

NATIONAL UNIVERSITY OF SINGAPORE  
SCHOOL OF COMPUTING

TERM TEST #2  
Semester 1 AY2006/2007

**CS1101X/Y/Z — PROGRAMMING METHODOLOGY**

28 October 2006

Time Allowed: **1 hour 30 minutes**

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**INSTRUCTIONS**

1. This question paper contains **TWENTY THREE (23)** questions and comprises **TWELVE (12)** 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 **35 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 (20 Multiple Choice Questions: 20 Marks)**

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

1. What can be said about the following code?

```
int product = 0, count = 0;
while (product < 2500) {
    product *= 5; count++;
}
```

- A. The value of variable `count` after the loop is 500.
  - B. The value of variable `count` after the loop is 501.
  - C. It is an infinite loop.
  - D. The syntax of the 'while' statement is invalid.
  - E. The `count` variable is initialized incorrectly.
2. The following code cannot be compiled. Why?
- ```
for (int k = 0; true; )
    if (++k > 10) break;
System.out.println(k);
```
- A. The condition of the 'for' loop cannot be the boolean value `true`. It must be some boolean expression.
  - B. The update expression for the 'for' statement is missing; it cannot be empty.
  - C. The loop body (the 'if' statement) is not enclosed in a pair of braces { }.
  - D. The variable `k` in the `System.out.println()` statement is not recognised.
  - E. In the loop body, it should not be `++k`; it should be `k++` instead.
3. A method of object X is called, and a new object of the same class is created within that method and returned to the caller. The object that is returned \_\_\_\_\_.
- A. has the same address and the same data member value as the object X.
  - B. has a different address and possibly a different data member value from the object X.
  - C. has the same address and possibly a different data member value from the object X.
  - D. has a different address but the same data member value as the object X.
  - E. cannot be assigned back to the object X.

4. Given this code:

```

for (int i = 0; i < 10; i++) {
    for (int j = 0; j < 10; j++) {
        if (j > i)
            continue;
        System.out.println("Java");
    }
}

```

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

- A. `for (int i = 0, j = 0; j <= i; i++, j++)  
System.out.println("Java");`
- B. `for (int i = 0; i < 10; ++i)  
for (int j = 0; j < i; ++j)  
System.out.println("Java");`
- C. `for (int i = 0; i < 10; i++)  
for (int j = 10; j > 0; j--)  
System.out.println("Java");`
- D. `for (int i = 0; i < 10; ++i)  
for (int j = 0; j <= i; ++j)  
System.out.println("Java");`
- E. `System.out.println("Java");`

5. How many line(s) of “Java” does the code in question 4 above print?

- A. 1
- B. 10
- C. 45
- D. 55
- E. 99

6. How do we have a method propagate an exception?

- A. Include “throws” at the end of the method signature.
- B. Include “throw” in the method body.
- C. Include “try-catch” in the method body.
- D. Include “finally” in the method body.
- E. It is not possible to propagate an exception.

7. What is the output of the following code (assuming that the necessary package has been imported)?

```
try {
    double num1 = Double.parseDouble("2.3");
    System.out.println("First is okay.");

    int num2 = Integer.parseInt("a59");
    System.out.println("Second is okay.");
}
catch (NumberFormatException e) {
    System.out.println("Error 1...");
}
catch (InputMismatchException e) {
    System.out.println("Error 2...");
}
finally {
    System.out.println("Finally!");
}
```

- A. First is okay.  
Second is okay.  
Finally !
- B. First is okay.  
Error 1...
- C. First is okay.  
Error 1...  
Finally!
- D. First is okay.  
Error 2...
- E. First is okay.  
Error 2...  
Finally!

8. Which of the following is a valid set of overloaded methods?

- i. `public int m() { ... };`  
`public int m(float f) { ... };`
- ii. `public int m(int i) { ... };`  
`public int m(float f) { ... };`
- iii. `public int m(int i, float j) { ... };`  
`public int m(float i, int j) { ... };`
- iv. `public int m(int i, float j) { ... };`  
`public double m(int a, float b) { ... };`

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

9. The matriculation numbers of students matriculated in 2006 begin with “U06”, followed by 4 digits, followed by one of these letters: A, B, E, H, J, L, M, N, R, U, W, X, Y. How are matriculation numbers represented in regular expression?

