UNIVERSITI SAINS MALAYSIA

First Semester Examination
2015/2016 Academic Session

December 2015/January 2016

CPT111 – Principles of Programming
[Prinsip Pengaturcaraan]

Duration : 2 hours
[Masa : 2 jam]

INSTRUCTIONS TO CANDIDATE:
[ARAHAN KEPADA CALON:]

• Please ensure that this examination paper contains **THREE** questions in **THIRTEEN** printed pages before you begin the examination.

*[Sila pastikan bahawa kertas peperiksaan ini mengandungi **TIGA** soalan di dalam **TIGA BELAS** muka surat yang bercetak sebelum anda memulakan peperiksaan ini.]*

• Answer **ALL** questions.

*[Jawab **SEMUA** soalan.]*

• You may answer the questions either in English or in Bahasa Malaysia.

[Anda dibenarkan menjawab soalan sama ada dalam bahasa Inggeris atau bahasa Malaysia.]

• 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.]

1. (a) Given the following C++ segment:

```cpp
cout << "\n enter a positive integer ";
cin >> num;
do {
   cout <<  num % 10;
   num /= 10;
}while (num > 0);
cout << '\n';
```

(i) What is the output, if the input is 401?

(ii) What does the program segment above do?

(iii) Which variable is the loop control variable?

(iv) Rewrite the program segment above using a `for` loop.

(30/100)

(b) What is the output of the following code?

(i)
```cpp
int num = 12;
while (num >= 0)
{
   if (num % 5 == 0)
      break;
   cout << num << " ";
   num = num - 2;
}
cout << endl << num;
```

(ii)
```cpp
int a = 3;
int b = 2;
b = a++;
cout << ++b;
```

```
(iii)  int a = 6;
       if (a > 0)
          switch (a)
          {
          case 1:
             a = a + 3;
             cout << a << "   ";
          case 3:
             a++;
             cout << a << "   ";
             break;
          case 6:
             a = a + 2;
             cout << a << "   ";
          case 8:
             a = a * 8;
             cout << a << "   ";
             break;
          default:
             a--;
             cout << a << "   ";
          }
          else {
             a = a + 2;
             cout << a << "   ";
          }
```

(15/100)

(c) Write a program that mimics a calculator. The program should take as input two integers and the operation to be performed. It should then output the numbers, the operator, and the result. (For division, if the denominator is zero, output an appropriate message.) Some sample outputs follow:

3 + 4 = 7
13 * 5 = 65

(i) Write a pseudocode to solve the problem above.

(ii) Write a C++ program for the pseudocode in 1(c)(i).

(55/100)

2. (a) (i) What is a formal parameter and actual parameter?

(ii) Briefly explain the differences between passing parameter by value and passing parameter by reference.

(18/100)

(b) As a junior software engineer at the aviation firm, you are assigned by a senior software engineer to write a program to calculate the appropriate speed of the airplane which travels from the departure city to the destination city so that the plane will arrive on time as scheduled. In order to find the appropriate speed of the airplane in the air, the junior software engineer should find the net speed of the airplane which has two components: ground speed of the plane and wind speed. Ground speed represents the speed of the plane without wind. When the plane is flying into a head wind (wind pushing against plane), the net speed of the plane is the ground speed of the plane minus the wind speed. When the plane is flying with a tailwind (wind pushing plane), the net speed of the plane is the ground speed of the plane plus the wind speed. The following are given the two formulas:

With head wind
 Distance (in miles) = (plane ground speed – wind speed) *
 time (in hour)
With tail wind
 Distance (in miles) = (plane ground speed + wind speed) *
 time (in hour)

The program should accept the following input:

- Distance between the cities, in miles
- Wind direction (1 – head wind, 2 – tail wind)
- Wind speed, in miles
- Flight duration (e.g. 13 hours 40 minutes)

You should write the following functions:

- `validation` – this function is used for validating the input to determine wind direction either head wind or tail wind. This function only accepts two integer numbers, `int 1` if head wind and `int 2` if tail wind. Otherwise the `validation` function will ask a user to enter again. Parameters should be passed by reference.
- `estimateSpeed` – This function is used to calculate the appropriate speed of the airplane. This is a return value function which receives appropriate parameters such as flight distance, wind direction, wind speed and flight duration. Parameters should be passed by value.
- `tohours` – This function is used to convert the flight duration in hours and minutes to hours.(e.g. 12 hours 30 minutes = 12.5 hours) This is a return value function which receives flight duration in hours and minutes. Parameters should be passed by value.

