Autumn 2022, ISTM, Purdue-FCU 2+2 ECE Program
ISTM116 Programming Applications for Engineers, Midterm Exam

Use file name mexam_dxxxxxxx_1.c for Question 1, file name mexam_dxxxxxxx_2.c for Question 2, and file name mexam_dxxxxxxx_3.c for Question 3 of your source code， where dxxxxxxx is your student ID. When you finish a question, submit the source code files to the instructor's computer.

1. (30 points) You may start with program skeleton **mexam_skeleton_1.c** and change the file name to **mexam_dxxxxxxx_1.c**. An integer linear equation of n variables is:

$$a_1x_1+a_2x_2+...+a_nx_n=c.$$

Write a C program to (1) input the number of variables, n (1 to 10), of a linear equation, (2) input n integers of the coefficients and a constant term, (3) print the linear equation with the pretty printing format, i.e., not printing zero coefficient terms, not printing coefficient of value 1 or -1, and not printing "+" sign for a negative coefficient. Check invalid linear equation when there is no non-zero coefficient. (Hint: the n coefficients are stored in array coeff[n]. Repeat the steps until the value of n is 0.

Example of program execution:

```
D:\>mexam_1
Enter the number of coefficients (1 to 10): 3
Enter coeffcient a1: -1
Enter coeffcient a2: 2
Enter coeffcient a3: 3
Enter constant term: -8
The linear equation of 3 variables is:
    -X_1 + 2 X_2 + 3 X_3 = -8

---------------------------------
Enter the number of coefficients (1 to 10): 4
Enter coeffcient a1: 1
Enter coeffcient a2: 3
Enter coeffcient a3: 0
Enter coeffcient a4: -4
Enter constant term: 6
The linear equation of 4 variables is:
    X_1 + 3 X_2 - 4 X_4 = 6

---------------------------------
Enter the number of coefficients (1 to 10): 3
Enter coeffcient a1: 0
Enter coeffcient a2: -1
Enter coeffcient a3: 6
Enter constant term: 4
The linear equation of 3 variables is:
    -X_2 + 6 X_3 = 4

---------------------------------
Enter the number of coefficients (1 to 10): 2
Enter coeffcient a1: 0
Enter coeffcient a2: 0
Enter constant term: 0
The linear equation of 2 variables is:
**** Not a linear equation. No non-zero coefficients.

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Enter the number of coefficients (1 to 10): 0
```

(to be continued)

2. (35 points) You may start with program skeleton **mexam_skeleton_2.c** and change the file name to **mexam_dxxxxxxx_2.c**. Consider holidays in the United States of America. In a given *leap* year, Labor day (the first Monday in September) is September 6. Write a C program to compute and print the following days of that year:
   (a) Valentine's day, February 14,
   (b) Thanksgiving day, the forth Thursday in November.

   Examples of program execution:

```
D:\>mexam_2
Labor day of a given leap year: Monday, September 6

Valentine's day: Saturday, February 14
Thanksgiving day: Thursday, November 25
```

(to be continued)

3. (35 points) You may start with program skeleton **mexam_skeleton_3.c** and change the file name to **mexam_dxxxxxxx_3.c**. Write a C program to print a 2-digit octal multiplication table in vertical format such that the first operand is a two-digit octal number between 0_8 (0_{10}) and 77_8 (63_{10}) and the second operand is a two-digit non-zero octal number input from the console. Hence, you will to input the second operand first and then print the octal multiplication table in the vertical format as the execution example below:

```
D:\>mexam_3
Enter a two-digit non-zero octal number for the 2nd operand: 35
Two-digit Octal Multiplication Table in Vertical Format:

     0      1      2      3      4      5      6      7
  x 35   x 35   x 35   x 35   x 35   x 35   x 35   x 35
------ ------ ------ ------ ------ ------ ------ ------
     0     35     72    127    164    221    256    313

    10     11     12     13     14     15     16     17
  x 35   x 35   x 35   x 35   x 35   x 35   x 35   x 35
------ ------ ------ ------ ------ ------ ------ ------
   350    405    442    477    534    571    626    663

    20     21     22     23     24     25     26     27
  x 35   x 35   x 35   x 35   x 35   x 35   x 35   x 35
------ ------ ------ ------ ------ ------ ------ ------
   720    755   1012   1047   1104   1141   1176   1233

    30     31     32     33     34     35     36     37
  x 35   x 35   x 35   x 35   x 35   x 35   x 35   x 35
------ ------ ------ ------ ------ ------ ------ ------
  1270   1325   1362   1417   1454   1511   1546   1603

    40     41     42     43     44     45     46     47
  x 35   x 35   x 35   x 35   x 35   x 35   x 35   x 35
------ ------ ------ ------ ------ ------ ------ ------
  1640   1675   1732   1767   2024   2061   2116   2153

    50     51     52     53     54     55     56     57
  x 35   x 35   x 35   x 35   x 35   x 35   x 35   x 35
------ ------ ------ ------ ------ ------ ------ ------
  2210   2245   2302   2337   2374   2431   2466   2523

    60     61     62     63     64     65     66     67
  x 35   x 35   x 35   x 35   x 35   x 35   x 35   x 35
------ ------ ------ ------ ------ ------ ------ ------
  2560   2615   2652   2707   2744   3001   3036   3073

    70     71     72     73     74     75     76     77
  x 35   x 35   x 35   x 35   x 35   x 35   x 35   x 35
------ ------ ------ ------ ------ ------ ------ ------
  3130   3165   3222   3257   3314   3351   3406   3443
```