UNIVERSITI SAINS MALAYSIA

First Semester Examination
2010/2011 Academic Session

November 2010

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 **FOUR** questions in **FIFTEEN** printed pages before you begin the examination.

  *[Sila pastikan bahawa kertas peperiksaan ini mengandungi **EMPAT** soalan di dalam **LIMA 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) State whether each of the following is **TRUE** or **FALSE**.

(i) During a program execution, the content of a constant variable can be changed.

(ii) A `char` variable cannot be used in an arithmetic expression.

(iii) The arithmetic operators `*`, `/`, `+` and `–` all have the same level of precedence.

(iv) The `continue` statement can be used to terminate a loop.

(v) The expression in a `switch` statement can be a logical expression.

(vi) To use manipulator `setprecision`, `setw`, and `setfill`, the program must include the file `iomanip`.

(6/100)

(b) A parking garage charges a $2.00 minimum fee to park for up to three hours. The garage charges an additional $0.50 per hour for each hour additional. The maximum charge for any given 24-hour period is $10.00. Assume that no car parks for longer than 24 hours at a time. Write a function `calculateCharge` to determine the charge for each user.

(7/100)

(c) What is the output of the following program segments?

(i)
```
int x = 72;
if (x > 10)
   if ((x < 100) || (x > 50))
      cout << x << endl;
      if ((x < 100) && (x > 50))
         cout << x + 1;
      else
         cout << x * x;
```

(ii)
```
int x = 5;
do {
   cout << x << endl;
   x = x + 2;
} while (x != 10);
cout << x << endl;
```

(iii)
```
#include <iostream>
using namespace std;
int main()
{
   char c;
   c = 'A'; //the ASCII value is 65
   while (c <= 80) {
      cout << c;
      c += 5;
}
```

(9/100)

(d) A binomial coefficient is computed by using the following formula.

$$c(n, k) = \frac{n!}{(n - k)!k!}$$

where $n! = \prod_{i=1}^{n} i = 1 * 2 * 3 \ldots * n$

example: $4! = \prod_{i=1}^{4} i = 1 * 2 * 3 * 4$

(i) Write a `for` statement to calculate n! (factorial).

(4/100)

(ii) Write a C++ program that calculates the binomial coefficient.

(8/100)

2. (a) (i) Convert the following C++ code segment into a post-test loop.

```
int number;
cout << "Enter an odd number:";
cin >> number;
while (number %7 == 0) {
   cout << "Enter an odd number divisible by 7 again";
   cin >> number;
}
```

(ii) Convert the following `if-else` statement into a `switch` statement.

```
int age;
if ((age > 0) && (age <= 2)
   cout << "This is a baby" << endl;
else
   if (age > 2) && (age <= 4)
      cout << "This is a toddler" << endl;
else
   if (age > 4) && (age <= 6)
      cout << "This is a child" << endl;
else
   cout << "You are not a child anymore" << endl;
```

(4/100)

(b) Find the syntax and/or semantics error(s) in each of the following code segments and explain how to correct them.

(i)
```
x = 1
while (x <= 10);
   x++;
for (y = .1; y != 1.0; y += .1)
   cout << y << endl;
switch (n) {
   case 1:
      cout << "The number is 1" << endl;
   case 2:
      cout << "The number is 2: << endl;
      break;
   default:
      cout << "The number is not 1 or 2" << endl;
      break
```

(ii)
```
int x = 1, total;
while (x <= 10) {
   total += x;
   ++x;
}
```

(iii)
```
if (gender == 1)
   cout << "Woman" << endl;
   cin >> gender;
else
   cout << "Man" << endl;
```

(6/100)

(c) Determine the values of all variables after the expression is executed. Assume that, when each statement begins its execution; all variables have the integer value of 5. All question are independent of each other.

(i) `product *= x++;`

(ii) `quotient /= ++x;`

(iii) `(x++ < ++x)? cout << "No": cout << "YES";`

(6/100)

3. (a) (i) Declare **two** (**2**) arrays in C++ that may be used in parallel to store 10 employee identification numbers and 10 weekly gross pay.

(ii) Write a loop in C++ that use these arrays in Question 3(a)(i) to print each employee's identification number and weekly gross pay.

(8/100)

(b) (i) Given the following C++ array definition.

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

What will the following statement display?

```
cout << *(numbers + 3) << endl;
```

(ii) Write a function whose prototype is

```
void exchange (int *p, int *q);
```

that takes two pointers of integer variables and exchanges the values in those variable.

(9/100)

(c) Given the following C++ program, show the output and explain the purpose of function `whatIsIt`.

