程式設計(一) - 作業 6

NCKU Program Design I Homework 6

The key focus of this Assignment

- array
- loops
- function
- random number generator

Before Start

- Don't attack any system otherwise you will fail this course.

- One instances of severe plagiarism, hiring someone to write assignments, or similar activities are detected, the semester's assignment scores will be calculated as 0 point across the board.

Before Start

- If you have any question about this homework tasks (ex. problem description), please feel free to contact me
- (資訊 115 陳俊安, f74114744@gs.ncku.edu.tw).

DeadLine: 11/2 00:00

- No Delay Submission ！ ！ ！

Submission

- Login the system by your personal account. (Use the ssh command)
- Create an directory with name “HW6” in your home directory.
- You can use the “pwd” command to confirm your current directory.
- The “mkdir [name]” command can create a directory with the name [name]
- In HW6 directory, you need to create 2 files with name “hw6.c”,”hw6_random.c”
- You need to compile your program by yourself, and create 2 executable files with the filenames “hw6”,”hw6_random”

Subtask & Grading

- Homework 6_General (hw6.c) (60 %)
  - Function 6-1: 15 %
  - Function 6-2: 15 %
  - Function 6-3: 15 %
  - Function 6-4: 15 %
- Homework 6_Random (hw6_random.c) (40 %)

Homework 6_General

- You need to write a program (hw6.c) that, at the beginning, will input a number from 1 to 4, indicating the function to be used.
  - Input 1 = Function Homework 6-1
  - Input 2 = Function Homework 6-2
  - Input 3 = Function Homework 6-3
  - Input 4 = Function Homework 6-4

Homework 6_General

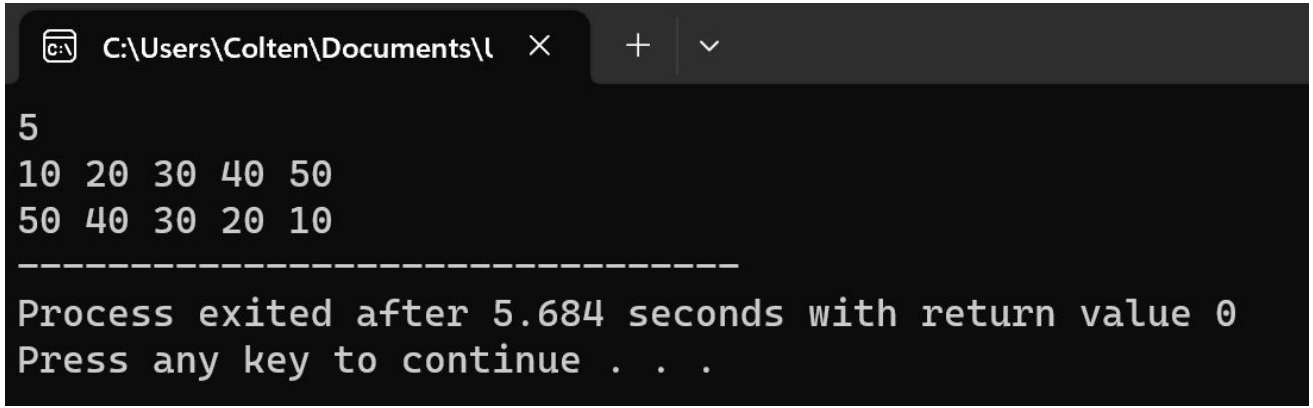
```
 3 int main()
 4 {
 5     int opt;
 6     scanf("%d",&opt);
 7
 8     if( opt == 1 )
 9     {
10         Homework6_1();
11     }
12     else if( opt == 2 )
13     {
14         Homework6_2();
15     }
16     else if( opt == 3 )
17     {
18         Homework6_3();
19     }
20     else
21     {
22         Homework6_4();
23     }
24 }
```

Homework 6-1 : Reverse the sequence

- Write a function to reverse a sequence.
- Input Format :
  - First Line: N (Length of sequence)
  - Second Line: a_1,...,a_N (sequence)
- Input Limits :
  - 1 <= N <= 2 * 10^5
  - 1 <= a_i <= 10^9

Homework 6-1 : Reverse the sequence

- Output Format :
  - [Number1] [Number2] … [Number N]

