CS1010: LAB ASSIGNMENT 3

0 INTRODUCTION

This lab contains 2 exercises.

To receive the attempt mark for this lab assignment, you must submit all programs and get a passing feedback mark for each of the program.

If you have any questions on the task statements, you may post your queries on the relevant IVLE discussion forum. However, do not post your programs (partial or complete) on the forum before the deadline!

Please be reminded that lab assignments must be done in your own effort.

Mark allocation is as follows (60% correctness, 20% style, 20% design):

- Exercise 1: 2 marks
- Exercise 2: 5 marks

1 EXERCISE 1: MATRIX ROTATION

1.1 LEARNING OBJECTIVES

- Using repetition statement.
- Learning basic operation to matrix.
- Applying neat logic in problem solving.

1.2 TASK STATEMENT

Given a 2 dimensional matrix of size N x N, you are required to rotate the matrix by 90 degree clockwise and output the result.

The first line of the input file is an integer, N (1 <= N <= 20). The following is a 2 dimensional array with size N x N. The output is the array after being rotated by 90 degree clockwise. For example, given a 3 dimensional array:

1 2 3

4 5 6

7 8 9

After rotation of 90 degree clockwise, it becomes:

7 4 1

8 5 2

9 6 3

1.3 SAMPLE RUNS

Sample run using interactive input (user's input shown in blue; output shown in bold purple). Note that the first two lines (in green below) are commands issued to compile and run your program on UNIX.

Sample run #1:

```
$ gcc -Wall rotation.c -o rotation
$ ./rotation
4
2 4 1 3
3 5 8 1
2 9 4 6
6 4 2 8
6 2 3 2
4 9 5 4
```

```
2 4 8 1
8 6 1 3
```

Sample run #2:

```
$ gcc -Wall rotation.c -o rotation
$ ./rotation
2
5 9
4 1
4 5
1 9
```

1.4 SKELETON PROGRAM AND TEST DATA

The skeleton program is provided: **rotation.c**

Test input: **Input Files**

Test output: **Output Files**

1.5 IMPORTANT NOTES

- Write a function rotate() to rotate the matrix and a function print_matrix() to print the result.
- In writing functions, we would like you to include function prototypes before the main() function, and the function definitions after the main() function.
- This is a problem-solving task where we look for neat logic in your program. Using descriptive variable names, and adding appropriate comments will help the readers (and yourself) to understand the logic better.

1.6 ESTIMATED DEVELOPMENT TIME

The time here is an estimate of how much time we expect you to spend on this exercise. If you need to spend way more time than this, it is an indication that some help might be needed.

- Devising and writing the algorithm (pseudo-code): 15 minutes
- Checking/tracing the algorithm: 10 minutes
- Translating pseudo-code into code: 5 minutes
- Typing in the code: 5 minutes
- Testing and debugging: 5 minutes
- Total: 40 minutes

2 EXERCISE 2: PRINT THE CALENDAR

2.1 LEARNING OBJECTIVES

- Using repetition statements.
- Using 3 dimensional array
- Using special values to deal with special cases
- Printing in a given format
- Problem solving.

2.2 TASK STATEMENT

In this task, you are required to print the calendar of all the months in a randomly given year. Please refer to Lab 2 exercise 3 for the format of one month. But to make every month have the same size, we assume every month has eight lines. The first line is the name of the month, which is above "Wed". We use three-letter abbreviation to represent the names of the months. They are "JAN","FEB","MAR","APR","MAY","JUN","JUL","AUG","SEP","OCT","NOV","DEC" respectively. The second line is "Sun Mon Tue Wed Thu Fri Sat". Then follows the dates in that month. If the dates only occupy 4 lines, fill the

remaining two lines with blank spaces (see Figure 2.1). If the dates only occupy 5 lines, fill the remaining one line with blank spaces(see Figure 2.2). If the dates occupy all the 6 lines, fill the remaining part in last line with blank spaces (see Figure 2.3).

