



EASTERN UNIVERSITY, SRI LANKA  
DEPARTMENT OF MATHEMATICS  
FIRST YEAR EXAMINATION IN SCIENCE - 2016/2017  
FIRST SEMESTER (AUG./SEP., 2018)  
CS 1013 - INTRODUCTION TO PROGRAM DESIGN AND  
PROGRAMMING  
THEORY

Answer all questions

Time allowed: Two Hours

Q1. Computer Programming is the process of creating computer programs. A program is a set of instructions that tells the computer what to do.

- Explain any four various features of Java programming language. [5%]
- Briefly explain the difference between the terms *compiler* and *assembler*. [2%]
- What do you mean by *BYTECODE* and *Java Virtual Machine (JVM)*? How does *JVM* handles the *BYTECODE*? [2%]
- Describe the typical Java program structure. [4%]

e. Construct a flowchart and corresponding pseudocode to solve the following problem:

*ABC* company needs a weekly payroll report for its salespeople. Input is the salesperson's *name*, *number*, and *weekly sales*. Output is the salesperson's *name*, *number*, and *pay*. Each salesperson receives a base pay of Rs. 3000 as well as a 10% commission on his or her total sales up to Rs. 5000 and 15% commission over Rs. 5000. compute the weekly payroll for employees.

(For example, if sales = Rs. 6000,

then pay = Rs. 3000 + 0.10 × 5000 + 0.15 × 1000 = Rs. 3650.) [12%]

Q2. The tokens that can be used to construct the high-level language program is known as basic elements.

- What is the difference between *runtime errors* and *compile time errors*? Explain the above difference with the aid of an example.
- What is *Package* in Java? List four predefined packages and show an example of creating and using a user defined package.
- State whether the following variable names are valid / invalid. Give reason if it is invalid.

Variable name	valid/ invalid	Reason, if invalid
T_raise		
(area)		
char		
_hello		
25 <sup>th</sup>		
Mr.John		
\$1000		
Num 1		

- Give the value that the variable on the left hand side will hold in the following statements:

```
float a = (float)(21 / 2);
```

```
int b = 5 * 3 / 4 + 4 / 3 + 6;
```

```
int c = 100 + 10 > 10 ? 10 : 20;
```

```
int e = 20 % 7 / 2 * 3;
```

```
a += b - c * 2 * e;
```

- Show the output of the following program if x & y are integers and x=5.

```
System.out.println(x++*2);
```

```
System.out.println(++x*2);
```

```
y=x++ + ++x + x++ + ++x;
```

```
System.out.println(y);
```

```
x+=x++ + ++x;
```

```
System.out.println(x);
```

```
System.out.println(x- + " " + -x + " " + -x + " " + x-);
```

Q3. The flow of control jumps from one part of the program to another, depending on calculations performed in the program are called control structures.

a. Compare the three types of loops with an example. [6%]

b. Convert the following, [6%]

if to switch	if to ternary operator	while to for
<pre> if(status == 1)     System.out.println("Single"); else{     if(status == 2)         System.out.println("Married");     else         System.out.println("Divorsed"); }                     </pre>	<pre> if(n &gt; m){     s=n/m; } else{     s=m/n; }                     </pre>	<pre> count=0; n=256; while(n &gt; 0){     d=n%10;     count++;     n/=10; }                     </pre>

c. Find the output of the following code fragment. (Show the appropriate steps).

```

int a=5, b=3;
do{
    a=++b;
    System.out.println(a + " " + b);
}while (a > 0);
                    
```

[4%]

d. What does it mean by the term *arrays* in computer programming? [2%]

e. Let's assume an array *Z* contains 10 integer numbers. Write down a Java program to find the average of the array elements and print how many numbers are above or equal to the average and how many numbers are below the average. [7%]

Eg:  $Z=[1,4,25,35,34,100,38,68,79,0]$

Average = 38

Greater or Equal = 4

Smaller = 6

Q4. Function/method is a group of statements that together perform a task. It can be used to define reusable code and organize and simplify coding.

- a. Write a double function called *GetArea(int x, int y)* to obtain the area of rectangle. [3%]
- b. Explain the concept of *overloading* with the aid of an example. [5%]
- c. Briefly explain the meaning of *recursion* in computer programming. [3%]
- d. Let's consider an array A with 5 elements, where A = [3,4,2,5,6].
  - i. Write a Java program to calculate the sum of the elements in this array using a for loop. [7%]
  - ii. The sum of the elements in this array can also be calculated recursively as follows:

$$sum(A, i) = \begin{cases} A[0], & \text{where } i = 0 \\ A[i] + sum(A, i - 1), & \text{where } i > 0 \end{cases}$$

Where i is an index.

For example, the sum of the elements of the array A = [3,4,2,5,6] can be calculated by calling sum(A,4), which can be expressed as,

$$sum(A, 4) = A[4] + sum(A, 3) = A[4] + A[3] + sum(A, 2) \text{ and so on.}$$

Write a recursive function to calculate the sum of a given array using recursion. [7%]