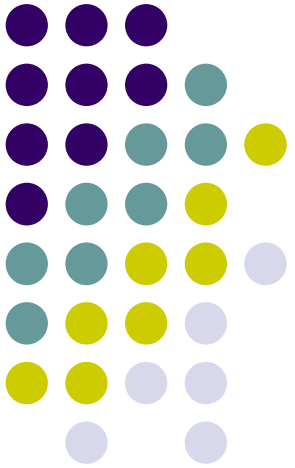
陣列與指標的關聯

C 語言中陣列是以指標實作的

陣列與指標在定義時, 使用記憶體不一樣大, 但是在存取資料時幾乎是等效的



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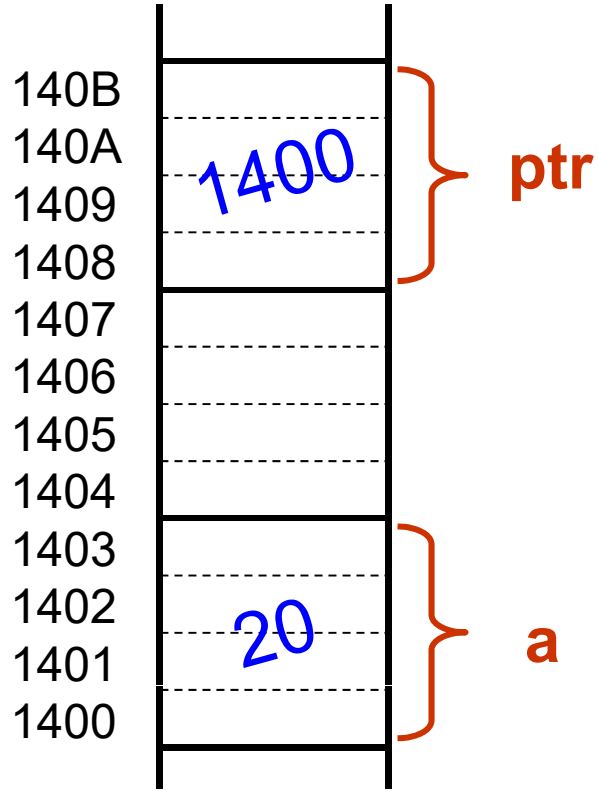

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整數指標變數 ptr
記錄整數變數 a
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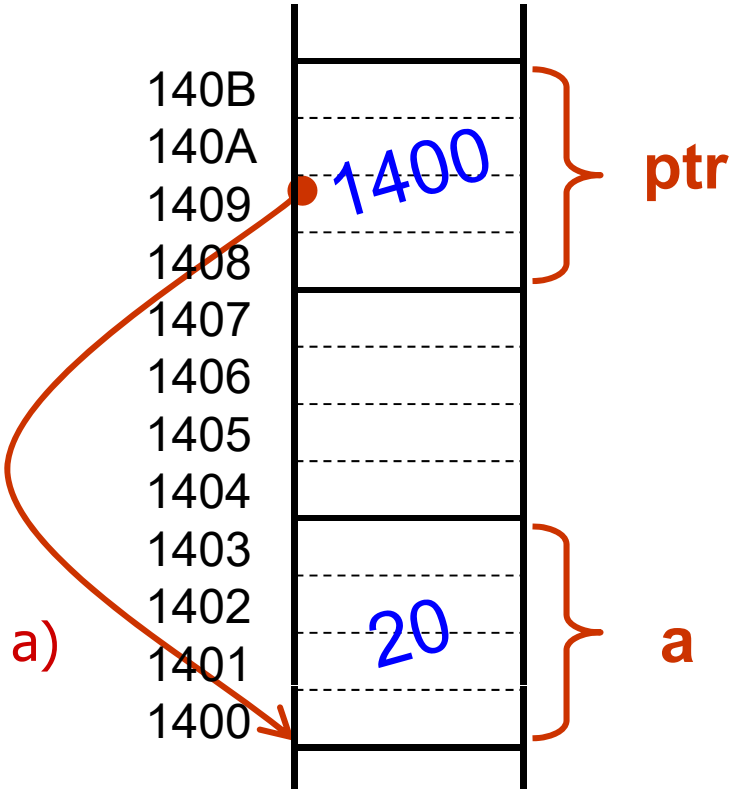

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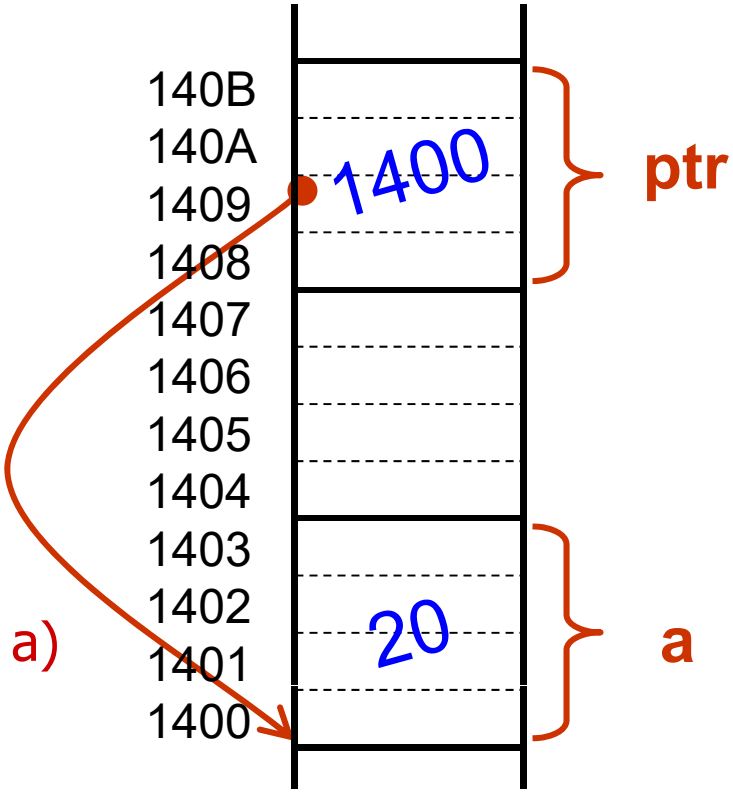

整數指標變數 ptr
記錄整數變數 a
的記憶體位址 &a
(ptr 指向整數變數 a)

a = 321
***&a** = 321;
***ptr** = 321;

- 拿到一個位址常數 **&a** 或是指標變數 **ptr**, 主要目標是運用間接存取運算子 * 來存取安排在該位址的變數 **a**

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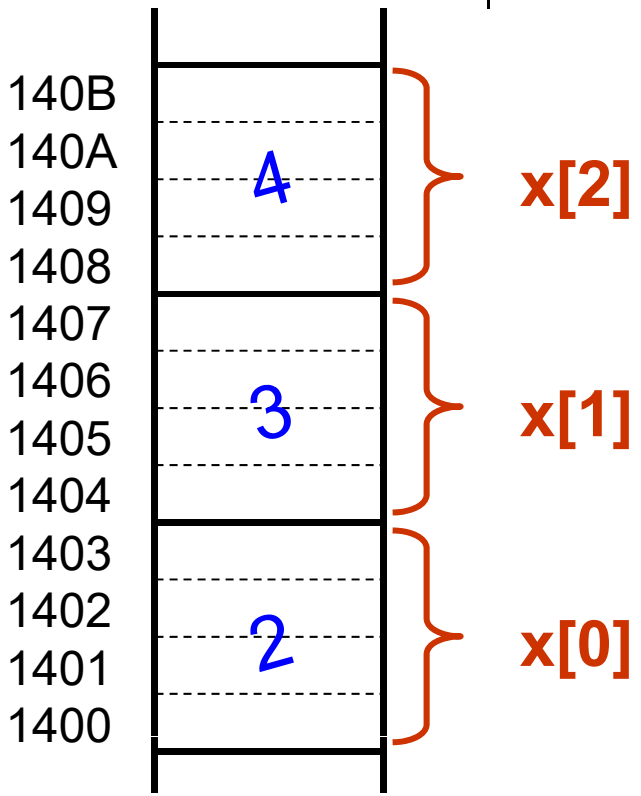

