請照題號次序作答
Please use C, C++, Java or Python programming language to design your computer programs.

1. (25%) Given a binary image, which is 1000 × 1000 pixels, and there are several white circles with the black background. Assume that value of white pixel is 1 and the value of black pixel is 0. Please write a program **detect_circle()** that can detect all circles that has radius from 100 ~ 300 pixels. For each circle, output the center (x,y) and radius r.
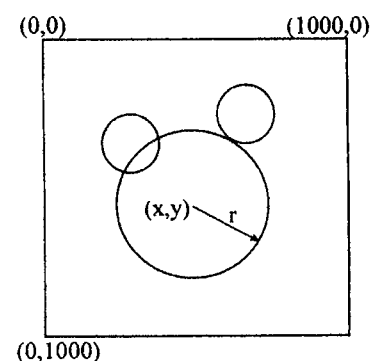
2. (20%) Given 2 different strings, please write a program `lcs(str1, str2)` to find the **longest common subsequence** (LCS). Please output the finding LCS and the length of LCS.
   For examples:
   LCS for input Sequences "GWEXXSW" and "ABXGWEX" is "GWEX" of length 4.
   LCS for input Sequences "AAABAEZ" and "BABAEZAG" is "ABAEZ" of length 5.

3. (15%) The **Armstrong number** is an n digit number that is sum of n-th power of its digits for example: $6 = 6^1$ and $1634 = 1^4 + 6^4 + 3^4 + 4^4$. Please write a program that can list all the **Armstrong number** between 1 and 1000000.

4. (20%)
   (a) Given an array of integer, write a program of **insertion sort**, which can sort the number in ascending order.
   (b) What are the time complexities of insertion sort in **average** case and in **best** case?
   (c) In what condition does the insertion sort outperform other comparison sorting algorithm?

5. (20%) Terminology explanations
   a. What is **deadlock**? What are the necessary conditions for deadlock? What are the ways that we deal with the **deadlock**?
   b. What are the difference between **Isolated IO** and **Memory Mapped IO**?
   c. What is **Reduced Instruction Set Computer (RISC)**? Given one RISC program and one CISC program, both do the same function. Which program might be longer? Why can the RISC program outperform the CISC program?
   d. What is the **thrashing** of virtual memory? If we want to lower the probability of thrashing, what can we do?
   e. In IEEE 754 floating-point standard (format with sign + exponent + mantissa), we use the **excess system** to represent the exponent part of the floating-point format. What is the excess system in floating-point standard ? What the advantage of using excess system rather than 2's complement system to represent the exponent part of the floating-point format?

<center>試題隨卷繳回</center>