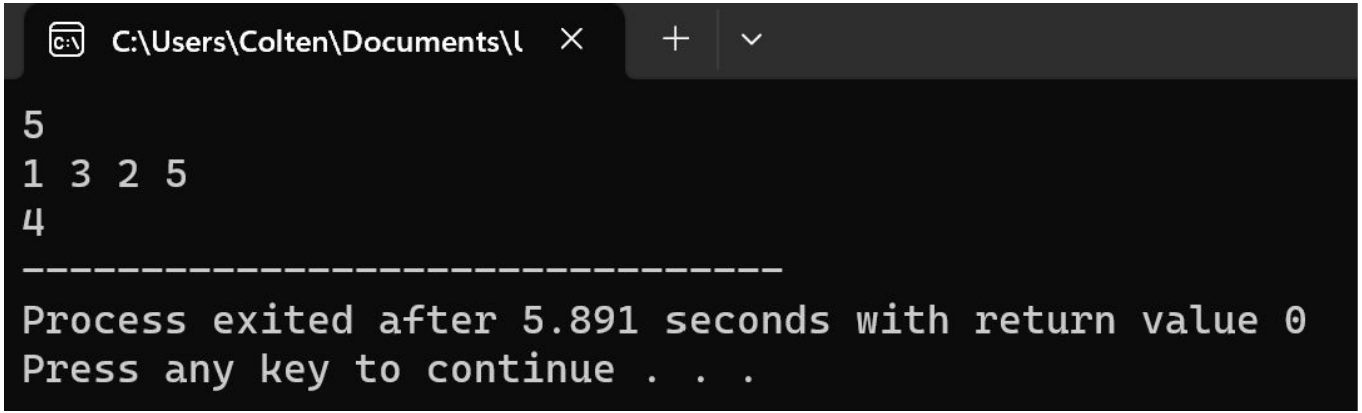


Homework 6-2 : Find the missing number

- A permutation missing a number please write a function to finding it.
- Input Format:
  - N
  - [Number 1] [Number 2] … [Number N-1]
- Input Limit:
  - 1 <= N <= 2 * 10^5 (Length of permutation)
  - permutation (1,2,3,4 … N)

Homework 6-2 : Find the missing number

- Output Format:
  - [Answer]



Homework 6-2 : Hints

- You can use array index to keep track of whether the number has appeared.
  - arr[i] = 1 -> appear
  - arr[i] = 0 -> disappear
  - {1,3,4,5} -> a[1] = 1, a[3] = 1, a[4] = 1, a[5] = 1
    - a[2] = 0, so answer is 2

Homework 6-3 : Range Queries of Sum

- Given a sequence and some queries that require two positive integers to find the sum of a given range.
- Input Format:
  - N (Length of sequence)
  - [Number 1] [Number 2] … [Number N]
  - Q (Query Times)
  - [query1_L] [query1_R]
  - …
  - [queryQ_L] [queryQ_R]

Homework 6-3 : Range Queries of Sum

- Sample Input:
  - 5
  - 1 2 3 4 5
  - 2
  - 1 5
  - 3 4
- Sample Output:
  - 15
  - 7

Homework 6-3 : Range Queries of Sum

- Time Limits: 1 second
  - Pay attention to time limit !!!!
  - Otherwise, you will got time limit exceed.
- Input Limit:
  - 1 <= N,Q <= 10^5
  - 1 <= [Number i] <= 10^9
  - 1 <= query-L <= query-R <= N

Homework 6-3：Hints

- 如果每一次查詢時都利用迴圈計算總合是一個非常沒有效率的方法
- Using a loop to calculate the sum for each query every time is a highly inefficient approach.
- 這其實是一個科普題，這題的技巧被叫做前綴和
- This is actually an educational question, and the technique for this question is called "prefix sum".

Homework 6-3：Hints

- 我們可以額外開一個陣列並定義：
- We can create an additional array and define it：
  - $b[i] = a[1] + \cdots + a[i]$
- Do this before querying the range sum.
- 在查詢區間和之前，先把這件事情做好

Homework 6-3：Hints

- [L , R] = a[L] + ⋯ + a[R]
- b[R] = a[1] + ⋯ + a[L-1] + a[L] ⋯ + a[R]
- b[L-1] = a[1] + ⋯ + a[L-1]
- b[R] - b[L-1] = a[L] + ⋯ + a[R]
- 如此一來每一次查詢你都不用再用迴圈計算任何東西，效率大提升！
- This way, you don't need to calculate anything with a loop for each query, which greatly improves efficiency!

Homework 6-3

Homework 6-4 : 2D-Array

- Define a grid of n * m dimensions, with the top-left corner at (1,1) and the bottom-right corner at (n,m).
- Please design a function to perform 5 swap operations after inputting the grid and output the results after the swaps.