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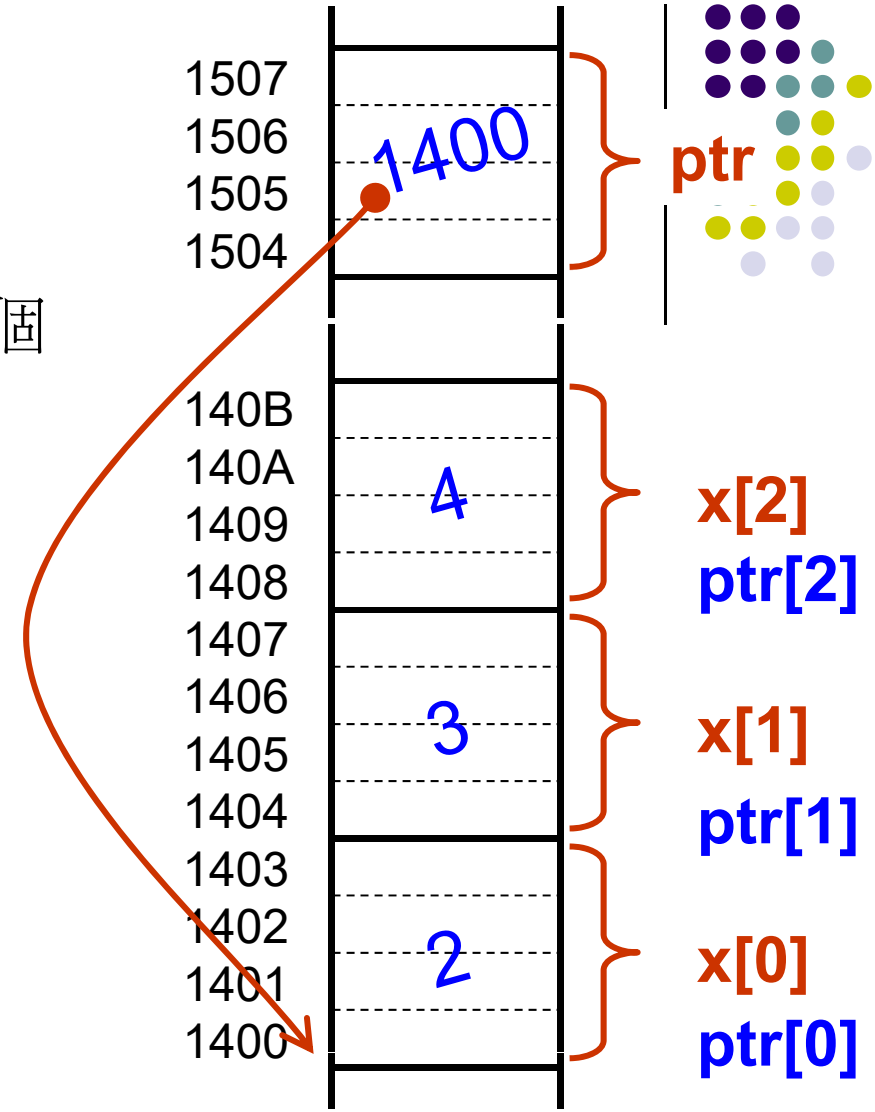

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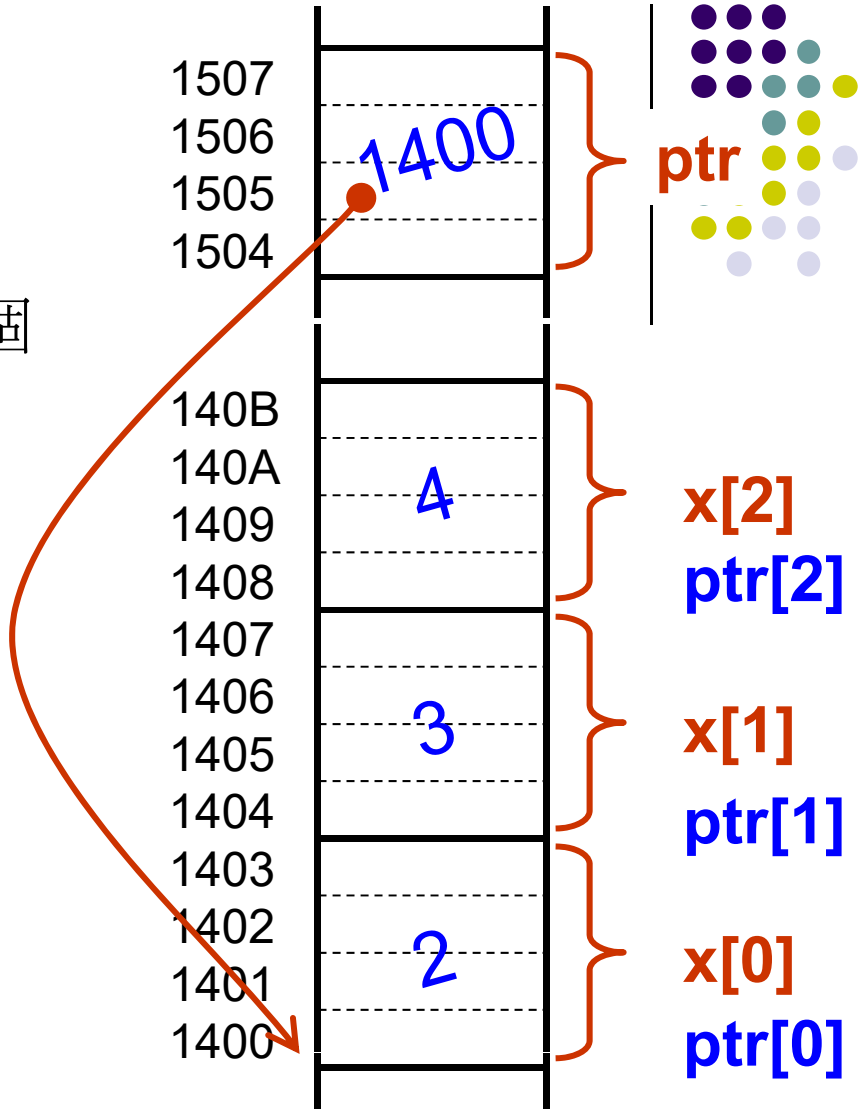

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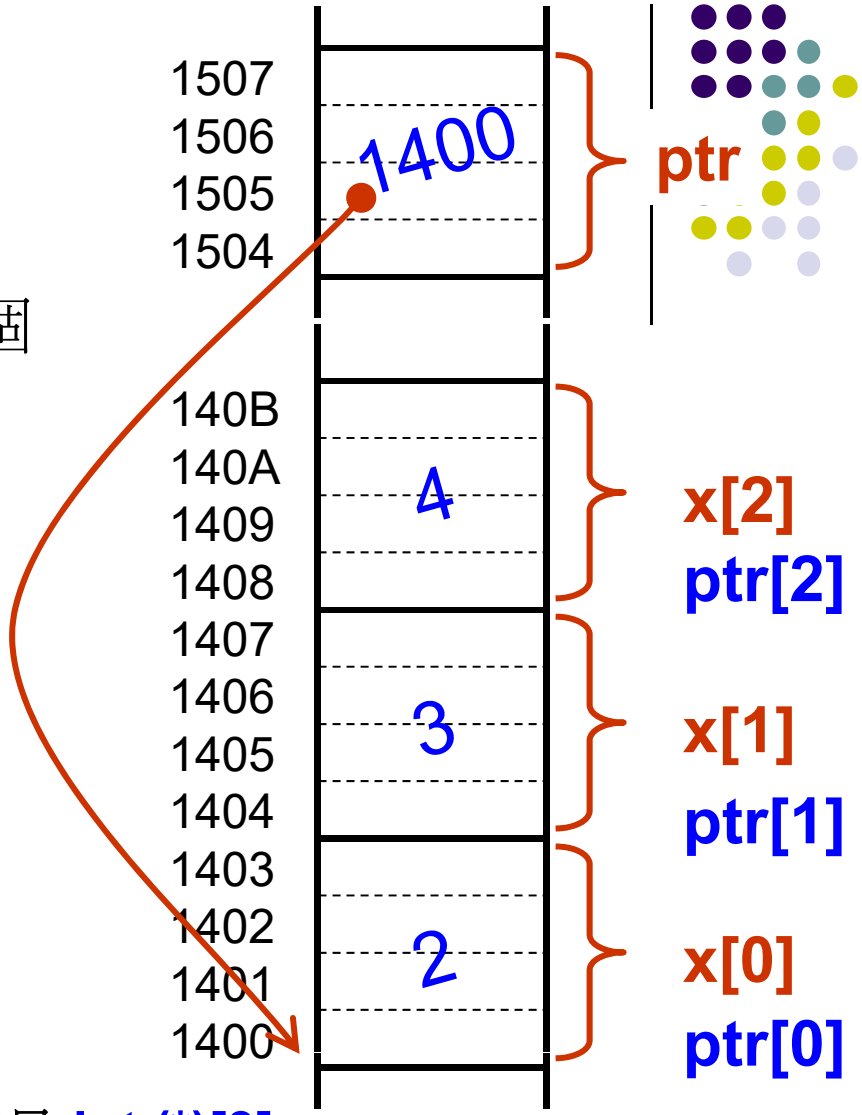


