaca nilai-nilai A dan B sebagai input pengguna dari papan kekunci/skrin dan memaparkan hasil pengiraan nilai-nilai C dan θ pada skrin komputer. Program `main` juga harus memanggil dua fungsi iaitu `void Hypotenuse (...)` dan `float Angle (...)` untuk mengira hipotenus C dan sudut θ bagi suatu segi tiga bersudut tepat berdasarkan nilai-nilai input A dan B. Fungsi `void Hypotenuse (...)` harus mengembalikan hasil pengiraan C apabila dipanggil. Fungsi `float Angle (...)` harus mengembalikan hasil pengiraan sudut θ apabila dipanggil. Penggunaan pembolehubah global dan prototaip fungsi global tidak dibenarkan.

3. Write a C++ program that reads a list of integer values as one-dimensional array from an input file named "input.txt" until the end-of-file is reached. The program should then produce a new list by removing the repeated values in the input list of integer values. The old list with repeated values and the new list without repeated values should be printed in an output file named "output.txt".

An example of the input file (input.txt) is as follows.

```
15 60 85 85 25 20 80 15 55 15 65 95 95 80 50
```

The output file (output.txt) for the above input file example is shown below.

```
The old list with repeated values:
15 60 85 85 25 20 80 15 55 15 65 95 95 80 50

The new list without repeated values:
15 60 85 25 20 80 55 65 95 50
```

3. Tulis satu program C++ yang membaca satu senarai nilai-nilai integer sebagai tatasusunan satu dimensi dari fail input bernama "input.txt" sehingga hujung fail dikesan. Seterusnya, program tersebut harus menghasilkan satu senarai baru dengan mengeluarkan nilai-nilai berulang dalam senarai input nilai-nilai integer tersebut. Senarai lama dengan nilai-nilai berulang dan senarai baru tanpa nilai-nilai berulang harus dicetak dalam fail output bernama "output.txt".

Satu contoh fail input (input.txt) adalah seperti yang berikut.

```
15 60 85 85 25 20 80 15 55 15 65 95 95 80 50
```

Fail output (output.txt) untuk contoh fail input di atas ditunjukkan di bawah.

```
The old list with repeated values:
15 60 85 85 25 20 80 15 55 15 65 95 95 80 50

The new list without repeated values:
15 60 85 25 20 80 55 65 95 50
```

- ooo O ooo -