															F	E	B													
S	u	n			M	o	n			T	u	e			W	e	d			T	h	u			F	r	i			S	a	t
		1					2					3					4					5					6					7
		8					9				1	0				1	1				1	2				1	3			1	4
	1	5				1	6				1	7				1	8				1	9				2	0			2	1
	2	2				2	3				2	4				2	5				2	6				2	7			2	8

Figure 2.1

															A	P	R													
S	u	n			M	o	n			T	u	e			W	e	d			T	h	u			F	r	i			S	a	t
							1					2					3					4					5					6
		7					8					9				1	0				1	1				1	2			1	3
	1	4				1	5				1	6				1	7				1	8				1	9			2	0
	2	1				2	2				2	3				2	4				2	5				2	6			2	7
	2	8				2	9				3	0																			

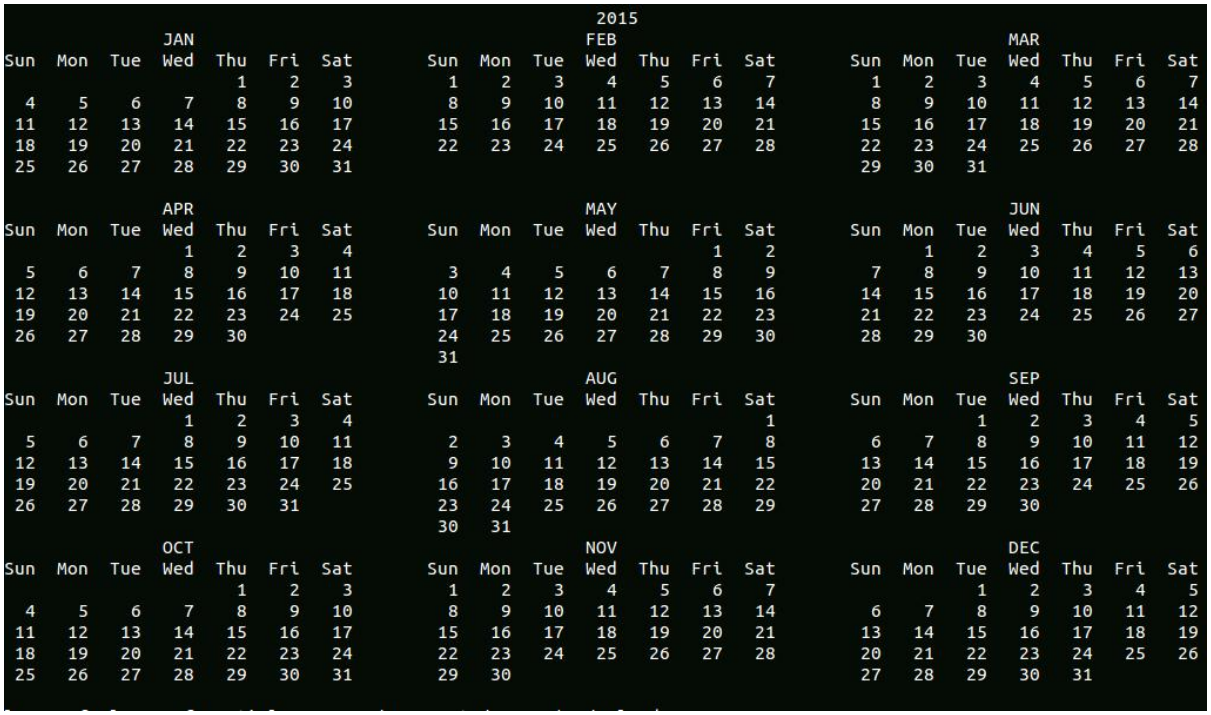
Figure 2.2

															J	A	N													
S	u	n			M	o	n			T	u	e			W	e	d			T	h	u			F	r	i			S	a	t
																															1
		2					3					4					5					6					7					8
		9				1	0				1	1				1	2				1	3				1	4			1	5
	1	6				1	7				1	8				1	9				2	0				2	1			2	2
	2	3				2	4				2	5				2	6				2	7				2	8			2	9
	3	0				3	1																								