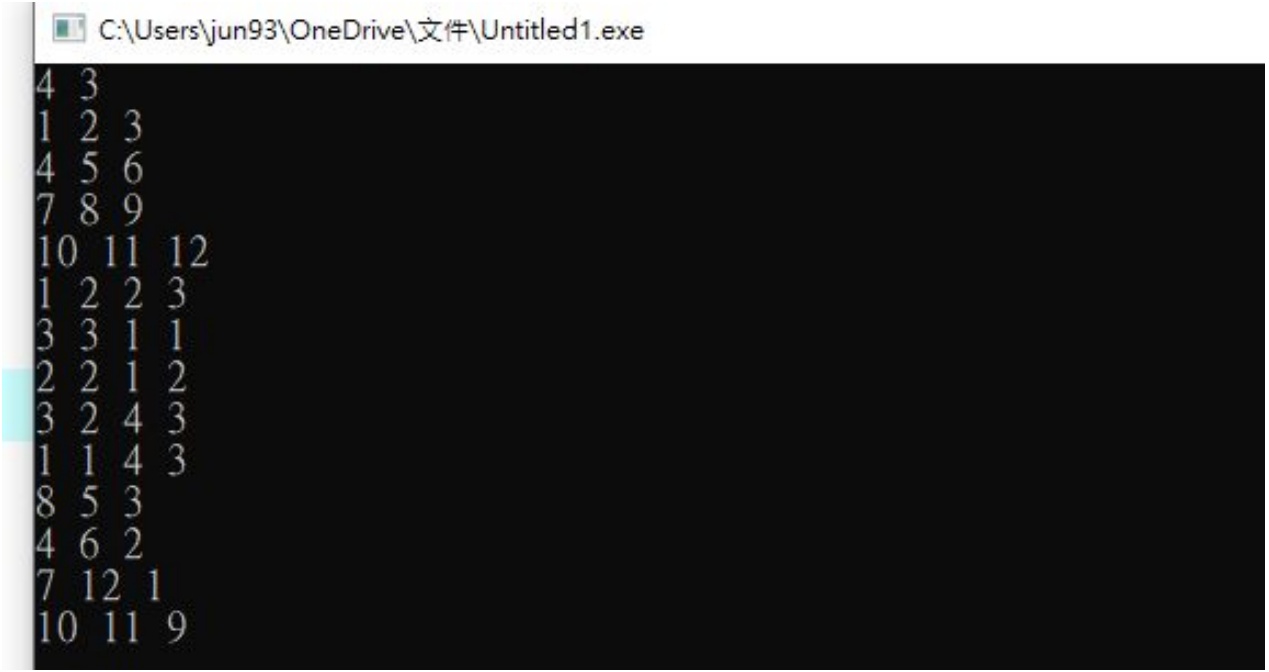
Homework 6-4 : 2D-Array

- Input Format:
  - n m
  - [number of (1,1)] … [number of (1,m)]
  - …
  - [number of (n,1)] … [number of (n,m)]
  - [swap1-X1] [swap1-Y1] [swap1-X2] [swap1-Y2]
  - …
  - [swap5-X1] [swap5-Y1] [swap5-X2] [swap5-Y2]

Homework 6-4 : 2D-Array

- Output Format:
  - [number of (1,1)] … [number of (1,m)]
  - …
  - [number of (n,1)] … [number of (n,m)]
- Input Limits:
  - 1 <= n,m <= 1000
  - 1 <= number of (X,Y) <= 1000
  - 1 <= swap-X <= n & 1 <= swap-Y <= m

Homework 6-4：2D-Array



Homework 6_Random (hw6_random.c)

- 這個版本的差別只在於所有輸入你要自己 random 產生出來
- The only difference in this version is that all inputs need to be generated randomly by yourself.
- 請將你 random 的測試資料先輸出，再輸出該測試資料的答案
- Please output the randomly generated test data first, and then output the answers for that test data.

Homework 6_Random (hw6_random.c)

- 特別注意到，一開始輸入的 Function 類型一樣是我們腳本輸入，你不需要 random 也不需要輸出這一個值
- Please take special note that the function type you input at the beginning is still entered by our script, and you don't need to randomize or output this value.

Homework 6_Random (hw6_random.c)

- 每一題 Random 的 Input Limit 必須遵守
- The input limits for each randomly generated question must be adhered to.
- 額外給予一些 Random 的特殊限制：
- Provide some additional random special restrictions:
  - Homework 6-1：N >= 5000
  - Homework 6-2：N >= 5000
  - Homework 6-3：N,Q >= 50000
  - Homework 6-4：N >= 500 & M >= 500

Homework 6_Random Example

- Input :
  - 1 ← Our input , no random & output
- Output :
  - 5123 ← Your random number of N
  - [Number_Random 1] … [Number_Random 5123] ← Your random number of sequence
  - [Reverse Value 1] … [Reverse Value 5123] ← Answer

Homework 6_Random Example

- Input :
  - 2 ← Our input , no random & output
- Output :
  - 8150 ← Your random number of N
  - [Number_Random 1] … [Number_Random 8149] ← Your random number of sequence
  - [Missing Number] ← Answer

Homework 6_Random

- 我們腳本會重複跑好幾次檢查你的程式有沒有確實的 random
- Our script will run several times to check whether your program is genuinely random.
- 懶人包：
  - Random 的版本我們只會輸入一個數字 (1~4)
  - 剩下的東西你要自己 random
  - 先輸出你 random 的東西，再輸出如果把你的 random 當輸入時的答案