例子:內置函數

```
printf ("性別(m/f): ");
scanf ("%c", &gender);
gender = toupper (gender);
```

```
gender = toupper (getche());
```

```
printf ("輸入 a&b: ");
scanf ("%i%i", &a, &b);
diff = abs (a-b);
```

```
c = sqrt (a*a+b*b);
x = ceil (c);
y = floor (c);
```

sin (…)
cos (…)
tan (…)
pow (…)
rand (…)

子程式(subprogram)

```
#include <stdio.h>
int min (int p, int q){
        if
        return _____
}
main(){
        int a,b,c,d, x,y,n;    1   3   4   2
        scanf ("%i%i%i%i", &a, &b, &c, &d);

        if(a<b) x=a;  else x=b;
        if(c<d) y=c;  else y=d;
        if(x<y) n=x;  else n=y;

        // 最理想
        x = min(a,b);
        y = min(c,d);
        n = min(x,y);

        printf ("Minimum 最小 = %i\n", n);
}
```

子程式(subprogram)

```c
#include <stdio.h>
int min (int p, int q){
        if(p<q) return p; else return q;
}
```

```c
main(){
        int a,b,c,d, m,n;      1   3   4   2
        scanf ("%i%i%i%i", &a, &b, &c, &d);

        n = min( min(a,b), min(c,d) );
        printf ("Minimum (小) = %i\n", n);

        m = −min( min(−a,−b), min(−c,−d) );
        printf ("Maximum (大) = %i\n", m);
}
```

子程式(subprogram)

3

Tasks 完成以下子程式:
01. 辨別某年 (yy) 是否閏年 leap year

yy 是閏年，只要 yy
  (a) 可被400整除 或
  (b) 可被4整除，但不可被100整除

例: 400, 2000 ☑
例: 1900 ☒

```c
int leapYear (int yy){
        if ( _____
        _____ ) return 1;
        else return 0;
}
```

```c
main(){
        int isLeapYear=1, year=2000;
        isLeapYear = leapYear(1995);       // returns 0
        scanf("%i", &year);
        if (leapYear(year)==1)
                printf ("閏年 leap year\n");
}
```

子程式(subprogram)

4

02. factorial(n)   (n! = 1x2x3x4x..xn) 積
03. sumN(n)   (ie. 1+2+3+4+..+n) 和
04. sumN²(n)   (ie. 1²+2²+3²+4²+..+n²) 平方和

```
float factorial (int n){          int sumN (int n){          int sumN2 (int n){
        float x;                          int x=0;                    int x;
 ??     for (...) ...                      for (...) ...          ??    for (...) ...
        return x;                         return x;                  return x;
}                                 }                          }
```

for (i=1; i<=n; i++)
_____;

```
main(){
        x = factorial(5);        // 1x2x3x4x5 = 120
        y = sumN(10);            // 1+2+3+4+..+10 = 55
        z = sumN2(5);           // 1²+2²+3²+4²+5² = 55
}
```

子程式(subprogram)   5

---

05. 利用半徑radius 計算圓形circle 面積area及周界circumference
06. 計算 power (x,n) x^n

```
#include <stdio.h>                     float circumference (float r){
const float PI = 3.14;                         return _____;
                                       }
float circleArea (float r){
        return _____;             int power (int x, int n){
}                                              for(...) p = ...
                                               return p;
                                       }

main(){
        float area, circum;
        area = circleArea(10);              // 面積 a = πr²
        circum = circumference(10);         // 圓周 c = 2πr
        n = power(2,3);                     // 2³ = 2x2x2 = 8
        n = power(3,4);                     // 3⁴ = 3x3x3x3 = 81
}
```

子程式(subprogram)   6

```
char downcase (char c){           char upcase (char c){
    if(c>='A' && c<='Z')              if(c>='a' && c<='z')
        return c+32;                      return _____;
    else                              else
        return c;                         return _____;
}                                 }
```

```
main(){
    char s[10]="chan", ch;
    ch=downcase('A');        // → 'a'
    ch=downcase('a');        // → 'a'
    ch=downcase('1');        // → '1'
    s[0]=upcase(s[0]);       // s[0] = toupper(s[0]);
    s[1]=upcase(s[1]);       // s[1] = toupper(s[1]);
}
```