Figure 2.3

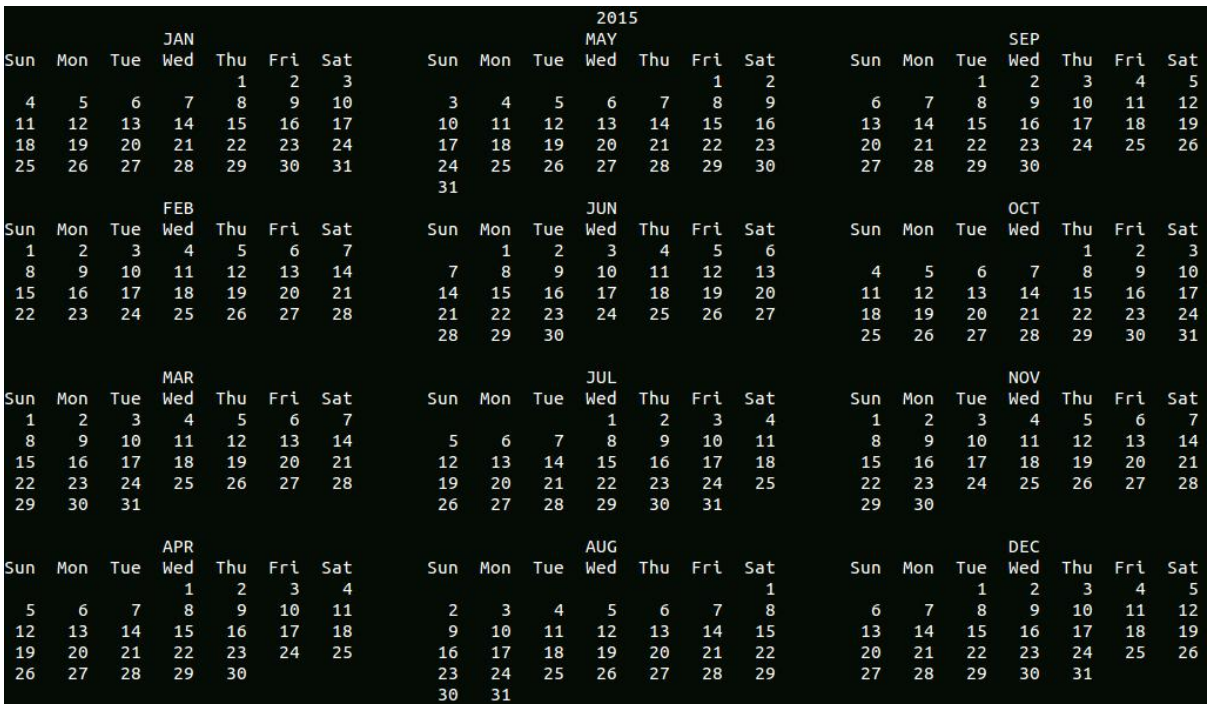
You are required to print the calendar in both horizontal and vertical format. For horizontal version, print JAN, FEB and MAR in the first row, and APR, MAY and

JUN in the second row, so on and so forth. Here is an example:



