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THE UNIVERSITY OF HONG KONG
FACULTY OF ENGINEERING
DEPARTMENT OF COMPUTER SCIENCE

CSIS1117C/D Computer Programming I
COMP1117C/D Computer Programming

Date: 25th May, 2013 Time: 9:30am – 12:30pm

Only approved calculators as announced by the Examinations Secretary can be used in this examination. It is candidates' responsibility to ensure that their calculator operates satisfactorily, and candidates must record the name and type of the calculator used on the front page of the examination script.

Brand and type of calculator: _____

Instructions:

1. **Write your university number at the top of every odd page.**
2. **You are encouraged to use pencils when you write the code.**
3. **Answer ALL questions in the space provided.**

Section A: Multiple Choices (10 marks)

- *Circle the letter of the most appropriate answer to each question.*
- *Each question carries 1 mark.*

1. What kind of errors will you get when you compile and run the following C++ program?

```
#include <iostream>
using namespace std;
int main() {
    cout << 100 / Rate;
    return 0;
}
```

A. Syntax error.
B. Runtime error.
C. No error.
D. None of the above.
E. Insufficient information to decide.

2. Which of the following is NOT a valid data type in C++?
A. `bool`
B. `char`
C. `short`
D. `struct`
E. None of the above.

3. What will you see on the display after the following statement is executed?

```
cout<< "\"\"a\\xx\"";
```

A. Nothing because of syntax error.
B. `\"\"a\\xx\"`
C. `""a\\xx"`
D. `a  xx"`
E. `""a\xx"`

4. Examine the following nested loop.

```
int counter1 = 9, counter2;
while (counter1 <= 100) {
      for (counter2 = 1; counter2 <= 100; counter2++)
          cout << "Hello" <<endl;
      counter1 = counter1 + 10;
}
```

How many lines of "Hello" will be displayed?

A. 900
B. 910
C. 890
D. 1000
E. None of the above.

5. What is the output of the following statement?

```
Cout << 30/4/2/2 + (-14)%3;
```

A. 1
B. 2
C. 0.875
D. 2.875
E. None of the above.

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6. What is the output of the following program?

```
#include <iostream>
using namespace std;
int f(int&x, int y) {
    x = x+y;  y++;
    return (x+y);
}
int main() {
    int x=5, y(10);
    cout << f(x,y) << ',';
    cout << x << "," << y;
}
```

A. 26,15,11
B. 26,5,11
C. 26,5,10
D. 26,15,10
E. None of the above.

7. What is the output of the following program fragment?

```
int L, m[6]={12,4,13,1};
for (L=0; L<=4; L++)
    cout << m[L]*m[L+1] <<',';
```

A. 48,52,13,1,0,
B. 48,52,13,0,0,
C. 48,52,13,0,
D. Insufficient information to decide.
E. None of the above.

8. What is the output of the following program fragment?

```
string s;
string a = "test ", b = "again ";
s = a + b + b + "!";
cout << s;
```

A. test again again !
B. test again again
C. test + again + again + "!"
D. test again !
E. Nothing because of syntax error.

Consider the following program fragment for Questions 9 and 10.

```
int k, *p; k = 9;
```

9. Which of the following statements prints the value 9?
A. p = *k; cout << &p;
B. p = &k; cout << p;
C. p = &k; cout << *p;
D. *p = &k; cout << *p;
E. *p = k; cout << p;

10. Which of the following statements assigns the value 5 to k?
A. p = &k; p = 5;
B. p = &k; *p = 5;
C. &p = k; *p = 5;
D. &k = 5;
E. k = *p; *p = 5;

Section B: Short Questions (90 marks)

- *Weighting of every question is stated adjacent to the question number.*

1. (1 mark) What is a variable?

   Answer:

2. (3 marks) Explain the usage of editors, compilers and linkers in developing a C++ program.

   Answer:

3. (3 marks) Consider the following declarations

```
struct Data {
        int time[10];
        char name[10];
};
Data *p, q;
```

   Which of the following statements are invalid?

   A. `p = &q;`
   B. `p.time[8] = 11.5;`
   C. `p = q;`
   D. `p->name = q.name;`
   E. `p->name[8]='\0';`
   F. `*p = q;`

   Answer:

4. (4 marks) Use an example to explain why we need the associativity of operators in a programming language.

   Answer:

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5. (2 marks) Suggest a way that rounds a double value `d` into the nearest value with 2 decimal places. For example, `123.45678` will be rounded to `123.46`.

Answer:

6. (3 marks) Let `d = 99.0`. The C++ statement

```
Cout << (1.0 / d * d == 1.0);
```

prints 0, while

```
cout << (1.0 * d / d == 1.0);
```

prints 1. Explain.