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

const int ROWS=2;
const int COLS=3;
typedef int Array[ROWS][COLS];  //defines the type Array

void whatIsIt(Array, int, int);
void print(const Array);

int main()
{
  Array a = { {11, 33, 55}, {22, 44, 66} };

  print(a);
  whatIsIt (a, 1, 2);
  print(a);
}

void whatIsIt (Array a, int c1, int c2)
{
  for (int i = 0; i < ROWS; i++)
  {
    int temp = a[i][c1];
    a[i][c1] = a[i][c2];
    a[i][c2] = temp;
  }
}

void print (const Array a)
{
  for (int i = 0; i < ROWS; i++)
  {
    for (int j = 0; j < COLS; j++)
      cout << a[i][j] << " ";
    cout << "\n";
  }
  cout << "\n";
}
```

(8/100)

4. (a) Write a function named `outOfOrder` that takes as parameters an array of `double` and an `int` parameter named `size` and returns a value of type `int`. This function will test this array for being out of order, meaning that the array violates the following condition:

```
a[0] <= a[1] <= a[2] <= ...
```

The function returns `-1` if the elements are not out of order; otherwise, it will return the index of the first element of the array is out of order.

For example, consider the declaration

```
double a[10] = {1.2, 2.1, 3.3, 2.5, 4.5, 7.9, 5.4, 8.7,
                9.9, 1.0};
```

In the array above, `a[2]` and `a[3]` are the first pair out of order and `a[3]` is the first element out of order, so the function returns `3`. If the array were sorted, the function would return `-1`.

(16/100)

(b) Write the correct C++ statements in the following program.

```
//Demonstrate pointers and references

#include <iostream>
using namespace std;

(i)  _____________________   //prototype using pointer
(ii) _____________________   //prototype using reference

int main()
{
   int x, y;
   //Pass the addresses to the pointers.
   (iii) _____________________  //function call

   //Use variable names when passing to references.
   //The addresses are actually passed.
   (iv)  _____________________ //function call

   return 0;
}

//Call-by-reference using pointers and indirection operator.
void AskForXandY(int *pX, int *pY)
{
   cout << "\n enter x and y ";
   cin >> (v) _____________________
}

//Call-by-reference using reference parameters.
void AskForXandY(int &rX, int &rY)
{
   cout << "\n enter x and y ";
   cin >> (vi) _____________________
)
```

(9/100)

1. (a) Nyatakan sama ada setiap satu yang berikut adalah **BENAR** atau **PALSU**.

(i) Semasa atur cara dilaksanakan, kandungan pemboleh ubah pemalar boleh ditukar.

(ii) Pemboleh ubah `char` tidak boleh digunakan dalam ungkapan aritmetik.

(iii) Semua operator aritmetik `*`, `/`, `+` dan `–` berada pada paras keutamaan yang sama.

(iv) Kenyataan `continue` boleh digunakan untuk memberhentikan gelung.

(v) Ungkapan data pernyataan `switch` boleh jadi ungkapan logikal.

(vi) Untuk menggunakan manipulator `setprecision`, `setw`, dan `setfill`, atur cara mesti memasukkan fail `iomanip`.

(6/100)

(b) Sesuatu tempat parkir mengenakan kadar bayaran minima $2.00 untuk setiap tiga jam pertama. Bagi setiap jam tambahan, kadar bayaran sebanyak $0.50 akan dikenakan. Kadar bayaran maksima bagi 24 jam ialah $10.00. Anggapkan yang tiada kereta di parkir lebih dari 24 jam pada satu-satu masa. Tulis satu fungsi `calculateCharge` untuk menentukan kadar bayaran untuk setiap pengguna.

(7/100)

(c) Apakah output bagi segmen atur cara berikut?

(i)
```
int x = 72;
if (x > 10)
   if ((x < 100) || (x > 50))
      cout << x << endl;
      if ((x < 100) && (x > 50))
         cout << x + 1;
      else
         cout << x * x;
```

(ii)
```
int x = 5;
do {
   cout << x << endl;
   x = x + 2;
} while (x != 10);
cout << x << endl;
```

(iii)
```
#include <iostream>
using namespace std;
int main()
{
   char c;
   c = 'A'; //the ASCII value is 65
   while (c <= 80) {
      cout << c;
      c += 5;
}
```

(9/100)

(d) Satu koefisien bionomial dikira dengan menggunakan formula berikut.

$$c(n, k) = \frac{n!}{(n - k)!k!}$$

di mana $n! = \prod_{i=1}^{n} i = 1 * 2 * 3 \ldots * n$

contoh: $4! = \prod_{i=1}^{4} i = 1 * 2 * 3 * 4$

(i) Tulis pernyataan `for` untuk mengira n! (faktorial).

(4/100)

(ii) Tulis atur cara C++ yang mengira koefisien binomial.

(8/100)

2. (a) (i) Tukarkan segmen kod C++ berikut menjadi gelung pasca-ujian.

```
int number;
cout << "Enter an odd number:";
cin >> number;
while (number %7 == 0) {
   cout << "Enter an odd number divisible by 7 again";
   cin >> number;
}
```

(ii) Tukarkan pernyataan `if-else` kepada pernyataan `switch`.