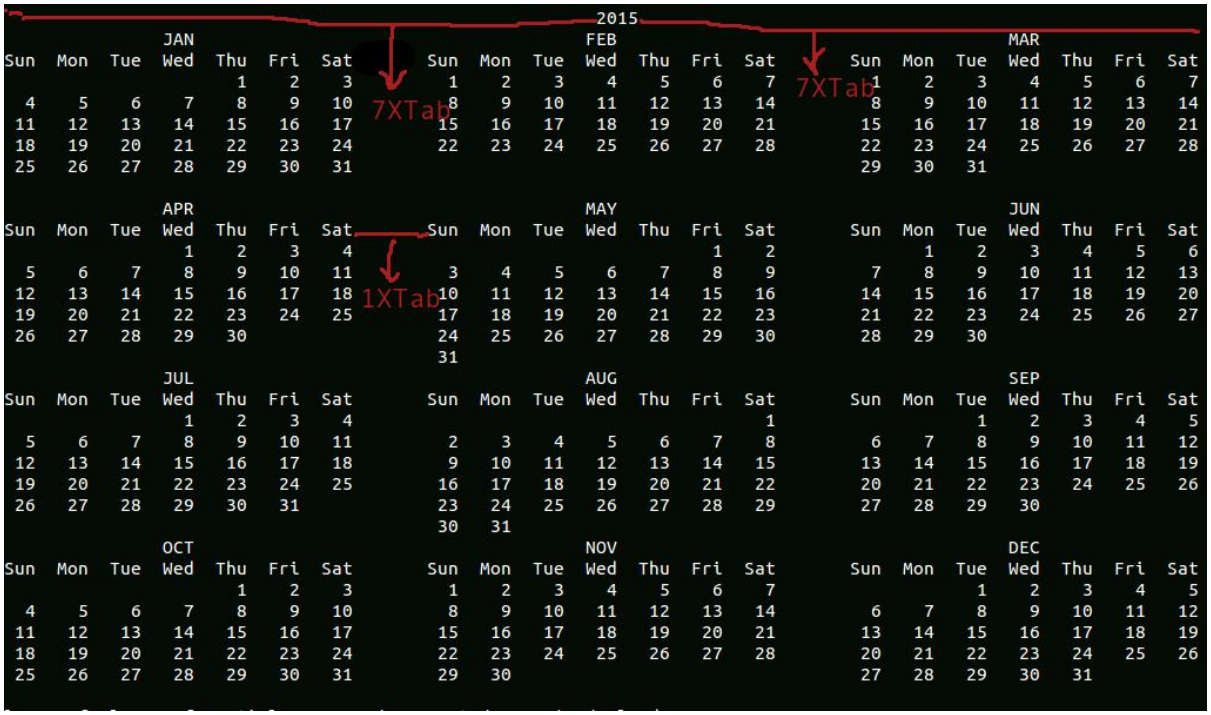
```
                                  2015

                JAN                             FEB                             MAR
Sun  Mon  Tue  Wed  Thu  Fri  Sat   Sun  Mon  Tue  Wed  Thu  Fri  Sat   Sun  Mon  Tue  Wed  Thu  Fri  Sat
                   1    2    3     1    2    3    4    5    6    7     1    2    3    4    5    6    7
  4    5    6    7    8    9   10     8    9   10   11   12   13   14     8    9   10   11   12   13   14
 11   12   13   14   15   16   17    15   16   17   18   19   20   21    15   16   17   18   19   20   21
 18   19   20   21   22   23   24    22   23   24   25   26   27   28    22   23   24   25   26   27   28
 25   26   27   28   29   30   31                                        29   30   31

                APR                             MAY                             JUN
Sun  Mon  Tue  Wed  Thu  Fri  Sat   Sun  Mon  Tue  Wed  Thu  Fri  Sat   Sun  Mon  Tue  Wed  Thu  Fri  Sat
                   1    2    3    4                             1    2          1    2    3    4    5    6
  5    6    7    8    9   10   11     3    4    5    6    7    8    9     7    8    9   10   11   12   13
 12   13   14   15   16   17   18    10   11   12   13   14   15   16    14   15   16   17   18   19   20
 19   20   21   22   23   24   25    17   18   19   20   21   22   23    21   22   23   24   25   26   27
 26   27   28   29   30             24   25   26   27   28   29   30    28   29   30
                                     31

                JUL                             AUG                             SEP
Sun  Mon  Tue  Wed  Thu  Fri  Sat   Sun  Mon  Tue  Wed  Thu  Fri  Sat   Sun  Mon  Tue  Wed  Thu  Fri  Sat
                   1    2    3    4                                  1                1    2    3    4    5
  5    6    7    8    9   10   11     2    3    4    5    6    7    8     6    7    8    9   10   11   12
 12   13   14   15   16   17   18     9   10   11   12   13   14   15    13   14   15   16   17   18   19
 19   20   21   22   23   24   25    16   17   18   19   20   21   22    20   21   22   23   24   25   26
 26   27   28   29   30   31         23   24   25   26   27   28   29    27   28   29   30
                                     30   31

                OCT                             NOV                             DEC
Sun  Mon  Tue  Wed  Thu  Fri  Sat   Sun  Mon  Tue  Wed  Thu  Fri  Sat   Sun  Mon  Tue  Wed  Thu  Fri  Sat
                        1    2    3     1    2    3    4    5    6    7                1    2    3    4    5
  4    5    6    7    8    9   10     8    9   10   11   12   13   14     6    7    8    9   10   11   12
 11   12   13   14   15   16   17    15   16   17   18   19   20   21    13   14   15   16   17   18   19
 18   19   20   21   22   23   24    22   23   24   25   26   27   28    20   21   22   23   24   25   26
 25   26   27   28   29   30   31    29   30                             27   28   29   30   31
```