子程式(subprogram)   7

10. to display on VDU a menu of 5 items: 顯示選單
    Add 增新, Delete 刪除, Search 找尋, Modify 修改, Quit 離開

```
                                void displayMenu(){
                                    printf ("增新 Add      \n");
                                    printf ("刪除 Delete   \n");
                                    printf ("找尋 Search   \n");
                                    printf ("修改 Modify   \n");
                                    printf ("離開 Quit      \n");
                                }

while(1){
    displayMenu();
    option = getche();   // scanf("%c",&option);
    switch(option){
        'A': addNewRecord(); break;
        'D': deleteRecord();   break;
        ...
    }
}
```

option = displayMenu();   ??

子程式(subprogram)   8

11. 顯示訊息(message) 並要求使用者 回答 'Y' 或 'N'

執行畫面:
Student <Y/N>?　　Y
Continue <Y/N>?　　N

```c
char confirm (char msg[]){
        char c;
        do{




        }while (                    );
        return c;

}
```

```c
main(){
        do{
                ...
                ans = confirm ("Student");
                ...
        }while (confirm ("Continue") == 'Y');
}
```

子程式(subprogram)　　　　　　　　　　　　9

執行畫面:
Understand <Y/N>? X
Error
Understand <Y/N>? y
...

```c
int  confirm(char msg[])       // 1,0
```

```c
main(){
        if(confirm("Understand?")==1)...
}
```

```c
char confirm(char msg[])     // 'Y','N'
```

```c
main(){
        if(confirm("Understand?")=='Y')...
        if(confirm("Accept")=='Y')...
        if(confirm("Another game")=='Y')...
        if(confirm("Try again")=='Y')...
        if(confirm("Another card")=='Y')...
}
```

子程式(subprogram)　　　　　　　　　　　　10

12. 要求使用者 輸入分數 score 直至分數在指定範圍為止

執行畫面:
         Enter score (0-200):   900
         Error - out of range!
         Enter score (0-200):   120

```
int getScore (int min, int max){
        int n;
        do{




        }while (                    );
        return n;
}
```

```
main(){
        mark = getScore (0,200);
        if ((mark = getScore (0,100) >=50)) ...;
}
```

子程式(subprogram)   11

("星期",0,6)

```
int getNum (char msg[], int x, int y){
        int n;
        do{

             printf ("%s (%i-%i) ",
             scanf ("%i",
             if (                ) printf("Error\n");

        }while (_____);
        return n;
}
```

```
dow     = getNum("星期",0,6);
mm      = getNum("月份",1,12);
mark    = getNum("分數",0,100);
age     = getNum("年齡",1,90);
hour    = getNum("時間",0,23);
```

子程式(subprogram)   12

```
char stud, cont;              // "Y" for Yes; "N" for No
int timeIn, age, dow;         // day of the week (0-6)
float fee;
main(){
        do{
                printf("\n<<< Country Park >>>\n");
```

getnum(...)

confirm(...)

```
                printf("Q: Day of the week (0-6) ? ");    scanf("%d",&dow);
                printf("       Time in (10-18) ? ");       scanf("%d",&timeIn);
                printf("          Student (Y/N) ? ");      scanf("%c",&stud);
                printf("             Age (1-99) ? ");      scanf("%d",&age);

                fee = calculateFee (dow, timeIn, age, stud);
                printf("A: Admission fee is HK$%.1f\n", fee);
                printf("Continue? "); scanf("%c", &cont);
        }while (cont=='Y');
}
```

```
fee = 100;
if(dow==__ || dow==__) fee = fee*1.1;
else if(timeIn_____) fee = fee*0.9;

if(age_____) fee = fee/2; else
if(age_____ || stud=='Y'){
        if (dow_____ && dow_____) fee = fee/2;
        else fee = fee*0.8;
}
```

