Test #2

Your name and student number: _____

- You have **40 minutes** to answer to **3 problems** (total 100 points).

- Total **3 pages** including this cover page and last two blank pages.

- You must write a complete C program as a solution of each problem. Submit the source code file for each problem to **https://forms.gle/7sQ6BZifrkMtcMcK8**

- Even if your answer is not perfect, it may receive some points if your program is well structured and it shows that you understand the key concepts.

- During the test, you are not allowed to reference any materials (including your own files), use any programming tools, or contact with anyone inside or outside of the classroom.

- Read the following quote from *Handong CSEE Standard* and declare your agreement below.

Examination

1. Examination is an educational act necessary for evaluation of the students' achievement and for encouraging the students to absorb the material in the process of preparation.
2. Student should do their best to prepare for exams in order to improve her/his own knowledge and skill and should fully engage in the test during examination hour.
3. Accessing or providing unauthorized information, including other students' answer sheets, is regarded as cheating. The use of electronic devices, including cell phones and computers, without permission is strictly prohibited.
4. Entering or leaving the classroom during the examination before the finish time without permission is regarded as cheating.

I uphold Handong Honor Code and Handong CSEE Standard in taking this exam.

your sign: _____

Problem 1 (40 points)

Write a C program `x.c` that receives a positive integer `N` and then plots a X-shape with `*` such that each side is `N` characters long. For example, when the user inputs 4, your program must print out the following:

```
*   *
 **
 **
*   *
```

If the input is 5, the output must be as follows:

```
*     *
 *  *
   *
 *  *
*     *
```

Assume that the user always gives a positive integer between 3 and 20.

Problem 2 (30 points)

One way to calculate an approximate value of π is to use the following series expansion:

$$\pi(n) = 4 \times \sum_{i=0}^{n-1} \frac{(-1)^i}{2i + 1}$$

In this formula, variable n controls the accuracy of approximation. For example, if n is 4, π is evaluated to 2.895238 $=(1 - \frac{1}{3} + \frac{1}{5} - \frac{1}{7})$; if n is 101, π is evaluated to 3.151493 $=(1 - \frac{1}{3} + \frac{1}{5} - \frac{1}{7} + \cdots - \frac{1}{199} + \frac{1}{201})$.

Write a C program `pi_iter.c` that uses iterations to compute an approximated π value using the given series expansion. This program first receives n from the user, and then prints out the evaluation result of $\pi(n)$.

Problem 3 (30 points)

Write a C program `pi_recur.c` that uses recursion to compute an approximated π value using the same series expansion as Problem 2.

(blank)