For vertical version, print JAN, FEB, MAR and APR in the first column, and MAY, JUN, JUL and AUG in the second column, so on and so forth. Here is an example:



```
                                  2015

                JAN                             MAY                             SEP
Sun  Mon  Tue  Wed  Thu  Fri  Sat   Sun  Mon  Tue  Wed  Thu  Fri  Sat   Sun  Mon  Tue  Wed  Thu  Fri  Sat
                   1    2    3                                  1    2                1    2    3    4    5
  4    5    6    7    8    9   10     3    4    5    6    7    8    9     6    7    8    9   10   11   12
 11   12   13   14   15   16   17    10   11   12   13   14   15   16    13   14   15   16   17   18   19
 18   19   20   21   22   23   24    17   18   19   20   21   22   23    20   21   22   23   24   25   26
 25   26   27   28   29   30   31    24   25   26   27   28   29   30    27   28   29   30
                                     31

                FEB                             JUN                             OCT
Sun  Mon  Tue  Wed  Thu  Fri  Sat   Sun  Mon  Tue  Wed  Thu  Fri  Sat   Sun  Mon  Tue  Wed  Thu  Fri  Sat
  1    2    3    4    5    6    7          1    2    3    4    5    6                             1    2    3
  8    9   10   11   12   13   14     7    8    9   10   11   12   13     4    5    6    7    8    9   10
 15   16   17   18   19   20   21    14   15   16   17   18   19   20    11   12   13   14   15   16   17
 22   23   24   25   26   27   28    21   22   23   24   25   26   27    18   19   20   21   22   23   24
                                     28   29   30                       25   26   27   28   29   30   31

                MAR                             JUL                             NOV
Sun  Mon  Tue  Wed  Thu  Fri  Sat   Sun  Mon  Tue  Wed  Thu  Fri  Sat   Sun  Mon  Tue  Wed  Thu  Fri  Sat
  1    2    3    4    5    6    7                   1    2    3    4     1    2    3    4    5    6    7
  8    9   10   11   12   13   14     5    6    7    8    9   10   11     8    9   10   11   12   13   14
 15   16   17   18   19   20   21    12   13   14   15   16   17   18    15   16   17   18   19   20   21
 22   23   24   25   26   27   28    19   20   21   22   23   24   25    22   23   24   25   26   27   28
 29   30   31                       26   27   28   29   30   31         29   30

                APR                             AUG                             DEC
Sun  Mon  Tue  Wed  Thu  Fri  Sat   Sun  Mon  Tue  Wed  Thu  Fri  Sat   Sun  Mon  Tue  Wed  Thu  Fri  Sat
                   1    2    3    4                             1                1    2    3    4    5
  5    6    7    8    9   10   11     2    3    4    5    6    7    8     6    7    8    9   10   11   12
 12   13   14   15   16   17   18     9   10   11   12   13   14   15    13   14   15   16   17   18   19
 19   20   21   22   23   24   25    16   17   18   19   20   21   22    20   21   22   23   24   25   26
 26   27   28   29   30             23   24   25   26   27   28   29    27   28   29   30   31
                                     30   31
```

Between two months in the horizontal direction, there is a Tab to separate them. The first line is the year. There are seven Tabs in front of and behind the year. See following figure.