子程式(subprogram)

13

---

13. 轉溫度 °C → °F

$$f = \frac{9}{5}c + 32$$

14. 轉溫度 °F → °C

$$c = \frac{5}{9}(f - 32)$$

```
float ctof (float c){
        return (_____);
}

float ftoc (float f){
        return (_____);
}
```

```
main(){
        c = ftoc(32);         // c = 0.00
        c = ftoc(98.6);       // c = 37.00
        f = ctof(37);         // f = 98.60
        f = ctof(100);        // f = 212.00
}
```

子程式(subprogram)

14

例一:　　　　　　　　　　　　　例二:

Enter choice (X-Z): A　　　　　Enter choice (0-5): 6
Error - out of range !　　　　　Error - out of range !
Enter choice (X-Z): X　　　　　Enter choice (0-5): 3

'X'　　　'Z'

```
char getChoice (char frCh, char toCh){
    char c;
    do{



    }while (                    );
    return c;

}
        main(){
            choice = getChoice ('X','Z');
            choice = getChoice ('0','5');
        }
```

子程式(subprogram)   15

宣告	儲存值 content	地址 pointer 指標
int a=3, b;	a=3, b=5	&a, &b
int *x, *y;	*x=11, *y=20	x, y
char c;	c='*'	&c
char name[10];	name[0], ...	name
char *s; char s[];	*s	s

地址	儲存格	
1000 (&a)	3	a=3;
1002 (&b)	5	b=5;
1004 (x)	11	*x=11;
1006 (y)	20	*y=20;
1100 (name)	C	name[0]='C';
name+1	H	name[1]='H';
name+2	A	name[2]='A';

子程式(subprogram)   16

數值(a,b)　　　　　地址pointers(a,b)

```
void swap (int a, int b){
        int c;
        c = a;
        a = b;
        b = c;              沒有return
}
```

```
void swap (int *a, int *b){
        int c;
         c = *a;
        *a = *b;
        *b = c;
}
```

```
main(){
        int x=3, y=4;
        swap (_____ ,_____);
        printf ("x=%i\t", x);
        printf ("y=%i\n", y);
}
```

```
main(){
        int x=3, y=4;
        swap (_____ ,_____);
        printf ("x=%i\t", x);
        printf ("y=%i\n", y);
}
```

x=3 y=4 (沒有變)　　　　　x=4 y=3 (交換了)

子程式(subprogram)　　　　　　　　　　　　　　　17

Money Notes:

index	0	1	2	3	4	5	6	7	8
note[]	1000	500	100	50	20	10	5	2	1
freq[]	0	0	0	0	0	0	0	0	0

```
#define MAX 9
int note[MAX] = {1000,500,100, 50,20,10, 5,2,1};
int freq[MAX] = {0};
```

```
void change (int amt){
        int i=0;
        for(                    ){
                n = amt/____
                if...
        }
}
```

```
main(){
        int amount=1234, i;
        change (amount);
}
```

子程式(subprogram)　　　　　　　　　　　　　　　18

index	0	1	2	3	4	5	6	7	8	9	10	11	12
arab[]	1000	900	500	400	100	90	50	40	10	9	5	4	1
roman[]	M	CM	D	CD	C	XC	L	XL	X	IX	V	IV	I

```
#define MAX 13
int arab[] = {1000,900,500,400, 100,90,50,40, 10,9,5,4,1};
char roman[MAX][3] =
{"M","CM","D","CD","C","XC","L","XL", "X","IX","V","IV","I"};


void num2roman (int num, char romanStr[ ])
```

例一：num2roman (23, romanStr);　　// 傳回至romanStr："XXIII"
例二：num2roman (444, romanStr);　　// 傳回至romanStr："CDXLIV"
假設：阿拉伯數字不大於10,000

子程式(subprogram)