Given the `main` program:

```
//ProgramAviation

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

//function prototype
(1) _____;// for validation input
(2) _____;// estimate the airplane speed
(3) _____;// convert flight duration to hourly

int main()
{
(4) _____//declare appropriate variables

    system("cls");
    cout  << fixed << showpoint << setprecision(2);
    cout <<"\t\t Enter the distance (in kilometers): ";
    cin >> dist;
    cout <<"\t\t Flight Duration in ";
    cout <<"Hours: ";
    cin >> hour;
    cout <<"\t\t Minutes: ";
    cin >> minutes;
    cout <<"\t\t Wind Direction[1-head wind, 2-tail wind]: ";
    cin >> direction;
(5) _____;// function call for validation
    cout <<"\t\t Wind Speed(in kilometers): ";
    cin >> wspeed;
(6) _____;//function call to convert flight duration to
                  hours
(7) _____;//function call to calculate the appropriate
                  airplane speed
(8) _____;//display the appropriate speed of the
                  airplane.
    return 0;
}//end of main
```

(i)   Complete the C++ statement in `main()` for (1), (2), (3), (4), (5), (6), (7) and
       (8).

(32/100)

(ii)   Write the function definitions for the following functions:

       • `validation`
       • `estimateSpeed`
       • `tohours`

(50/100)

3. You are required to maintain several parallel one-dimensional arrays to keep some data about the games belonging to a particular pool (i.e. group) during the rugby world that was held recently. The arrays are declared in the main program as follows:

```
string team[5];      // team names
int play[5];         // number of games played
int win[5];          // number of games won
int draw[5];         // number of games drawn
int lose[5];         // number of games lost
int points[5];       // points awarded
```

(a) List **two** (**2**) advantages of arrays.

(10/100)

(b) Explain what is meant by parallel arrays?

(10/100)

(c) Write a function that will read in the team name from a file to an array named `team`. The file must be declared, opened and closed within this function. The team names are stored in a file named `teamNames.txt`.

`teamNames.txt` contains:

ARG
ENG
NZL
RSA
WAL

(20/100)

(d) Write a function that will initialize all the relevant arrays.

(20/100)

(e) Write a function that will update the relevant arrays after a game is played. After a game is played, both teams' number of games played will be incremented by one. The winning team's number of games won will be incremented by one and the losing team's number of games lost will be incremented by one. The winning team's point will be incremented by four. In case of a draw, both teams' number of games drawn will be incremented by one and their points will be incremented by two. A function call to update the result after Wales beat England by a score of 44 – 20 will look as follows:

```
UpdateTable ("WAL", "ENG", 44, 20, ...);
```

Where `UpdateTable` is the name of the function, while `...` are the other actual parameters. Following are sample tables for one pool in the rugby world cup.

The initial table:

	P	W	D	L	Pts
AUS	0	0	0	0	0
ENG	0	0	0	0	0
NZL	0	0	0	0	0
RSA	0	0	0	0	0
WAL	0	0	0	0	0

The table after Wales beat England:

	P	W	D	L	Pts
AUS	0	0	0	0	0
ENG	1	0	0	1	0
NZL	0	0	0	0	0
RSA	0	0	0	0	0
WAL	1	1	0	0	4

(Note: P – Play, W – Win, D – Draw, L – Lose and Pts – Points)

(40/100)

1. (a) Diberikan keratan C++ berikut:

```cpp
cout << "\n enter a positive integer ";
cin >> num;
do {
   cout <<  num % 10;
   num /= 10;
}while (num > 0);
cout << '\n';
```

(i) Apakah output, jika input adalah 401?

(ii) Apakah yang dilakukan oleh keratan atur cara di atas?

(iii) Pemboleh ubah mana merupakan pemboleh ubah kawalan gelung?

(iv) Tulis semula keratan atur cara di atas menggunakan gelung `for`.

(30/100)

(b) Apakah output bagi kod berikut?