The first line of the input file is the year, follows printing method (in vertical or horizontal way). Input “vertical” or “horizontal” to choose the printing way.

Hint:

1. You may want to store all the months into a 3 dimensional array calendar[12][6][7]. calendar[0][0...5][0...6] stores the dates of January, calendar[1][0...5][0...6] stores the dates of February, so on and forth. And then print them.
2. You can use the functions in lab2 exercise3 to write the dates into arrays.
3. You are free to introduce additional functions if you deem it necessary. This must be supported by well-thought-out reasons, not a haphazard decision.
4. In writing functions, please put function prototypes before the main() function, and the function definitions after the main() function.

Remark: The easier way to solve this problem is to use a 3–d array. Actually it can also be solved using a 2–d array. Can you think of how to do that? (Hint: you can use an array of size 24x21 to store all the dates in the year, i.e., map the 3–d array calendar_3d[12][6][7] into the 2–d array calendar_2d[24][21]. and then change the index of the array so that you can set the dates in different month. For example, if you are using the horizontal way to print the month, the dates of June are stored in calendar_3d[5][0...5][0...6] and after being mapped into 2–d array, it becomes calendar_2d[6x1...6x1+5][7x2...7x2+6].)

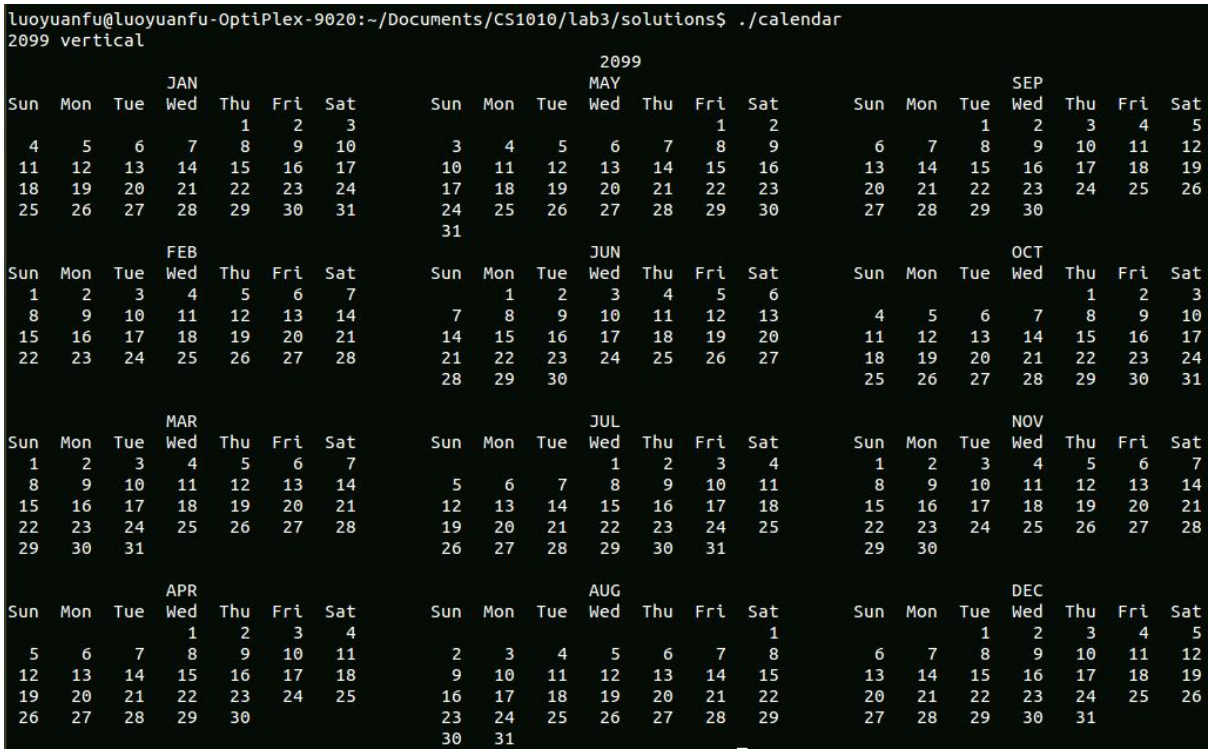
2.3 SAMPLE RUNS

Sample run using interactive input

Sample run #1:

```
luoyuanfu@luoyuanfu-OptiPlex-9020:~/Documents/CS1010/lab3/solutions$ ./calendar
1979 horizontal
                                                1979

                JAN                             FEB                             MAR
Sun  Mon  Tue  Wed  Thu  Fri  Sat       Sun  Mon  Tue  Wed  Thu  Fri  Sat       Sun  Mon  Tue  Wed  Thu  Fri  Sat
      1    2    3    4    5    6                             1    2    3                             1    2    3
  7    8    9   10   11   12   13         4    5    6    7    8    9   10         4    5    6    7    8    9   10
 14   15   16   17   18   19   20        11   12   13   14   15   16   17        11   12   13   14   15   16   17
 21   22   23   24   25   26   27        18   19   20   21   22   23   24        18   19   20   21   22   23   24
 28   29   30   31                      25   26   27   28                      25   26   27   28   29   30   31

                APR                             MAY                             JUN
Sun  Mon  Tue  Wed  Thu  Fri  Sat       Sun  Mon  Tue  Wed  Thu  Fri  Sat       Sun  Mon  Tue  Wed  Thu  Fri  Sat
  1    2    3    4    5    6    7                        1    2    3    4    5                             1    2