- i. `U06[0-9][0-9][0-9][0-9][ABEHJLMNRUWXY]`
- ii. `U06[0-9999][ABEHJLMNRUWXY]`
- iii. `U06[0000-9999][ABEHJLMNRUWXY]`
- iv. `U06[0-9]{4}[ABEHJLMNRUWXY]`

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

10. What is the output of the following code?

```
int count = 0;
for (int k=0; k<90; k+=3) {
    if (k%9 == 0) continue;
    if (k%10 == 0) break;
    count++;
}
System.out.println(count);
```

- A. 0
- B. 6
- C. 7
- D. 9
- E. 10

11. What is the output of the following code?

```
int[] list = new int[10];
for (int i=0; i<list.length; i+=2) {
    list[i]++;
    for (int j=0; j<list.length; j+=3) {
        list[j] += list[i];
    }
}

for (int i=0; i<list.length; i++)
    System.out.print(list[i] + " ");
```

- A. 10 0 1 10 0 1 10 0 1 10
- B. 10 0 1 10 1 0 11 0 1 11
- C. 10 0 1 11 1 0 12 0 1 13
- D. 10 0 0 11 0 0 12 0 0 13
- E. 10 0 1 10 1 0 11 0 1 15

12. Which of the following statements is false?

- A. When an array is passed to a method, only the reference is passed, and a copy of the array is not created in the method.
- B. An individual array element cannot be passed to a method.
- C. An ArrayList is resizable.
- D. The indices of an ArrayList begin from zero.
- E. An abstract method has no body.

13. What is the output of the following code?

```
public static int f(int n) {
    return 2 * n;
}

public static void main(String[] args) {
    System.out.println( f(f(f(5))) );
}
```

- A. 10
- B. 20
- C. 40
- D. 80
- E. Error, because `f(f(f(5)))` is not valid.

14. Given the method `f(int n)` in question 13 above, what is the value of ans the following code prints in terms of `x` and `k`?

```
public static void main(String[] args) {
    int x = ...; // a value is assigned to x
    int k = ...; // a positive value is assigned to k

    int ans = x;
    for (int i=0; i<k; i++) {
        ans = f(ans);
    }
    System.out.println(ans);
}
```

- A.  $k^x$
- B.  $kx$
- C.  $2^x k$
- D.  $2^k x$
- E.  $2kx$

15. What is the output of the following code, or what will happen when the code is run?

```
String str = new String("Hello");
for (int i=0; i<6; i++)
    System.out.print(str.charAt(i));
System.out.println("#");
```

- A. Hello #
- B. Hello\n#
- C. A `NullPointerException` will be thrown.
- D. An `ArrayIndexOutOfBoundsException` will be thrown.
- E. A `StringIndexOutOfBoundsException` will be thrown.

16. Sorting is most suitable for which of the following problems?

- i. To find the largest and the second largest values in a large list of integers.
  - ii. To find the average and standard deviation of the test scores of students in a large class.
  - iii. Prizes of different values are awarded to all contestants in a competition. The champion will get the best prize, the runner-up the second-best prize, and so on.
- A. Only (i)
  - B. Only (ii)
  - C. Only (iii)
  - D. Only (i) and (iii)
  - E. All

17. Which of the following declarations are acceptable (i.e. no compilation error)?

- i. `int[] a = new int[4, 4];`
  - ii. `int[] a = new int[4][4];`
  - iii. `int[][] a = new int[4][4];`
  - iv. `int[] a = new int[4 * 4];`
  - v. `int[][] a = new int[4 * 4];`
- A. Only (i) and (iii)
  - B. Only (ii) and (iii)
  - C. Only (iii)
  - D. Only (iii) and (iv)
  - E. Only (iii), (iv) and (v)

18. Given the following code fragment, what is its output?

```

int[] arr = {1, 1, 1, 1, 1, 1, 1, 1, 1}; // 9 elements

for (int i=1; i<arr.length; i*=2)
    for (int j=0; j<arr.length - i; j++)
        arr[j] += arr[j+i];

for (int j=0; j<arr.length; j++)
    System.out.print(arr[j] + " ");
```

- A. 1 2 3 4 5 6 7 8 9
- B. 9 8 7 6 5 4 3 2 1
- C. 1 3 5 7 9 11 13 15 17
- D. 17 15 13 11 9 7 3 2 1
- E. 9 9 9 9 9 9 9 9 9

19. Assume we have an array of strings and want to write a method that finds a particular string within the array. If the string is found, we wish to print "found". Which of the following implements this?