地址pointers(romanStr[ ])

```
void num2roman (int num, char romanStr[ ]){
        int i=0;
        romanStr[0] = '\0';
        while (num>0){
                if (                          )


        }
}
```

```
main(){
        num2roman ( 23, romanStr);        // 傳回"XXIII"
        puts (romanStr);
        num2roman (444, romanStr);        // 傳回"CDXLIV"
        // 假設：阿拉伯數字不大於10,000
}
```

子程式(subprogram)

```
#include <stdio.h>     0        1        2
char titleArr[3][4]={"Mr", "Ms", "Mrs"};
```

```
int title (char gender, char mstatus){
        …

        return 0;        // Mr
}
```

```
main(){
        n= title('M','S');        // 0: male, single
        n= title('M','M');        // 0: male, married
        printf("%s \n", titleArr[n]);

        n= title('F','S');        // 1: female, single
        n= title('F','M');        // 2: female, married
}
```

子程式(subprogram)   21

```
main(){
        int n; char sign='+';
        n=10; sign = signOf(n);              // '+'
        printf("%c%i\n", sign, abs(n));       // +10

        n=-10; sign = signOf(n);             // '–'
        printf("%c%i\n", sign, abs(n));       // –10

        printf("%+d\n", 10);          // +10
        printf("%+d\n", -10);         // –10

        // 利用signOf() 改寫下列隨機數 (a+b)(c+d)
        for (i=0; i<20; i++){
                a = rand()%20-10;
                b = rand…; c = rand…; d = rand…;
                printf ("(%i+%i)(%i+%i)\n", a,b,c,d);
        }
}
```

```
printf("%+d",n);
```

子程式(subprogram)   22

```c
#include <stdio.h>
char grade[40];
int score[40]={70,…};
```

```c
void drawline (char c, int n){
        int i;
        for (i=0; i< n ; i++)
                printf ("%c", c);
        printf("\n");
}
```

```c
char score2grade (int n){
        if (n<30)
                return 'F';



}
main(){
        drawline ('-', 40);
        drawline ('*', 20);
        for (i=0; i<40; i++)
                grade[i] = score2grade (score[i]);
}
```

A	80+
B	70+
C	60+
D	50+
E	30+
F	00+

子程式(subprogram)

◎ 月尾日數

```c
int maxdays (int yy, int mm){        // no array
        int n=31;
        switch (mm){




        }
        return n;
}
```

1月	31
2月	28或29
4月	
6月	
9月	
11月	30

```c
n = maxdays(2000,2);        // n=29
```

子程式(subprogram)

$$area = \sqrt{s(s-a)(s-b)(s-c)}$$

$$s = \frac{a+b+c}{2}$$

```
float areaOfTriangle (int a, int b, int c){
        float s=…
        return …
}
```

```
main(){
        float area, s1=3,s2=4,s3=5;
        area = areaOfTriangle (s1,s2,s3);

        printf ("三角形邊長 = %.1f, %.1f, %.1f \n", s1,s2,s3);
        printf ("面積 = %.1f\n", area);
}
```

子程式(subprogram)   25

```
// x=135, return 3
int ndigits (int x){
        int n=0;

        while (x>0){
                ___
                ___
        }
        return n;
}
```

```
// x=135, return 9
int digitSum (int x){
        int sum=0;

        while (___){
                ___
                ___
        }
        return sum;
}
```

```
main(){
        n = ndigits(1234);            // 4
        n = ndigits(2345678);         // 7

        n = digitSum(1234);           // 10
        n = digitSum(13579);          // 25
}
```

子程式(subprogram)   26

```
int nthdigit (int x, int n){
        char s[10];



        return
}
```

```
int digitOf (int x, int n){
        if (x<n) return -1;
        return (_____);
}
```

```
main(){
        n = nthdigit (13579,2);      // 3
        n = nthdigit (13579,99);     // -1

        n = digitOf (13579,100);     // 5
        n = digitOf (135,10000);     // -1
}
```