(i)
```cpp
int num = 12;
while (num >= 0)
{
   if (num % 5 == 0)
     break;
   cout << num << " ";
   num = num - 2;
}
cout << endl << num;
```

(ii)
```cpp
int a = 3;
int b = 2;
b = a++;
cout << ++b;
```

```
(iii)  int a = 6;
       if (a > 0)
          switch (a)
          {
          case 1:
             a = a + 3;
             cout << a << "  ";
          case 3:
             a++;
             cout << a << "  ";
             break;
          case 6:
             a = a + 2;
             cout << a << "  ";
          case 8:
             a = a * 8;
             cout << a << "  ";
             break;
          default:
             a--;
             cout << a << "  ";
          }
          else {
             a = a + 2;
             cout << a << "  ";
          }
```

(15/100)

(c) Tulis satu atur cara yang mimik suatu mesin kira. Atur cara perlu menerima dua integer dan operasi yang akan dilaksanakan sebagai input. Seterusnya atur cara akan memaparkan nombor-nombor, operator dan hasil operasi sebagai output. (Untuk operasi bahagi, jika nombor yang dibahagi adalah sifar, berikan mesej yang bersesuaian). Berikut adalah beberapa contoh output:

    3 + 4 = 7
    13 * 5 = 65

(i) Tulis satu pseudokod untuk menyelesaikan masalah di atas.

(ii) Tulis satu atur cara C++ bagi pseudokod 1(c)(i).

(55/100)

2. (a) (i) Apakah parameter formal dan parameter sebenar?

 (ii) Terang secara ringkas perbezaan antara penghuluran parameter melalui nilai dan penghuluran parameter melalui rujukan.

 (18/100)

 (b) Sebagai jurutera perisian muda di firma penerbangan, anda dikehendaki oleh jurutera perisian senior untuk menulis atur cara untuk mengira kelajuan yang sesuai kapal terbang yang terbang dari bandaraya berlepas ke bandaraya destinasi supaya kapal terbang akan sampai tepat masa seperti yang telah dijadualkan. Untuk mencari kelajuan yang sesuai di udara, jurutera perisian muda perlu mencari kelajuan bersih kapal terbang yang mempunyai dua komponen: kelajuan tanah kapal terbang dan kelajuan angin. Kelajuan tanah mewakili kelajuan kapal terbang tanpa angin. Apabila kepala kapal terbang terbang ke arah angin (angin menolak ke arah kapal terbang), kelajuan sebenar kapal terbang adalah kelajuan tanah kapal terbang tolak kelajuan angin. Apabila kapal terbang terbang dengan angin di belakang (angin menolak kapal terbang), kelajuan sebenar kapal terbang adalah kelajuan tanah tambah kelajuan angin. Berikut diberi dua formula:

 Dengan angin di hadapan
 Jarak (dalam batuan) = (kelajuan tanah kapal terbang – kelajuan angin) * masa (dalam jam)
 Dengan angin di belakang
 Jarak (dalam batuan) = (kelajuan tanah kapal terbang + kelajuan angin) * masa (dalam jam)

 Atur cara perlu menerima input berikut:

 • Jarak antara bandar, dalam batuan
 • Arah angin (1 – angin di hadapan, 2 – angin di belakang)
 • Kelajuan angin, dalam batuan
 • Masa penerbangan (contoh 13 jam 40 minit)

 Ada perlu menulis fungsi-fungsi berikut:

 • `validation` – Fungsi ini digunakan untuk pengesahan input untuk menentukan arah angin sama ada angin hadapan atau angin belakang. Fungsi ini hanya menerima dua nombor integer, `int 1` jika angin hadapan dan `int 2` jika angin belakang. Jika tidak, fungsi `validation` akan meminta pengguna memasukan input semula. Parameter perlu dihantar melalui rujukan.
 • `estimateSpeed` – Fungsi ini digunakan untuk mengira kelajuan kapal terbang yang sesuai. Fungsi ini merupakan fungsi yang memulangkan nilai yang menerima parameter seperti jarak penerbangan, arah angin, kelajuan angin dan masa penerbangan. Parameter perlu dihantar melalui nilai.
 • `tohours` – Fungsi ini digunakan untuk menukar masa penerbangan dalam jam dan minit kepada jam (contoh 12 jam 30 minit = 12.5 jam). Fungsi ini merupakan fungsi yang memulangkan nilai yang menerima parameter masa penerbangan dalam jam dan minit. Parameter perlu dihantar melalui nilai.

