# C Programming – Problem Set

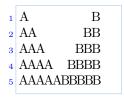*Wan-Lei Zhao*

## 1   Branch clause

1. Given a user input of three integers year, month, day, output this day is which day of the year. Do it with switch clause.

## 2   Loop

1. Find out all Armstrong numbers that are less than 100,000. Armstrong number: Given an n-digit number, the summation on the 'n' power of each digit number equals to the number.

   Example:  1 2 3 4 5 6 7 8 9 153 370 371 407

2. Convert a decimal float number into binary and output loop until the residue is lower than 0.005

3. Print out the two pyramids of characters in the following shape

   ```
   1  A            B
   2  AA          BB
   3  AAA        BBB
   4  AAAA    BBBB
   5  AAAAABBBBB
   ```

4. Implement $e^x$, the x is specified by the user. Please only consider the term that is larger than 1e-6.

5. Print out the first n terms of Fibonacci series. 'n' is specified by the user.

6. Given a character 'a' - 'z' or 'A' - 'Z', if it is in the lower case, convert it to the upper case, if it is in the upper case, convert it to the lower case.

7. Given two positive integers, work out the least common multiple of the two integers.

8. Find out all four-digits number that the sum of its first and the fourth digits equals to the sum of the its second and its third digits. Print out all these numbers, each number takes up 7 positions, and separated by one blank. Five numbers at most should be printed on each line. The numbers on each column are left-aligned.

9. Find out all Palindrome numbers ($< 10,000$), print 8 numbers at most on each line.

10. find out all numbers ($< 10,000$) that they are both squares and Palindrome numbers print 8 numbers at most on each line.

11. Accept an integer input 'n' from user, then the output a 'n' rows of characters in a pyramid shape. For instance, when the user input 4, your code output the pyramid shape as

```
1       A
2      BBB
3     CCCCC
4    DDDDDDD
```

12. Accept an integer input 'n' from user, then the output a 'n' rows of characters in a pyramid shape. For instance, when the user input 4, your code output the pyramid shape as

```
1       A
2      BCD
3     EFGHI
4    JKLMNOP
```

13. Accept an integer input from user, then output the integer number with the digits in reversed order. For instance, the input is "879", the output is "978". The input is "810", the output is "18".

14. Given an integer number input by the user. For the output prime number, it shouold satisfy another condition. Namely, the digit in the higher position should be larger than the digit in the lower position. For instance, number "631" is a valid number, while prime number "113" is not. When user input "100 10000", the valid output should be as follows.

```
1  421 431 521 541 631 641 643 653 743 751 761 821 853 863 941 953 971
      983 5431
2  6421 6521 7321 7541 7621 7643 8431 8521 8543 8641 8731 8741 8753 8761
      9421
3  9431 9521 9631 9643 9721 9743 9851 9871
4
```

15. Find out all integers that their sum of all digits is 25. Print 10 numbers on each line. One number takes up 8 digit position.

## 3   Function

1. Please calculate sin(x) by its progression form. Given any float number input x, output its sin(x) value

2. Please calculate cos(x) by its progression form. Given any float number input x, output its cos(x) value

3. Define a function to judge whether an input integer is a prime number. In the main() function, print out all the prime numbers in the range of [2, 1000].

4. List out all the Fibonaci numbers that are less than and equal to 10,000. When you print the number, each number takes up 5 digits number. The number should be also dividable by integer '5'.

5. Define two functions to check wether one number is prime and whether there is a duplicate digit in the number respectively.

6. Define a function to judge whether a three-digit integer is a narcissistic number. Call this function from the main() function to check the numbers from 100 to 999, print out all the narcissistic number in this range.

## 4   Array

1. Given a numeric string in a float number form "-321.12", please work out a function to convert it into an integer number without calling "atof()" C library. Here we assuming the user input the correct float number.

2. Given a user input of three integers year, month, day, output this day is which day of the year. Do it with 1D array.

3. Given a numeric string such as "321" that in pure positive integer form, work out a function to convert it into an integer number without calling "atoi()" C library.

4. Tranpose a 2D matrix that is kept in a 1D array print out the matrix in rows and columns both before and after the transpose.

5. Swap the minimum between the maximum number of an array and print out the array before and after the swapping.

6. Given 10 children stand in a circle, they count off from 'A'. Each time, the one counts 'n=3' gets out from the circle. The ones that are still in the circle continue to count off until no children left in the circle. Please print out the order that the children get out from the circle. The user is allowed to specify the number 'n'.

7. Given matrices A of 3-by-4 and B of 4-by-3, implement the multiplication between two matrices, and print out the resulting matrix in rows and columns.

8. Given two sorted arrays, merge them into a new one while keeping the resulting array sorted.

9. Given a sorted array, insert three numbers (unordered) in another array into the sorted array one by one.

10. Given a sentence that is kept by a string, the words could be separated by one or several blanks. Please help to remove extra blanks from the sentence. There should be one blank only between two words. There should be no blank at the end of the sentence.

11. Calculate the frequency of characters in a string. The calculation is not case sensitive. Only list out the frequencies of each character that appears in the string.

12. Given a decimal integer, print out its hexadecimal number.

13. Implement a function to convert an integer into a string that shows the same sequence of digits. For example, input integer -312, print out string (or array of chars): "-312".

14. Print out the factorial of n, namely $n!$, where n is an integer in the range of [80, 110].

## 5   Pointers

1. Build a single-directed list structure, no longer than 26. The length of the list is specified by the user. The value kept in each node is the character in the upper case. For example, the list looks like "A->B->C->D->NIL" when the user input "4". The task is you are required to build such a list first. Then you are required to reverse the list and print it out. For the above exmaple, the reversed list looks like "D->C->B->A->NIL".

2. Given a root of a binary tree, define a recursive function to calculate the depth of the tree

3. Define a recusive function to calculate the depth of an M-branch tree. The input parameter for the function is the root node of the M-branch tree.