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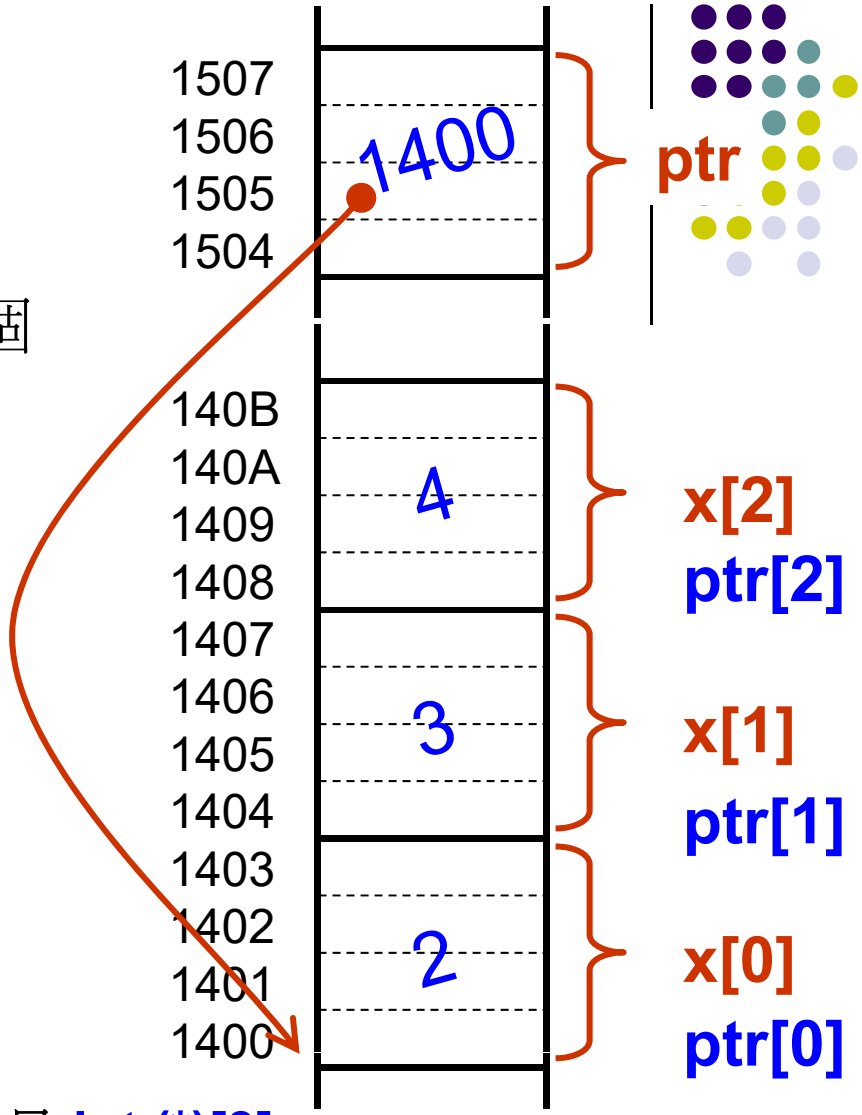


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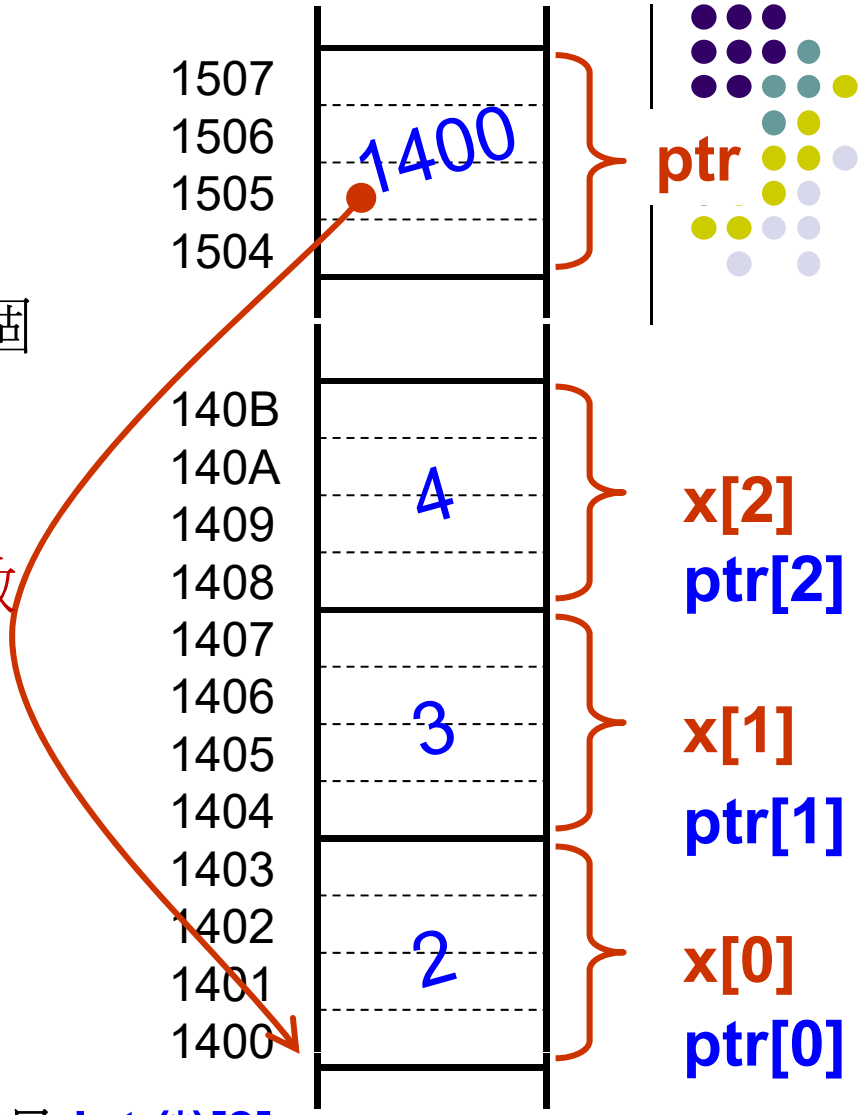