```
int age;
if ((age > 0) && (age <= 2)
   cout << "This is a baby" << endl;
else
   if (age > 2) && (age <= 4)
      cout << "This is a toddler" << endl;
else
   if (age > 4) && (age <= 6)
      cout << "This is a child" << endl;
else
   cout << "You are not a child anymore" << endl;
```

(4/100)

(b) Cari kesalahan-kesalahan sintaksis dan/atau semantik bagi kod segmen berikut dan jelaskan bagaimana membetulkannya.

(i)
```
x = 1
while (x <= 10);
   x++;
for (y = .1; y != 1.0; y += .1)
   cout << y << endl;
switch (n) {
   case 1:
      cout << "The number is 1" << endl;
   case 2:
      cout << "The number is 2: << endl;
      break;
   default:
      cout << "The number is not 1 or 2" << endl;
      break
```

(ii)
```
int x = 1, total;
while (x <= 10) {
   total += x;
   ++x;
}
```

(iii)
```
if (gender == 1)
   cout << "Woman" << endl;
   cin >> gender;
else
   cout << "Man" << endl;
```

(6/100)

(c) Tentukan nilai semua pemboleh ubah selepas pelaksanaan dibuat. Anggapkan bahawa semua pemboleh ubah mempunyai nilai 5 apabila setiap pernyataan memulakan pelaksanaannya. Setiap soalan tidak bergantung pada satu sama lain.

(i) `product *= x++;`

(ii) `quotient /= ++x;`

(iii) `(x++ < ++x)? cout << "No": cout << "YES";`

(6/100)

3. (a) (i) Isytihar **dua** (**2**) tatasusunan dalam C++ yang boleh digunakan secara selari untuk menyimpan 10 nombor pengenalan pekerja dan 10 gaji kasar mingguan pekerja.

(ii) Tulis gelung dalam C++ yang menggunakan tatasusunan dalam Soalan 3(a)(i) untuk mencetak setiap nombor pengenalan pekerja dan gaji kasar mingguan pekerja.

(8/100)

(b) (i) Diberi definisi tatasusunan C++ berikut.

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

Apakah yang akan dipapar oleh kenyataan berikut?

```
cout << *(numbers + 3) << endl;
```

(ii) Tulis suatu fungsi di mana prototaipnya ialah

```
void exchange (int *p, int *q);
```

yang menerima dua pemboleh ubah penuding berjenis integer dan menukar ganti nilai-nilai pemboleh ubah tersebut.

(9/100)

(c) Diberi atur cara C++ seperti berikut, tunjukkan output dan jelaskan tujuan fungsi `whatIsIt`.

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

const int ROWS=2;
const int COLS=3;
typedef int Array[ROWS][COLS];  //defines the type Array

void whatIsIt(Array, int, int);
void print(const Array);

int main()
{
  Array a = { {11, 33, 55}, {22, 44, 66} };

  print(a);
  whatIsIt (a, 1, 2);
  print(a);
}

void whatIsIt (Array a, int c1, int c2)
{
  for (int i = 0; i < ROWS; i++)
  {
    int temp = a[i][c1];
    a[i][c1] = a[i][c2];
    a[i][c2] = temp;
  }
}

void print (const Array a)
{
  for (int i = 0; i < ROWS; i++)
  {
    for (int j = 0; j < COLS; j++)
      cout << a[i][j] << " ";
    cout << "\n";
  }
  cout << "\n";
}
```

(8/100)

4. (a) Tulis fungsi bernama `outOfOrder` yang menerima tatasusunan berjenis `double` dan pemboleh ubah bernama `size` berjenis `int` sebagai parameter dan fungsi ini kembalikan nilai berjenis `int`. Fungsi ini akan menguji sama ada tatasusunan tidak tersusun, bermaksud tatasusunan tidak menepati keadaan berikut:

```
a[0] <= a[1] <= a[2] <= ...
```

Fungsi ini mengembalikan `-1` jika elemen tidak tersusun, jika tidak ia mengembalikan indeks elemen pertama tatasusunan tidak tersusun.

Sebagai contoh, diberi pengisytiharan

```
double a[10] = {1.2, 2.1, 3.3, 2.5, 4.5, 7.9, 5.4, 8.7,
                9.9, 1.0}
```

Dalam tatasusunan di atas `a[2]` dan `a[3]` adalah pasangan pertama yang tidak tersusun dan `a[3]` adalah elemen pertama yang tidak tersusun, maka fungsi mengembalikan `3`. Jika tatasusunan tersusun, fungsi mengembalikan `-1`.

(16/100)

(b) Tulis kenyataan C++ yang betul dalam atur cara berikut.

```
//Demonstrate pointers and references

#include <iostream>
using namespace std;

(i)  _____________________   //prototype using pointer
(ii) _____________________   //prototype using reference

int main()
{
   int x, y;
   //Pass the addresses to the pointers.
   (iii) _____________________  //function call

   //Use variable names when passing to references.
   //The addresses are actually passed.
   (iv)  _____________________ //function call

   return 0;
}

//Call-by-reference using pointers and indirection operator.
void AskForXandY(int *pX, int *pY)
{
   cout << "\n enter x and y ";
   cin >> (v) _____________________
}

//Call-by-reference using reference parameters.
void AskForXandY(int &rX, int &rY)
{
   cout << "\n enter x and y ";
   cin >> (vi) _____________________
)
```

(9/100)