

## 2014 Winter Entrance Examination

Department of Creative Informatics  
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# Programming

### INSTRUCTIONS

1. Do not open this brochure until the signal to begin is given.
2. Write your examinee ID number below on this cover page.
3. An answer sheet and a draft sheet accompany this brochure. Write down your examinee ID number on these sheets.
4. You may choose any programming language to answer.
5. You may consult only one printed manual of a programming language during the examination. *You can use or copy any libraries or program fragments stored in your PC, but you may not connect to the Internet.*
6. By the end of the examination, make a directory/folder on your PC, whose name is the same as your examinee ID number, and put your program files and related files into the directory/folder. Copy the directory/folder onto the delivered USB flash drive.
7. At the end of the examination, the USB flash drive, the answer sheet and the draft sheet are collected.
8. After these are collected, stay at your seat, until all the examinee program results have been checked briefly by the test supervisor.
9. After the brief check, try to save your program execution environment on the PC so that you can run your program as soon as possible during the oral examination in the afternoon.
10. *Leave your PC and this brochure together in the room for the oral examination and stay out of the room until you are called.*

Examinee ID \_\_\_\_\_

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# Programming

Use 64bit (or less) integer arithmetic when writing the following programs.

(1) Write a program that computes  $f(10)$  where  $f$  is a function defined as follows:

$$f(x) = \begin{cases} 1 & \text{if } x \leq 2, \\ f(x-1) + f(x-2) & \text{otherwise,} \end{cases}$$

where  $x$  is a positive integer.

(2) Write a program that computes  $f(50)$  within 10 seconds. Note that the result of  $f(50)$  is not a 32bit integer. In some languages, you would have to use 64bit-integer type such as `long` in Java.

(3) Write a program that takes two character strings representing a positive 32-digit decimal integer and print the sum of the two integers. Test the program by giving the following inputs:

```
00123456789012345678901234567890
00987654321098765432109876543210
```

(4) Write a program that computes  $f(140)$  within 10 seconds. The result can be represented by a 32-digit decimal number.

(5) Consider the following notation to represent a 32-digit decimal floating-point number:

```
12345678901234567890123456789012 02
```

It consists of 32 digits and 2 digits separated by a white space. The number above represents  $1.2345678901234567890123456789012 \times 10^2$ .

Write a program that takes two character strings representing a positive 32-digit decimal floating-point number and print the multiplication of the two numbers. Test the program by giving the following inputs:

```
12345678901234567890123456789012 04
98765432109876543210987654321098 09
```

(6) Write a program that computes the value of  $\phi$  defined as follows:

$$\phi = \frac{1 + \sqrt{5}}{2}$$

Use a 32-digit decimal floating-point number to compute the value.

(7) Write a program that computes the value of  $g(140)$  where:

$$g(x) = \frac{\phi^x}{\sqrt{5}} .$$

Use a 32-digit decimal floating-point number to compute the value.

(8) Write a program that computes the maximum value of  $|f(x) - g(x)|$ , where  $x$  is an integer such that  $1 \leq x \leq 140$ . Use a 32-digit decimal floating-point number for computing the number.

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