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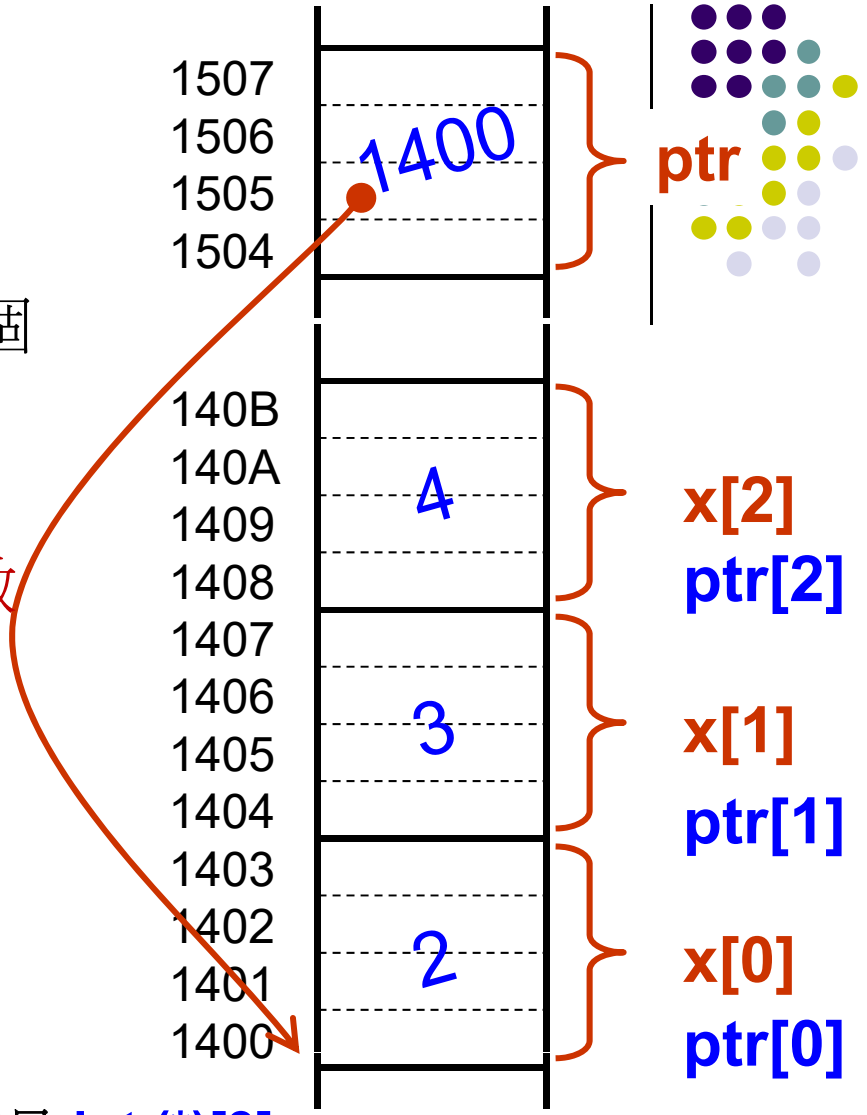

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需要記憶體位址的地方, **x** 代表陣列第一個元素的位址 **&x[0]**, 型態是 **int *const**

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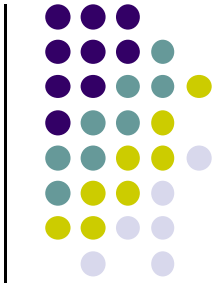

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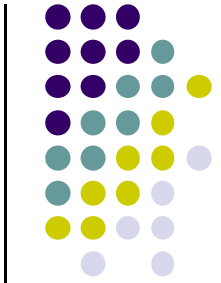

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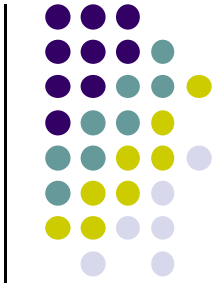

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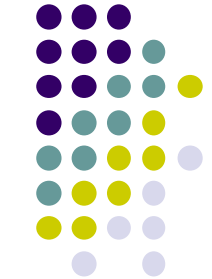

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完全不會出現 **int **** 的型態

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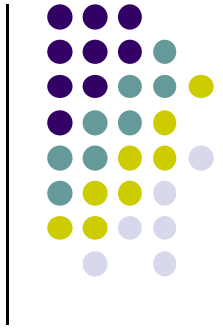

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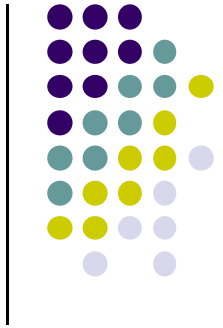

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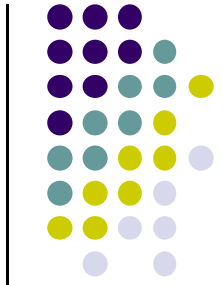

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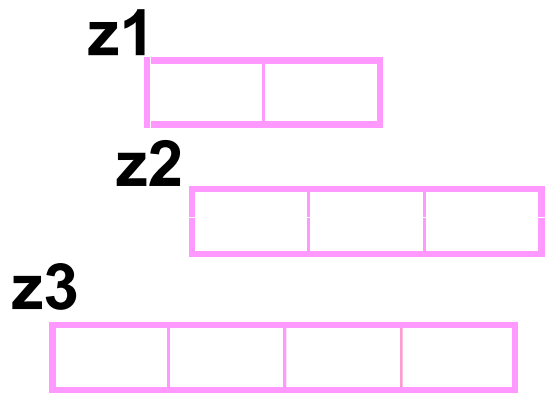

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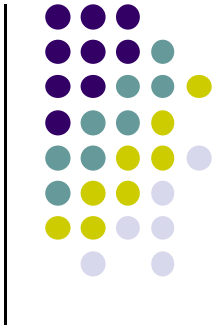

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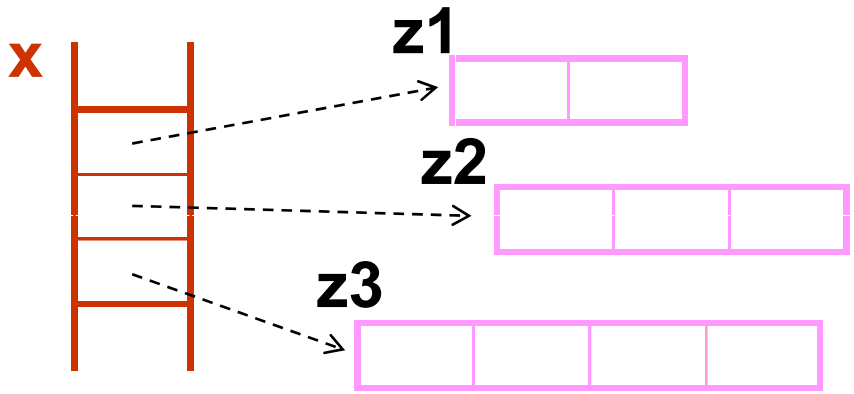

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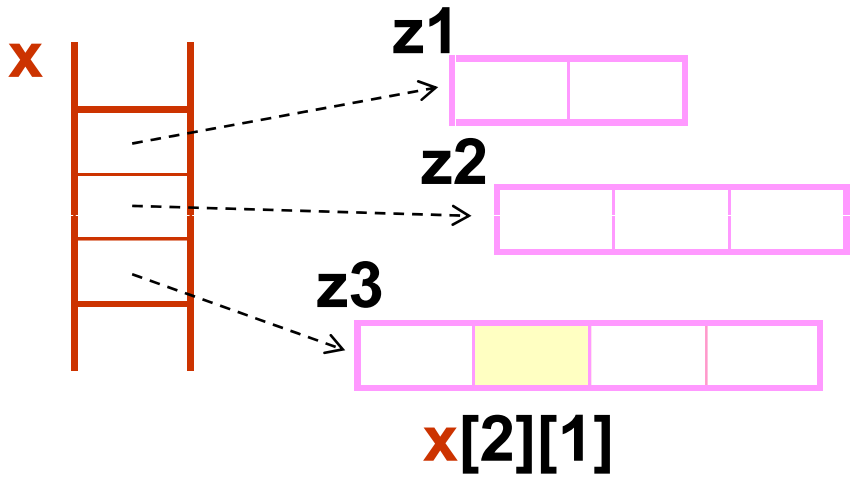