子程式(subprogram)

聘請保安員條件 (security guard)

犯罪紀錄	性別	年齡	身高	工作經驗
0	男	18–30歲	≥1.70m	
		31–45歲	≥1.65m	≥3年

```
int criminalRecord=0, age=18, yrOfExperience=0;
float ht=1.70;
int ok=1;
```

```
if ( (犯罪紀錄==____) && (性別==_____) &&
     (    ( (年齡>=__) && (年齡<=__) && (身高>=____) )  ||
          ( (年齡>30) && (年齡<=45) && (身高>=1.65)
                              && (工作經驗_____) )          )
   ) 合資格=1;
else 合資格=0;
```

子程式(subprogram)

聘請保安員條件 (security guard)

```
int eligible (int criminalRec, char gender,
                  int age, float ht, int yr){      // 合資格?


    if



    if



    return 0;
}
```

```
main(){
     ok = eligible (3, 'M', 25, 1.6, 0);
     ok = eligible (0, 'F', 25, 1.7, 0);
     ok = eligible (0, 'M', 35, 1.65, 0);
}
```

子程式(subprogram)

Rotate Left

	[0]	[1]	[2]	[3]	[4]	[5]	[6]
box[i]	55	60	65	70	75	80	50

```
for(i=0;i<_____;i++)
        box[_____]=box[_____];
```

box[0]=box[___];
box[1]=box[___];
box[2]=box[___];
…

Rotate Rigft

	[0]	[1]	[2]	[3]	[4]	[5]	[6]
box[i]	80	50	55	60	65	70	75

```
for(i=_____; i_____; i_____)
        box[_____]=box[_____];
```

box[6]=box[___];
box[5]=box[___];
box[4]=box[___];
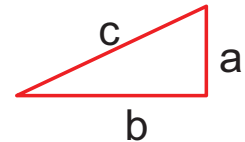…

子程式(subprogram)

$$Ax^2 + Bx + C = 0$$

```
int discriminant (int a, int b, int c){
        return           // d=b²−4ac
}
```

$$r = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

```
float hypotenuse (int a, int b){        // 斜邊c
        return
}
```

```
int isTriangle (int a, int b, int c){
        if (_____&&_____&&_____)
                return 1;
        else
                return 0;
}
```

子程式(subprogram)

```
int reverseNum (int n){        // 12345 -> 54321
        int x=0;
        while (n        ){
                x =
                n =
        }
        return x;
}
```

```
n = 12345;
r = reverseNum(n);
```

```
int random (                    ){
        return
}
```

```
n = random(1,10);
```

int category (float l, float w, float h, int wt)
KCR luggage ???

int bmiGroup (int bmi, char gender)

子程式(subprogram)

```
int isprime (int n){    // n是否質數
        int i;
        for
                if (            ) return 0;
        return 1;
}
```

n = isprime(13);

```
int rootOfQuadEqn (int a, int b, int c){
        int d=          ;
        if (          ) return 0;
        else if (        ) return 1;
        else return 2;
}
```

$$r = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

n = parity("1011",1);

```
int parity (char s[], int par){  // even/odd
        int i, sum=0;
        for (i=0; _____ )
                if (_____ ) sum++;
        return _____ ;
}
```

parity	sum	return
even(0)	0	
even(0)	1	
odd(1)	0	
odd(1)	1	

子程 33

```
char checkDigit (char idno[]){
        int sum=…
        … ()*8 +()*7 +()*6 +…

        return …               // 0-9,A
}
```

d = checkDigit("A123456");   // '3'

```
int isSqNum (int n){           // 1,4,9,16,…
        if(               ) return …;
        return …;
}
```

$$n > \left(\sqrt{n}\right)^2$$

n = isSqNum(5);   // 0
n = isSqNum(25);   // 1

子程式(subprogram)   34

試寫子程式 getChar()，讓使用者輸入字符char

```c
char getChar (char msg[ ], char options[ ]){
        char ans; int ok=0;
        do{
                printf
                ans =
                ok =


        }while(ok==0);
        return ans;
}
```

```c
main(){
        gender = getChar ("性別", "MF");
        size   = getChar ("Size", "LMS");
        grade  = getChar ("等級", "ABCDEFU");
        dir    = getChar ("方向", "ESWN");
}
```

