

NATIONAL UNIVERSITY OF SINGAPORE

SCHOOL OF COMPUTING

MID-SEMESTER TEST

AY2014/15 Semester 1

CS1010 PROGRAMMING METHODOLOGY

11 October 2014

Time Allowed: **1 hour 30 minutes**

INSTRUCTIONS

1. This question paper contains **NINE (9)** questions and comprises **FIVE (5)** printed pages, including this page.
2. An **ANSWER SHEET** is provided for you to write the answers. It comprises **TWO (2)** printed pages.
3. Answer **ALL** questions within the space provided on the **Answer Sheet**.
4. Maximum score is **30 marks**.
5. This is an **OPEN BOOK** test.
6. Write legibly with a pen or pencil.
7. Calculators are allowed, but not laptops, PDAs or other computing devices.
8. Submit only the **Answer Sheet** at the end of the test. You may keep the question paper.
9. Write your **MATRICULATION NUMBER** on the **Answer Sheet** using **A PEN**.

———— **END OF INSTRUCTIONS** ————

SECTION A: 4 Multiple Choice Questions (4 Marks)

Each question has only one correct answer. Write your answers in the boxes provided on the **Answer Sheet**. 1 mark for each correct answer and no penalty for wrong answer.

1. What is the output of the following code segment?

```
int i = 1.9;

switch (i) {
    case 1: printf("%d ", i);
    case 2: printf("%d ", i);
    case 3: printf("%d ", i);
    default: printf("invalid");
}

printf("\n");
```

- A. 1
 B. 1 1 1
 C. 1 1 1 invalid
 D. 1 2 3 invalid
 E. invalid
2. Which of the following statements is/are the correct way(s) of assigning the integer 8 to all the 6 elements of the array A?

- i. `int A[2][3] = {{8}};`
 ii. `int A[2][3] = {{8, 8}, {8, 8}, {8, 8}};`
 iii. `int A[][3] = {{8, 8, 8}, {8, 8, 8}};`
 iv. `int A[2][] = {{8, 8, 8}, {8, 8, 8}};`
 v. `int A[][] = {8};`

- A. None is correct.
 B. Only (i) is correct.
 C. Only (ii) is correct
 D. Only (iii) is correct
 E. All are correct.

3. Given the following declaration statement:

```
int x, y = 10, z = 10;
```

Which of the following statements will assign a value of 20 to variable **x**?

- i. `x = --y + ++z;`
- ii. `x = ++y + z--;`
- iii. `x = ++y + --z;`
- iv. `x = y++ + z--;`

- A. Only (i).
- B. Only (iii).
- C. Only (i) and (iii).
- D. Only (iii) and (iv).
- E. Only (i), (iii) and (iv).

4. Given the following code fragment, assuming that **n** is a positive integer and its value does not cause an overflow on **count**.

```
int count = 0, a, b;

for (a = n; a > 0; a--) {
    for (b = n/2; b > 0; b--) {
        count++;
    }
}
```

Which of the following statements is equivalent to the code above?

- A. `int count = 2 * n;`
- B. `int count = n * n;`
- C. `int count = n * n / 2;`
- D. `int count = n * (n / 2);`
- E. `int count = n * (n - 1) / 2;`

SECTION B: Structured Questions (12 Marks)

Write your answers in the boxes provided in the **Answer Sheet**.

5. What is the output of the following code fragment?

[2 marks]

```
int main(void) {
    int x = 9;

    if (2.5 < x < 7.5)
        printf("Number is between 3 and 7 inclusively.\n");
    else
        x++;
    printf("x = %d\n", x);

    return 0;
}
```

6. What does the following function compute?

[2 marks]

```
int what(int a) {
    int i=0, d;

    do {
        d = a%10;
        if (d%2) i++;
        a /= 10;
    } while (a);
    return i;
}
```

7. For each of the statements below, indicate whether it is TRUE or FALSE. Give your reason. No mark will be given if the reason is missing or incorrect. [4 marks]

(a) The statement `int Continue = 5;` is valid.

(b) Suppose `arr` is an integer array of 5 elements. The following statement is valid:

```
sum = sumArray(arr[], 5);
```

(c) A function cannot have more than one return statement in its code.

(d) The following 'for' statement will result in the loop body being executed 3 times.

```
int i;
for (i = 4; i < 10; i+2) {
    <loop body>
}
```

8. Write a function called `printDouble()` that takes in a two-dimensional integer array (assume each element contains only a single digit) and prints out the array such that each element is printed twice as shown below. You may assume the array has a maximum of 5 rows and 8 columns. [4 marks]

Original array:

```
1 0 3
4 7 6
```

Output:

```
1 1 0 0 3 3
4 4 7 7 6 6
```

SECTION C: Short Programming Question (14 Marks)

Write your answer in the space provided on the **Answer Sheet**.

9. One method of generating pseudo-random numbers is the **middle-square method**. In this method, to generate a sequence of 4-digit pseudorandom numbers, a 4-digit starting value is used and squared, producing an 8-digit number (if the result is less than 8 digits, leading zeroes are added to compensate). The middle 4 digits of the result would be the next number in the sequence, and returned as the result. This process is then repeated to generate more numbers.

There are several special cases to be considered:

1. If the middle 4 digits are all zeroes, the generator would have generated zeroes thereafter.
 2. The middle-squared method can also get stuck on a number other than zero, e.g. this occurs with the values 0100, 2500, and 3792.
 3. Some starting values form very short repeating cycles, e.g. 0540 → 2916 → 5030 → 3009 → 0540.
- a) Write pseudo-code for a program that reads in a starting 4-digit number, generates and prints a set of 8 pseudo-random numbers. If any of the above special cases is encountered, an appropriate message should be printed, and the program should terminate (see sample runs). Note: you do not need to print the leading zeros. [7 marks]
- b) Write the C code for the pseudo-code you have written in (a). [7 marks]

Sample runs:

```
$ Enter your 4-digit number: 5000
The sequence is: 5000
Next number 0 generated. Sequence terminated.
```

```
$ Enter your 4-digit number: 1234
The sequence is: 1234 5227 3215 3362 3030 1809 2724 4201
```

```
$ Enter your 4-digit number: 0540
The sequence is: 540 2916 5030 3009
Next number 540 is repeated. Sequence terminated.
```

```
$ Enter your 4-digit number: 2500
The sequence is: 2500
Next number 2500 is repeated. Sequence terminated.
```

————— **END OF PAPER** —————