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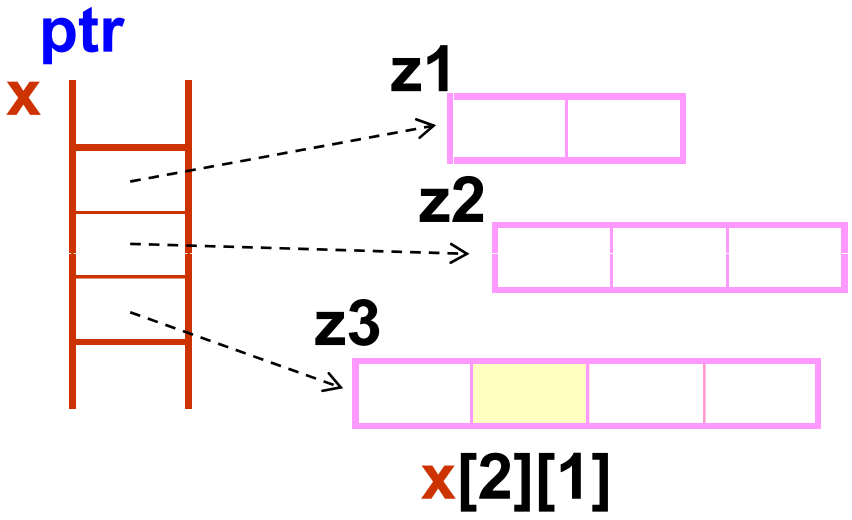

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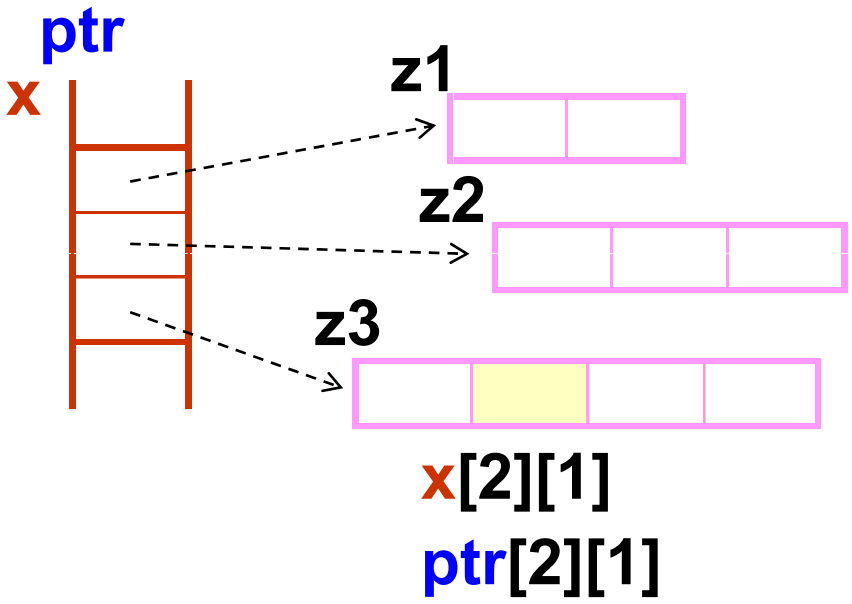
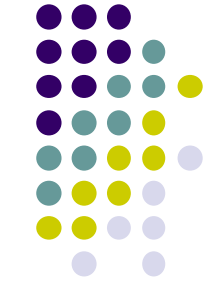
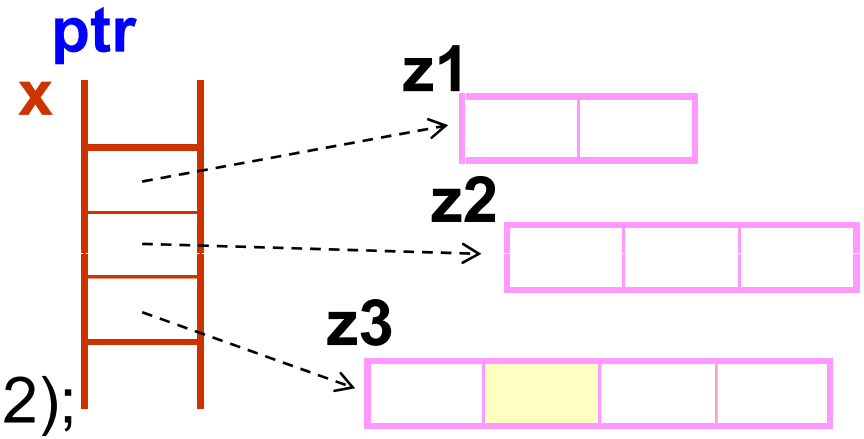


一維指標陣列



- int *x[3]; 一次定義了
  - 存放在連續記憶體裡面的三個整數指標變數 **x**[0], **x**[1], 與 **x**[2]
  - 還有一個整數雙重指標常數 **x**, 型態是 int **const, 值是 &**x**[0], 或是 int*[3]

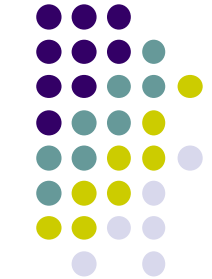
```
int z1[2], z2[3], z3[4];
int *x[3] = {z1,z2,z3};
int **ptr = x; // &x[0]
```



比較常看到用來組織動態配置的記憶體

```
int *z1=(int*) malloc(sizeof(int)*2);
int *z2=(int*) malloc(sizeof(int)*3);
int *z3=(int*) malloc(sizeof(int)*4);
```

動態配置 m x n 二維陣列



- 在 Heap 區域配置 m 列 n 行的二維陣列
- 範例

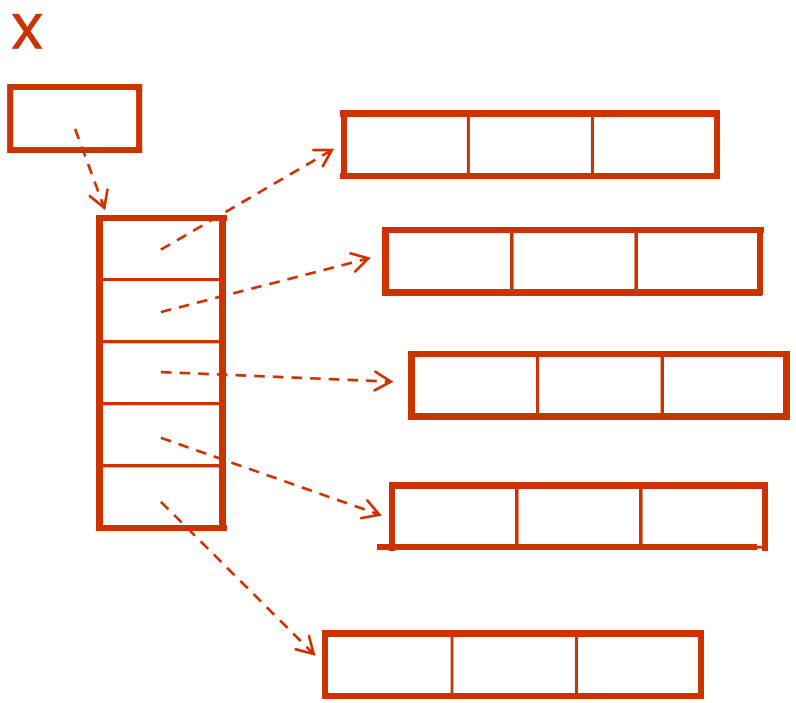
```
int i, j, m=5, n=3;
int **x;

x = (int **) malloc(sizeof(int *)*m);
for (i=0; i<m; i++)
    x[i] = (int *) malloc(sizeof(int)*n);

for (i=0; i<m; i++)
    for (j=0; j<n; j++)
        x[i][j] = 0;
fun(x);

for (i=0; i<m; i++)
    free(x[i]);
free(x);
```

Conceptual layout



void fun(int **const intarray) { ... } or void fun(int *intarray[]) { ... }

C/C++ 的陣列都是一維的

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- C/C++ **array** syntax is **one dimensional**

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```
int x[3];
```

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  `int x[3];` 3-element array of int

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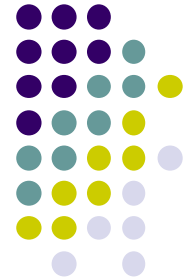

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- Another way to define array

