

Lab 12/04

1. Fibonacci number matrix

Fibonacci number can be generated by power of matrix $\begin{bmatrix} a_{11} & a_{12} \\ a_{21} & a_{22} \end{bmatrix} = \begin{bmatrix} 1 & 1 \\ 1 & 0 \end{bmatrix}^n$. For example,

$\begin{bmatrix} a_{11} & a_{12} \\ a_{21} & a_{22} \end{bmatrix} = \begin{bmatrix} 1 & 1 \\ 1 & 0 \end{bmatrix}^3 = \begin{bmatrix} 1 & 1 \\ 1 & 0 \end{bmatrix} \begin{bmatrix} 1 & 1 \\ 1 & 0 \end{bmatrix} \begin{bmatrix} 1 & 1 \\ 1 & 0 \end{bmatrix} = \begin{bmatrix} 2 & 1 \\ 1 & 1 \end{bmatrix} \begin{bmatrix} 1 & 1 \\ 1 & 0 \end{bmatrix} = \begin{bmatrix} 3 & 2 \\ 2 & 1 \end{bmatrix}$, the series of element a_{12} with $n=3$ are Fibonacci series 1 1 2.

Please define the function of matrix multiplication and calculate Fibonacci series with length $(n+1)$.

You can't use other variables in the main function or define other functions, and you must follow the prototype of function void mul(...).

```
#include<stdio.h>

void mul(int *a11,int *a12,int *a21,int *a22,int w11,int w12,int w21,int w22);

int main()
{
    int n;
    while(scanf("%d",&n)) {
        int a11=1,a12=1,a21=1,a22=0;
        for(int i=0;i<n;i++){
            printf("%d ",a12);
            mul(...,1,1,1,0);
        }
        printf("%d",a12);
    }
    return 0;
}
```

```
10
1 1 2 3 5 8 13 21 34 55 89
```

2. Encoder

Please write a function with prototype “void encoder(int *x, int N, int bias)” to process the encoding rule showed as following.

Step 1. Right shift the code x

Right shift the code x N times, and the overflow digit will be put to the front.

Example: 12345 right shifts 102 digits → 45123

Step 2. Add the bias

Add the bias to the code x.

Example: 45123+99999 → 145122

Step 3. Truncate the extra digits

If the length of result is longer than original length, the extra digits will be truncated.

Example: 145122 → 45122

The input is consisted of three integers, which represent code x, shift digits, and bias. And the program should be stop until the input is ^D.

```
12345 102 99999
45122
```

3. Coffee maker

Please implement a coffee maker program. It has two actions, add ingredients and make coffee. To make coffee, user will choose one kind of coffee and coffee maker will make that kind of coffee as much as possible. When coffee maker can not make any coffee, coffee maker will inform user.

There are three kind of coffee, following is their ratio. The volume of output coffee is **integer** and the amount of ingredients must **follow the ratio completely**.

flavor	composition ratio (espresso : milk : chocolate : froth)
latte	3 : 3 : 0 : 4
cappuccino	7 : 3 : 0 : 5
mocha	3 : 1 : 1 : 0

User can also make coffee by user defined ratio.

You should implement and use all the following functions to complete your program.

Function Prototype	Description
void show(int espresso, int milk, int chocolate, int froth)	Show current volume of four kinds of ingredients.
void add(int *espresso, int *milk, int *chocolate, int *froth, int supply_espresso, int supply_milk, int supply_chocolate, int supply_froth)	Add ingredients to coffee maker.

<pre>bool make(int *espresso, int *milk, int *chocolate, int *froth, int r0 ,int r1 ,int r2 ,int r3 ,int *output)</pre>	<p>Make coffee according to required ratio.</p> <p>This function should consume ingredients and output the volume of coffee. Return value is true when ingredients are enough, otherwise it is false.</p>
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Example

Select Add ingredient and input 100 100 100 100

```
Espresso:0
Milk:0
Chocolate:0
froth:0
1. Add ingredient
2. Make coffee
1
Input increased volume<in order of espresso, milk, chocolate, froth>
100 100 100 100
Continue?(y/n)y
```

Select Make coffee and select Latte

```
Espresso:100
Milk:100
Chocolate:100
froth:100
1. Add ingredient
2. Make coffee
2
1. Latte
2. Cappuccino
3. Mocha
4. User define
1
Congratulations! You make 250 ml Latte
Continue?(y/n)y
```

Select Make coffee and make user defined coffee by ratio 3, 3, 3, 0

```
Espresso:25
Milk:25
Chocolate:100
froth:0
1. Add ingredient
2. Make coffee
2
1. Latte
2. Cappuccino
3. Mocha
4. User define
4
Input ratio<in order of espresso, milk, chocolate, froth>
3 3 3 0
Congratulations! You make 75 ml user defined coffee
Continue?(y/n)y
```

Select Add ingredient and input 1 0 0 0

```
Espresso:0
Milk:0
Chocolate:75
froth:0
1. Add ingredient
2. Make coffee
1
Input increased volume(in order of espresso, milk, chocolate, froth)
1 0 0 0
Continue?(y/n)y
```

Select Make coffee and select Latte

```
Espresso:1
Milk:0
Chocolate:75
froth:0
1. Add ingredient
2. Make coffee
2
1. Latte
2. Cappuccino
3. Mocha
4. User define
1
Ingredients are not enough
Continue?(y/n)y
```

Select Make coffee and make user defined coffee by ratio 2, 0, 1, 0

```
Espresso:1
Milk:0
Chocolate:75
froth:0
1. Add ingredient
2. Make coffee
2
1. Latte
2. Cappuccino
3. Mocha
4. User define
4
Input ratio(in order of espresso, milk, chocolate, froth)
2 0 1 0
Ingredients are not enough
Continue?(y/n)n
```

You can use `system("cls")` to clear window. (include `<stdlib.h>`)