子程式(subprogram)

35

Fibonacci Sequence

a+b=c

```c
void fibonacci (int n){
        int i, a=0,b=1,c=1;
        for (i=0; i<n; i++){
                c =
                printf ("        \t",     );
                a =
                b =
        }
        printf ("\n");
}
```

```
a b c
1 1 2 3 5 8 13 ...
  a b c
    a b c
```

```c
main(){
        fibonacci(5);           // 1,1,2,3,5
        fibonacci(10);          // 1,1,2,3,5,8,13,21,34,55
}
```

子程式(subprogram)

36

HCF/GCD & LCM

```
int gcd (int a, int b){
        int r=1;
        while(          ){
                r =
                a =
                b =
        }
        return b;
}
```

a	b	r=a%b
25	20	5
20	5	0

a	b	r=a%b
12	20	12
20	12	8
12	8	4
8	4	0

```
main(){
        int x=25,y=20,hcf,lcm;
        printf ("HCF=%i\n", gcd(x,y));
        lcm = x*y /gcd(x,y);
        hcf = gcd( gcd(36,100), 144);
}
```

子程式(subprogram)

試寫子程式ndays()，計算1月1日至某月某日之間共有多少天。
  例一：n = ndays (12,3);   // 31+28+...+3 (天)
  例二：n = ndays (3,10);   // 31+28+10 (天)
  設2月有28天。

```
#include <stdio.h>
int maxdays[13] = {0,31,28,31,30,31,30,31,31,30,31,30,31};
```

```
int ndays (int mm, int dd){
        int i, n=
        for (i=1; i<_____; i++)
                n+=
        return n;
}
```
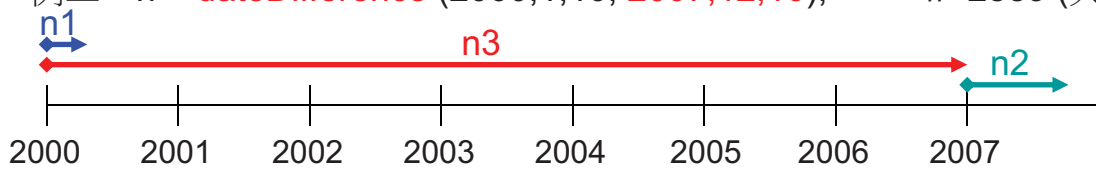
```
main(){
        n = ndays (12,3);
}
```

子程式(subprogram)

利用上題的子程式ndays(mm,dd)，
試寫另一子程式，計算兩日期的日數差。
例一：n = dateDifference (2000,1,10, 2002,02,10);　　// 761 (天)
例二：n = dateDifference (2000,1,10, 2007,12,10);　　// 2889 (天)

n1　　　　　　　　　　n3　　　　　　　　　n2

2000　2001　2002　2003　2004　2005　2006　2007

```
int dateDifference (int yy1, int mm1, int dd1,
                    int yy2, int mm2, int dd2){
        int i, n1,n2,n3=0;
        n1 =
        n2 =

        for (i= __; i< __; i++) n3+= ___;
        return n3+n2-n1;
}
```

子程式(subprogram)

BA, GA	BB, GB	BC, GC
16歲或以上	14-15歲	13歲或以下

```
#include <stdio.h>
char grades[6] = {"BA","BB","BC","GA","GB","GC"};
```

```
int gradeOf (int yob, char sex){
        int n, age=
        if(              ) …
        else …
        return n;
}
```

```
main(){
        int yob=1996, n=0;
        char gender='B';
        n = gradeOf(yob,gender);
        printf ("Grade = %s \n", grades[n]);
}
```

子程式(subprogram)