```
typedef int INT3[3];
```

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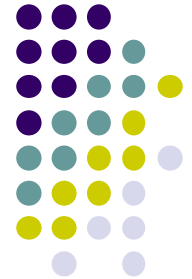

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```
typedef int INT3[3];
INT3 x[4];

typedef int INT4x3[4][3];
```

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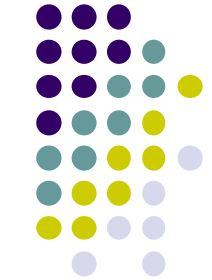

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- Another way to define array `int x[4][3];`

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INT3 x[4];

typedef int INT4x3[4][3];
INT4x3 y[5];
```

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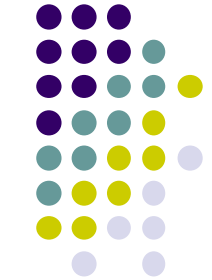

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```
typedef int INT3[3];  INT3 x[4];
                      int y[5][4][3];
typedef int INT4x3[4][3];  INT4x3 y[5];
```

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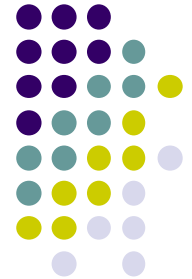

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  `typedef int INT3[3];` `INT3 x[4];` `INT4x3 x;`

  `int y[5][4][3];`

  `typedef int INT4x3[4][3];` `INT4x3 y[5];`

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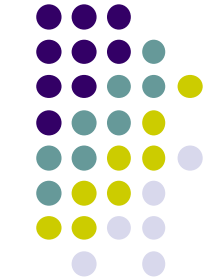

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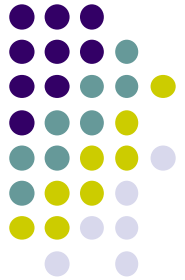
  `typedef int INT3[3];` `INT3 x[4];` `INT4x3 x;`

  `int y[5][4][3];`

  `typedef int INT4x3[4][3];` `INT4x3 y[5];` `INT3 y[5][4];`

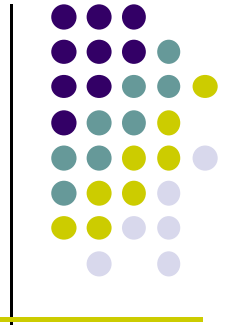
sizeof()

```
int x[4], y[5][4];
```



sizeof()

int x[4], y[5][4];



sizeof(**int**)	

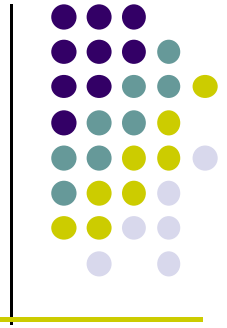
sizeof()

int x[4], y[5][4];

sizeof(**int**) **4**	

sizeof()

int x[4], y[5][4];



sizeof(**int**) **4**	
sizeof(**int***)	

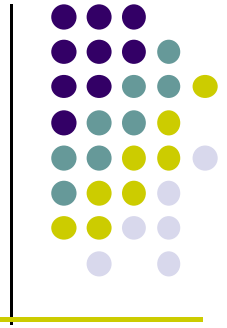
sizeof()

int x[4], y[5][4];

sizeof(**int**)	**4**
sizeof(**int***)	**8**

sizeof()

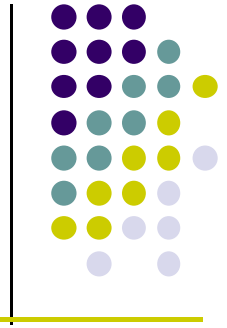
int x[4], y[5][4];



sizeof(**int**)	**4**	
sizeof(**int***)	**8**	
sizeof(**int[4]**)		

sizeof()

int x[4], y[5][4];



sizeof(**int**) **4**	
sizeof(**int***) **8**	
sizeof(**int[4]**) **16**	

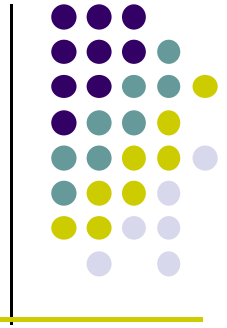
sizeof()

int x[4], y[5][4];

sizeof(**int**)	**4**	
sizeof(**int***)	**8**	
sizeof(**int[4]**)	**16**	
sizeof(**int*[4]**)		

sizeof()

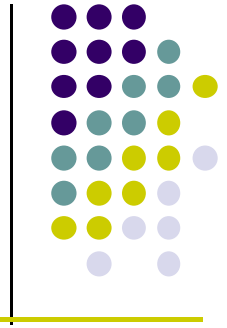
int x[4], y[5][4];



sizeof(**int**) **4**	
sizeof(**int***) **8**	
sizeof(**int[4]**) **16**	
sizeof(**int*[4]**) **32**	

sizeof()

int x[4], y[5][4];



sizeof(**int**) **4**	
sizeof(**int***) **8**	
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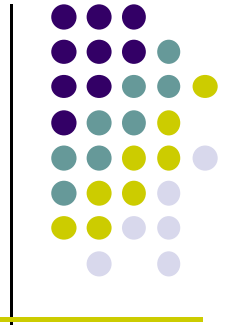
sizeof(**int*[4]**) **32**	
sizeof(**x**)	

sizeof()

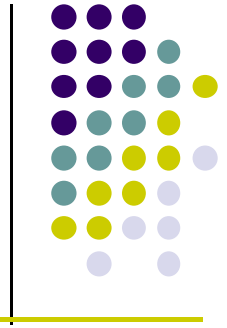
int x[4], y[5][4];



sizeof(**int**)	**4**	
sizeof(**int***)	**8**	
sizeof(**int[4]**)	**16**	
sizeof(**int*[4]**)	**32**	
sizeof(**x**)	**16**	**int[4]**

sizeof()

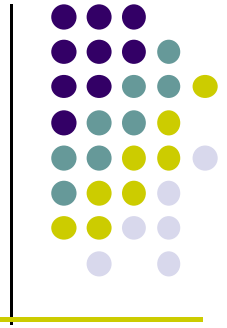
int x[4], y[5][4];



sizeof(**int**)	**4**	
sizeof(**int***)	**8**	
sizeof(**int[4]**)	**16**	
sizeof(**int*[4]**)	**32**	
sizeof(**x**)	**16**	**int[4]**
sizeof(**(int*)x**)		

sizeof()

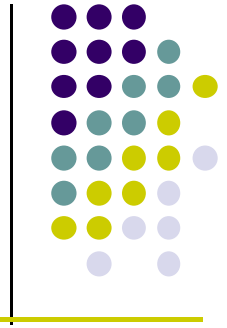
int x[4], y[5][4];



sizeof(**int**)	**4**	
sizeof(**int***)	**8**	
sizeof(**int[4]**)	**16**	
sizeof(**int*[4]**)	**32**	
sizeof(**x**)	**16**	**int[4]**
sizeof(**(int*)x**)	**8**	**int***

sizeof()

int x[4], y[5][4];



sizeof(**int**)	**4**		sizeof(***x**)
sizeof(**int***)	**8**		
sizeof(**int[4]**)	**16**		
sizeof(**int*[4]**)	**32**		
sizeof(**x**)	**16**	**int[4]**	
sizeof(**(int*)x**)	**8**	**int***	

sizeof()

int x[4], y[5][4];

sizeof(**int**)	**4**	sizeof(***x**) sizeof(***(int*)x**)
sizeof(**int***)	**8**	
sizeof(**int[4]**)	**16**	
sizeof(**int*[4]**)	**32**	
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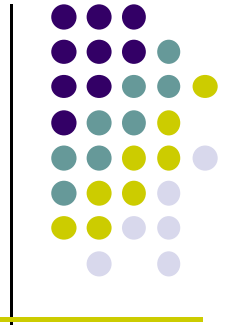

sizeof(**int**)	**4**	sizeof(***x**) **4** **int** sizeof(***(int*)x**)
sizeof(**int***)	**8**	
sizeof(**int[4]**)	**16**	
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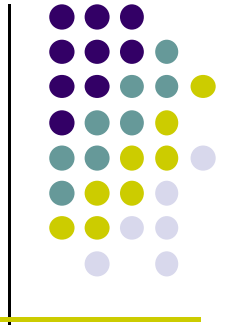
int x[4], y[5][4];