- i. **public static void**  
findString(String a, String[] searched){  
    **int** j=0;  
    **while** (!searched[j].equals(a))  
        j++;  
    System.out.println("found");  
}
- ii **public static void**  
findString(String a, String[] searched){  
    **for** (**int** j = 0; j < a.length; j++)  
        **if** (searched[j].equals(a))  
            System.out.println("found");  
}
- iii **public static void**  
findString(String a, String[] searched){  
    **for** (**int** j = 0; j < searched.length; j++)  
        **if** (searched[j].equals(a))  
            System.out.println("found");  
}
- iv **public static void**  
findString(String a, String[] searched){  
    **for** (**int** j = 0; j < searched.length; j++)  
        **if** (a.equals(searched[j]))  
            System.out.println("found");  
}

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

20. Given a general string `str`, we want to determine whether it contains the three characters “A”, “B”, then “A” in the given order, while allowing other characters to come between them. If it does, it prints out “true”. Which of the following code fragments achieve the goal (without making any assumption on `str`)?

```
i    if ( str.matches("[a-zA-Z]*A[a-zA-Z]*B[a-zA-Z]*A[a-zA-Z]*") )
        System.out.println("true");
```

```
ii   int j=0;
      String pat = "ABA";
      for (int i=0; i < str.length(); i++)
          if ( str.charAt(i) == pat.charAt(j) ) {
              j++;
              if (j == pat.length()) {
                  System.out.println("true");
                  break;
              }
          }
```

```
iii  int i, k = 0;
      String pat = "ABA";
      while (k < pat.length()) {
          for (i=0; i < str.length(); i++)
              if ( str.charAt(i) == pat.charAt(k) )
                  break;

          if (i == str.length()) break;
          else k++;
      }

      if (k == pat.length() )
          System.out.println("true");
```

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

**SECTION B (3 Questions: 15 Marks)**

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

21. Given an integer array, the method `reverse(int[] arr)` reverses elements in the array. For example, if the array originally contains

9 6 3 8 6

then after calling the method, the array contains

6 8 3 6 9

Fill in the `reverse(int[] arr)` method. You must not use any additional array in the method. [3 marks]

22. Given an array `list` that contains double values, write a method

`shiftRight(double[] list, int k)`

that shifts the array elements  $k$  positions to the right. The first  $k$  elements are replaced by zero. You may assume that  $k$  is non-negative and it is smaller than the size of the array. You must not use any additional array in the method. [5 marks]

For example, if that array contains

|     |     |     |     |     |     |     |
|-----|-----|-----|-----|-----|-----|-----|
| 1.2 | 3.4 | 1.8 | 5.0 | 8.8 | 2.1 | 1.1 |
|-----|-----|-----|-----|-----|-----|-----|

then after shifting right 3 positions, the array becomes

|     |     |     |     |     |     |     |
|-----|-----|-----|-----|-----|-----|-----|
| 0.0 | 0.0 | 0.0 | 1.2 | 3.4 | 1.8 | 5.0 |
|-----|-----|-----|-----|-----|-----|-----|

23. Study the given partial code below.

```

class Rectangle {

    private int width, length; // data members

    public Rectangle() {
        // to be completed
    }

    public Rectangle(int wid, int len) {
        setWidth(wid);
        setLength(len);
    }

    public int computeArea() {
        // to be completed
    }

    // accessors and mutators for data members
    // width and length are omitted for brevity:
    // getWidth(), getLength(),
    // setWidth(int width), setLength(int length).
}

```

- a. The first constructor of Rectangle class is used to construct a new Rectangle object with width = 1 and length = 2. Fill in the body of the constructor with a single statement. Assignment statement is strictly not allowed. [1 mark]
- b. Fill in the body of the computeArea() method, which is to compute the area of a Rectangle object. [2 marks]
- c. Suppose you have created a Rectangle object called rect whose width is 12 and length is 35, and the following statement
- ```
System.out.println(rect);
```
- gives this output
- ```
[width=12, length=35]
```
- Add an appropriate method in the Rectangle class to make this possible. [2 marks]
- d. Write a main method to create a Rectangle object rect with width 12 and length 35, and print its area according to the following format. [2 marks]
- ```
Area = 420
```

————— **END OF PAPER** —————