Diberi atur cara `main`:

```
//ProgramAviation

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

//function prototype
(1) _____;// for validation input
(2) _____;// estimate the airplane speed
(3) _____;// convert flight duration to hourly

int main()
{
(4) _____//declare appropriate variables

    system("cls");
    cout  << fixed << showpoint << setprecision(2);
    cout <<"\t\t Enter the distance (in kilometers): ";
    cin >> dist;
    cout <<"\t\t Flight Duration in ";
    cout <<"Hours: ";
    cin >> hour;
    cout <<"\t\t Minutes: ";
    cin >> minutes;
    cout <<"\t\t Wind Direction[1-head wind, 2-tail wind]: ";
    cin >> direction;
(5) _____;// function call for validation
    cout <<"\t\t Wind Speed(in kilometers): ";
    cin >> wspeed;
(6) _____;//function call to convert flight duration to
                 hours
(7) _____;//function call to calculate the appropriate
                 airplane speed
(8) _____;//display the appropriate speed of the
                 airplane.
    return 0;
}//end of main
```

(i) Legkapkan pernyataan-pernyataan C++ dalam `main()` untuk (1), (2), (3), (4), (5), (6), (7) dan (8).

(32/100)

(ii) Tulis definisi fungsi bagi fungsi-fungsi berikut:

- `validation`
- `estimateSpeed`
- `tohours`

(50/100)

3. Anda dikehendaki mengendalikan beberapa tatasusunan satu-dimensi selari untuk menyimpan maklumat perlawanan untuk satu kumpulan pasukan semasa Perlawanan Ragbi Piala Dunia yang baru berlangsung. Tatasusunan ini telah diisytiharkan di dalam atur cara utama seperti berikut:

```
string team[5];      // nama pasukan
int play[5];         // bilangan permainan telah selesai
int win[5];          // bilangan permainan yang menang
int draw[5];         // bilangan permainan yang seri
int lose[5];         // bilangan permainan yang kalah
int points[5];       // bilangan mata
```

(a) Senaraikan **dua** (**2**) kelebihan tatasusunan.

(10/100)

(b) Jelaskan apakah yang dimaksudkan dengan tatasusunan selari?

(10/100)

(c) Tulis satu fungsi yang akan membaca senarai nama pasukan dari satu fail kepada satu tatasusunan bernama team. Fail berkenaan perlu diisytihar, dibuka dan ditutup dalam fungsi ini (i.e. fungsi yang akan ditulis ini). Nama-nama pasukan disimpan dalam fail yang diberi nama teamNames.txt.

teamNames.txt mengandungi:

ARG
ENG
NZL
RSA
WAL

(20/100)

(d) Tulis satu fungsi yang akan mengawalkan semua tatasusunan yang berkenaan.

(20/100)

(e) Tulis satu fungsi yang akan mengemaskini semua tatasusunan yang berkenaan selepas satu perlawanan berlangsung. Selepas satu perlawanan berlangsung, jumlah perlawanan bagi kedua-dua pasukan akan ditambah satu. Jumlah perlawanan yang dimenangi oleh pasukan yang menang akan ditambah satu dan jumlah perlawanan yang kalah oleh pasukan yang kalah juga akan ditambah satu. Mata bagi pasukan yang menang akan ditambah empat. Bagi kes perlawanan yang seri, jumlah perlawanan yang seri bagi kedua-dua pasukan akan ditambah satu manakala jumlah mata bagi kedua-dua pasukan akan ditambah dua. Satu panggilan fungsi untuk mengemaskini keputusan selepas Wales melawan England dengan keputusan 44-20 adalah seperti berikut:

```
UpdateTable ("WAL", "ENG", 44, 20, ...);
```

Di mana `UpdateTable` ialah nama fungsi, manakala `...` adalah parameter sebenar yang lain. Berikut adalah contoh jadual bagi satu kumpulan dalam Ragbi Piala Dunia.

Jadual awal:

	P	W	D	L	Pts
AUS	0	0	0	0	0
ENG	0	0	0	0	0
NZL	0	0	0	0	0
RSA	0	0	0	0	0
WAL	0	0	0	0	0

Jadual selepas Wales melawan England:

	P	W	D	L	Pts
AUS	0	0	0	0	0
ENG	1	0	0	1	0
NZL	0	0	0	0	0
RSA	0	0	0	0	0
WAL	1	1	0	0	4

(Nota: P – Main, W – Menang, D – Seri, L – Kalah dan Pts – Mata)

(40/100)

- oooOooo -