sizeof(**int**)	**4**		sizeof(***x**) sizeof(***(int*)x**)	**4** **int**
sizeof(**int***)	**8**		sizeof(***&x**)	
sizeof(**int[4]**)	**16**			
sizeof(**int*[4]**)	**32**			
sizeof(**x**)	**16**	**int[4]**		
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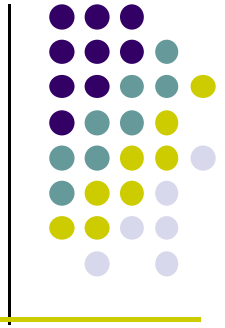
sizeof()

int x[4], y[5][4];



sizeof(**int**)	**4**	sizeof(***x**) sizeof(***(int*)x**) **4** **int**
sizeof(**int***)	**8**	sizeof(***&x**) sizeof(**y[0]**)
sizeof(**int[4]**)	**16**	
sizeof(**int*[4]**)	**32**	
sizeof(**x**)	**16** **int[4]**	
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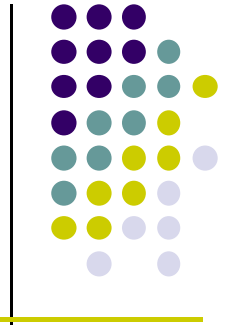
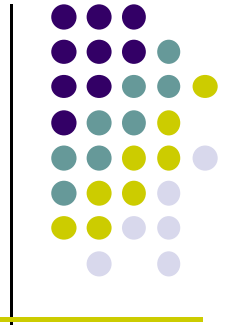


sizeof(**int**)	**4**	
sizeof(**int***)	**8**	
sizeof(**int[4]**)	**16**	
sizeof(**int*[4]**)	**32**	
sizeof(**x**)	**16**	**int[4]**
sizeof(**(int*)x**)	**8**	**int***

sizeof(***x**) sizeof(***(int*)x**)	**4**	**int**
sizeof(***&x**) sizeof(**y[0]**)	**16**	**int[4]**

sizeof()

int x[4], y[5][4];

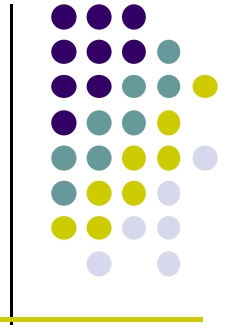


sizeof(**int**)	**4**	
sizeof(**int***)	**8**	
sizeof(**int[4]**)	**16**	
sizeof(**int*[4]**)	**32**	
sizeof(**x**)	**16**	**int[4]**
sizeof(**(int*)x**)	**8**	**int***

sizeof(***x**) sizeof(***(int*)x**)	**4**	**int**
sizeof(***&x**) sizeof(**y[0]**)	**16**	**int[4]**
sizeof(***&y[0]**)		

sizeof()

int x[4], y[5][4];



sizeof(**int**)	**4**	
sizeof(**int***)	**8**	
sizeof(**int[4]**)	**16**	
sizeof(**int*[4]**)	**32**	
sizeof(**x**)	**16**	**int[4]**
sizeof(**(int*)x**)	**8**	**int***

sizeof(***x**) sizeof(***(int*)x**)	**4**	**int**
sizeof(***&x**) sizeof(**y[0]**)	**16**	**int[4]**
sizeof(***&y[0]**)	**16**	**int[4]**

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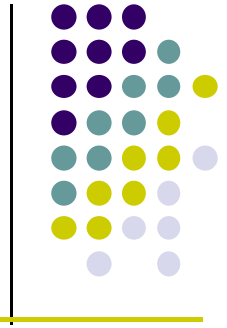
int x[4], y[5][4];

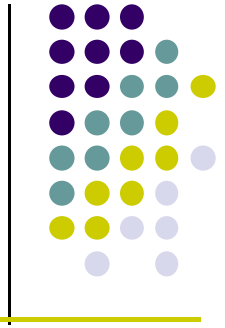


sizeof(**int**)	**4**	
sizeof(**int***)	**8**	
sizeof(**int[4]**)	**16**	
sizeof(**int*[4]**)	**32**	
sizeof(**x**)	**16**	**int[4]**
sizeof(**(int*)x**)	**8**	**int***

sizeof(***x**) sizeof(***(int*)x**)	**4**	**int**
sizeof(***&x**) sizeof(**y[0]**)	**16**	**int[4]**
sizeof(***&y[0]**)	**16**	**int[4]**
sizeof(**y**)		

sizeof()

int x[4], y[5][4];

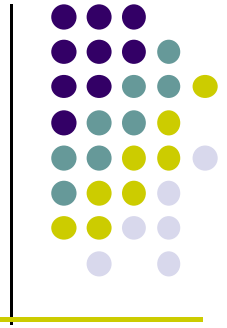


sizeof(**int**)	**4**	
sizeof(**int***)	**8**	
sizeof(**int[4]**)	**16**	
sizeof(**int*[4]**)	**32**	
sizeof(**x**)	**16**	**int[4]**
sizeof(**(int*)x**)	**8**	**int***

sizeof(***x**) sizeof(***(int*)x**)	**4**	**int**
sizeof(***&x**) sizeof(**y[0]**)	**16**	**int[4]**
sizeof(***&y[0]**)	**16**	**int[4]**
sizeof(**y**)	**80**	**int[5][4]**

sizeof()

int x[4], y[5][4];



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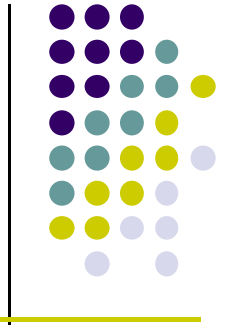
sizeof(**int***)	**8**	
sizeof(**int[4]**)	**16**	
sizeof(**int*[4]**)	**32**	
sizeof(**x**)	**16**	**int[4]**
sizeof(**(int*)x**)	**8**	**int***

sizeof(***x**) sizeof(***(int*)x**)	**4**	**int**
sizeof(***&x**) sizeof(**y[0]**)	**16**	**int[4]**
sizeof(***&y[0]**)	**16**	**int[4]**
sizeof(**y**)	**80**	**int[5][4]**
sizeof(***y[0]**)		

sizeof()

int x[4], y[5][4];



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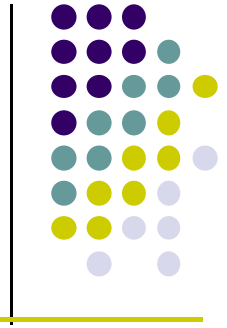
sizeof(***&y[0]**)	**16**	**int[4]**
sizeof(**y**)	**80**	**int[5][4]**
sizeof(***y[0]**) sizeof(***(int*)y[0]**)		

sizeof()

int x[4], y[5][4];



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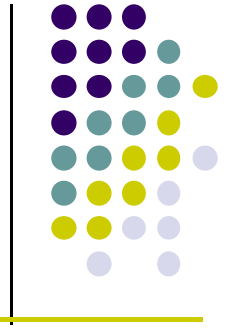
sizeof(**x**)	**16**	**int[4]**
sizeof((**int***)**x**)	**8**	**int***

sizeof(***x**) sizeof(***(int*)x**)	**4**	**int**
sizeof(***&x**) sizeof(**y[0]**)	**16**	**int[4]**
sizeof(***&y[0]**)	**16**	**int[4]**
sizeof(**y**)	**80**	**int[5][4]**
sizeof(***y[0]**) sizeof(***(int*)y[0]**)	**4**	**int**

sizeof()

int x[4], y[5][4];



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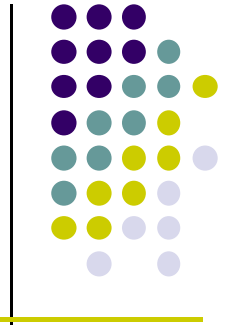
sizeof(***x**) sizeof(***(int*)x**)	**4**	**int**
sizeof(***&x**) sizeof(**y[0]**)	**16**	**int[4]**
sizeof(***&y[0]**)	**16**	**int[4]**
sizeof(**y**)	**80**	**int[5][4]**
sizeof(***y[0]**) sizeof(***(int*)y[0]**)	**4**	**int**
sizeof(***y**)		

sizeof()

int x[4], y[5][4];