  8    9   10   11   12   13   14         6    7    8    9   10   11   12         3    4    5    6    7    8    9
 15   16   17   18   19   20   21        13   14   15   16   17   18   19        10   11   12   13   14   15   16
 22   23   24   25   26   27   28        20   21   22   23   24   25   26        17   18   19   20   21   22   23
 29   30                              27   28   29   30   31                      24   25   26   27   28   29   30

                JUL                             AUG                             SEP
Sun  Mon  Tue  Wed  Thu  Fri  Sat       Sun  Mon  Tue  Wed  Thu  Fri  Sat       Sun  Mon  Tue  Wed  Thu  Fri  Sat
  1    2    3    4    5    6    7                   1    2    3    4                                       1
  8    9   10   11   12   13   14         5    6    7    8    9   10   11         2    3    4    5    6    7    8
 15   16   17   18   19   20   21        12   13   14   15   16   17   18         9   10   11   12   13   14   15
 22   23   24   25   26   27   28        19   20   21   22   23   24   25        16   17   18   19   20   21   22
 29   30   31                        26   27   28   29   30   31              23   24   25   26   27   28   29
                                                                             30

                OCT                             NOV                             DEC
Sun  Mon  Tue  Wed  Thu  Fri  Sat       Sun  Mon  Tue  Wed  Thu  Fri  Sat       Sun  Mon  Tue  Wed  Thu  Fri  Sat
      1    2    3    4    5    6                        1    2    3                                       1
  7    8    9   10   11   12   13         4    5    6    7    8    9   10         2    3    4    5    6    7    8
 14   15   16   17   18   19   20        11   12   13   14   15   16   17         9   10   11   12   13   14   15
 21   22   23   24   25   26   27        18   19   20   21   22   23   24        16   17   18   19   20   21   22
 28   29   30   31                      25   26   27   28   29   30              23   24   25   26   27   28   29
                                                                             30   31
```

Sample run #2:



2.4 SKELETON PROGRAM AND TEST DATA

The skeleton program is provided here: **calendar.c**

Test input: **input files**

Test output: **output files**

2.5 ESTIMATED DEVELOPMENT TIME

The time here is an estimate of how much time we expect you to spend on this exercise. If you need to spend way more time than this, it is an indication that some help might be needed.

- Devising and writing the algorithm (pseudo-code): 80 minutes
- Translating pseudo-code into code: 50 minutes
- Testing and debugging: 50 minutes
- Total: 3 hours

3 DEADLINE

The deadline for submitting all programs is 9 Mar, 11:59pm, 2015. Late submission will NOT be accepted.