Answer:

7. (3 marks) Complete the following function that removes all letter 'e' from a string. For example, if input is "level",return value is "lvl".You can assume that appropriate libraries have been included in this program. For each `/* ??? */`, you should fill in one expression.

```
String remove_e(string str) {
       string result = "";
       for (int i = 0; i<str.length(); ++i) {
           if ( /* ??? */ )      // 1:
              result = /* ??? */;       // 2:
       }
       return /* ??? */;                // 3:
}
```

Answer:

8. (3 marks) What is the output of the following code?

```
int  a[] = { 1, 2, 3, 4, 5, 5, 6, 7, 8, 9};
int i,  u,  v,  m,  key;

u = 0;   v = 9;  key = 5;
for (i=0;  i<2;  ++i) {
     m = (u + v) / 2;
     if (key < a[m])  v = m - 1;
     else if (key > a[m])  u = m + 1;
     else break;
}
Cout <<  "u = "  <<  u  <<  ";  v = "  <<  v  << endl;
```

Answer:

9. (3 marks) Give the content of array x[] after the execution of the following code.

```
int x[] = { 3, 7, 4, 9, 1, 5, 7};
int i, j, k, t;

for (i=0; i<2; ++i) {
     k = i;
     for (j=i+1;  j<7;  ++j)
          if  (x[k] > x[j])  k = j;
     t = x[i];   x[i] = x[k];  x[k] = t;
}
```

Answer:

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10. (5 marks) Complete the following method that computes and returns $\sum_{i=1}^{n} \frac{1}{i} = 1 + \frac{1}{2} + \frac{1}{3} + \cdots + \frac{1}{n}$. You can assume that $n \geq 1$.

Answer:

```
double harmonic(int n) {
```

11. Give C++ code for the following operations on a dynamic array of pointers to a structure.

a) (1 mark) Definition: define a structure `X` that contains a string `name` and a char `grade`.

Answer:

b) (2 marks) Declaration: declare `r` as a variable of `X`, `s` as a pointer variable to `X` and `w` as a pointer variable to a pointer of `X`.

Answer:

c) (1 mark) Creation: assign a newly created dynamic array of 999 pointers of `X` to `w`.

Answer:

d) (1 mark) Referencing I: assign the address of `r` to the last entry of `w`.

Answer:

e) (1 mark) Referencing II: assign "`Chan Tai Man`" to the `name` of the `struct` pointed by `w[5]`.

Answer:

f) (2 marks) Swapping: swap the values (i.e., the pointers) of the first two entries of `w`, using `s` as a temporary storage.

Answer:

g) (1 mark) Deletion: release the dynamic array to the freestore of the OS.

Answer:

12. Consider the following method that computes a value from two positive integers.

```
int riddle( int i, int j) {
    if (j == 0) return i;
    return riddle(j, i % j);
}
```

a) (1 mark) What is the return value of `riddle(100, 100)`?

Answer:

b) (1 mark) What is the return value of `riddle(195, 117)`?

Answer:

c) (1 mark) What is the return value of `riddle(55, 21)`?

Answer:

d) (2 marks) What does this function compute in general?

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e) (8 marks) Write a non-recursive function for `riddle(i, j)`. (Hint: this function can be completed using one `while`-loop. No `if`-statement is needed.)

Answer:

13. (4 marks) Complete the following program that computes the sum of all integers storing in a file. Fill every /* ??? */ with appropriate code.

```
#include <isotream>
/* ??? */                  // 1:
using namespace std;
int main() {
    cout << "Enter the name of file storing the integers: " ;
    string fname;
    cin >> fname;
    /* ??? */  src;        // 2:              // declaring the stream.
    src.open( /* ??? */ );   // 3:
    /* ??? */                // 4:  Exit if the above operation
                             //       is failed
    int j, sum = 0;
    while ( /* ??? */ ) {    // 5:
          sum += j;
    }
    cout << sum;
}
```

Answer:

14. (4 marks) What is the output of the following program fragment? Justify your answer.

```
int a=3, b=2, c=1;
if (a < b < c)
    cout << "a is the smallest." << endl;
else
    cout << "minimum is unknown." << endl;
```

Answer:

15. (2 marks) What would be the content of "out.txt" after the execution of the following code fragment? Justify your answer.

```
ofstream des;
des.open("out.txt");
des << "Hello " << endl;
des.close();

ofstream des2;
des.open("out.txt");
des2 << "World!" << endl;
des2.close();
```

Answer:

16. (5 marks) Rewrite the following while loop using quasi-infinite loop style.

```
int i = 0, sum = 0;
while (a[i] != -1) {
  sum += a[i];
  ++i;
}
```

```
int i = 0, sum = 0;
while (true) {   // quasi-infinite style
  // ...

}
```

Answer:

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17. (13 marks) Write a program that given an integer `n > 1`, expresses `n` as a product of its prime factors. Output the result in the format of `n = p1 x p2 x ... x pn`, where `p1 <= p2 <= ...<= pn` are all prime factors of `n`. E.g., if `n` = 12, the output should be `12 = 2 x 2 x 3`. When `n` = 17, output should be `17 = 17`.

Answer:

18. (2 marks) Give an appropriate post condition of the following function.

```
bool f(string s) {
  const string D = "0123456789";
  for (int i = 0; i < s.length(); ++i) {
      if (D.find(s[i]) == string::npos)
          return false;
  }
  return true;
}
```

Answer:

19. (8 marks) Complete the following function that sums all the digits that are odd in a given number. E.g., `sum_odd_digits(2139)` returns 1 + 3 + 9 = 13 and `sum_odd_digits(1024)` returns 1.

Answer:

```
int sum_odd_digits(int n) {
```

——— END OF PAPER ———