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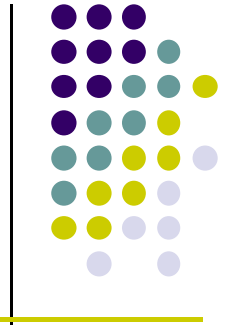
sizeof(**int*[4]**)	**32**	
sizeof(**x**)	**16**	**int[4]**
sizeof((**int***)**x**)	**8**	**int***

sizeof(***x**) sizeof(***(int*)x**)	**4**	**int**
sizeof(***&x**) sizeof(**y[0]**)	**16**	**int[4]**
sizeof(***&y[0]**)	**16**	**int[4]**
sizeof(**y**)	**80**	**int[5][4]**
sizeof(***y[0]**) sizeof(***(int*)y[0]**)	**4**	**int**
sizeof(***y**) sizeof(***(int(*)[4])y**)		

sizeof()

int x[4], y[5][4];



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sizeof(***&y[0]**)	**16**	**int[4]**
sizeof(**y**)	**80**	**int[5][4]**
sizeof(***y[0]**) sizeof(***(int*)y[0]**)	**4**	**int**
sizeof(***y**) sizeof(***(int(*)[4])y**)	**16**	**int[4]**

指標的型態

```
int x[4], y[5][4], a, z[6][5][4];
int *ptrI, (*ptrI4)[4], (*ptrI5x4)[5][4];
```

指標的型態

```
int x[4], y[5][4], a, z[6][5][4];
int *ptrI, (*ptrI4)[4], (*ptrI5x4)[5][4];
ptrI4 = &x;     // type matched   int (*)[4] => int (*)[4]
```

指標的型態

```
int x[4], y[5][4], a, z[6][5][4];
int *ptrI, (*ptrI4)[4], (*ptrI5x4)[5][4];
ptrI4 = &x;     // type matched   int (*)[4] => int (*)[4]
ptrI4 = y;      // type matched   int (*)[4] => int (*)[4]
```

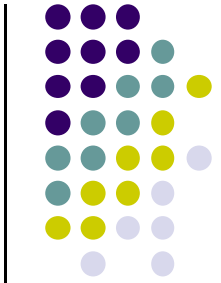
指標的型態

```
int x[4], y[5][4], a, z[6][5][4];
int *ptrI, (*ptrI4)[4], (*ptrI5x4)[5][4];
ptrI4 = &x;     // type matched   int (*)[4] => int (*)[4]
ptrI4 = y;      // type matched   int (*)[4] => int (*)[4]
ptrI = x;       // automatic type conversion int[4] => int *
```

指標的型態

```
int x[4], y[5][4], a, z[6][5][4];
int *ptrI, (*ptrI4)[4], (*ptrI5x4)[5][4];
ptrI4 = &x;     // type matched   int (*)[4] => int (*)[4]
ptrI4 = y;      // type matched   int (*)[4] => int (*)[4]
ptrI = x;       // automatic type conversion int[4] => int *
ptrI = y[0];    // automatic type conversion int[4] => int *
```

指標的型態



```
int x[4], y[5][4], a, z[6][5][4];
int *ptrI, (*ptrI4)[4], (*ptrI5x4)[5][4];
ptrI4 = &x;     // type matched   int (*)[4] => int (*)[4]
ptrI4 = y;      // type matched   int (*)[4] => int (*)[4]
ptrI = x;       // automatic type conversion int[4] => int *
ptrI = y[0];    // automatic type conversion int[4] => int *
//ptrI4 = &a;    // error int * => int (*)[4]
```

指標的型態

```
int x[4], y[5][4], a, z[6][5][4];
int *ptrI, (*ptrI4)[4], (*ptrI5x4)[5][4];
ptrI4 = &x;     // type matched   int (*)[4] => int (*)[4]
ptrI4 = y;      // type matched   int (*)[4] => int (*)[4]
ptrI = x;       // automatic type conversion int[4] => int *
ptrI = y[0];    // automatic type conversion int[4] => int *
//ptrI4 = &a;    // error int * => int (*)[4]
//ptrI = &x;     // error int (*)[4] => int *
```

指標的型態

```
int x[4], y[5][4], a, z[6][5][4];
int *ptrI, (*ptrI4)[4], (*ptrI5x4)[5][4];
ptrI4 = &x;     // type matched   int (*)[4] => int (*)[4]
ptrI4 = y;      // type matched   int (*)[4] => int (*)[4]
ptrI = x;       // automatic type conversion int[4] => int *
ptrI = y[0];    // automatic type conversion int[4] => int *
//ptrI4 = &a;    // error int * => int (*)[4]
//ptrI = &x;     // error int (*)[4] => int *
ptrI5x4 = &y;   // type matched int (*)[5][4] => int (*)[5][4]
```

指標的型態

```
int x[4], y[5][4], a, z[6][5][4];
int *ptrI, (*ptrI4)[4], (*ptrI5x4)[5][4];
ptrI4 = &x;     // type matched   int (*)[4] => int (*)[4]
ptrI4 = y;      // type matched   int (*)[4] => int (*)[4]
ptrI = x;       // automatic type conversion int[4] => int *
ptrI = y[0];    // automatic type conversion int[4] => int *
//ptrI4 = &a;    // error int * => int (*)[4]
//ptrI = &x;     // error int (*)[4] => int *
ptrI5x4 = &y;   // type matched int (*)[5][4] => int (*)[5][4]
ptrI5x4 = z;    // type matched int (*)[5][4] => int (*)[5][4]
```

函式參數的陣列宣告

```
int x[7]={1,2,3,4,5,6,7};
int result = sum(x);
printf("%d\n", result);
```

概念上最簡單的寫法

```
int sum(int x[7]){
    int i, y=0;
    for (i=0; i<7; i++)
        y += x[i];
    return y;
}
```

函式參數的陣列宣告

```
int x[7]={1,2,3,4,5,6,7};
int result = sum(x);
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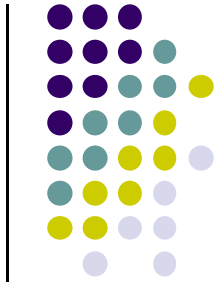
```
int sum(int x[7]) {
    int i, y=0;
    for (i=0; i<7; i++)
        y += x[i];
    return y;
}
```

```
int sum(int x[]) {
    int i, y=0;
    for (i=0; i<7; i++)
        y += x[i];
    return y;
}
```

函式參數的陣列宣告



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```

```
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    int i, y=0;
    for (i=0; i<7; i++)
        y += x[i];
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}
```

```
int sum(int x[]) {
    int i, y=0;
    for (i=0; i<7; i++)
        y += x[i];
    return y;
}
```

```
int sum(int *x) {
    int i, y=0;
    for (i=0; i<7; i++)
        y += x[i];
    return y;
}
```

函式參數的陣列宣告

```
int x[7]={1,2,3,4,5,6,7};
int result = sum(x);
printf("%d\n", result);
```

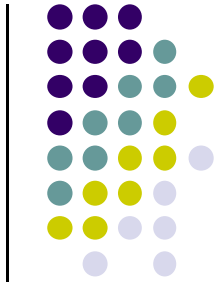
```
int sum(int x[7]) {
    int i, y=0;
    for (i=0; i<7; i++)
        y += x[i];
    return y;
}
```

```
int sum(int x[]) {
    int i, y=0;
    for (i=0; i<7; i++)
        y += x[i];
    return y;
}
```

```
int sum(int *x) {
    int i, y=0;
    for (i=0; i<7; i++)
        y += x[i];
    return y;
}
```

```
int sum(int *const x) {
    int i, y=0;
    for (i=0; i<7; i++)
        y += x[i];
    return y;
}
```

函式參數的陣列宣告



```
int x[7]={1,2,3,4,5,6,7};
int result = sum(x);
printf("%d\n", result);
printf("%d\n",sizeof(x));
```

```
int sum(int x[7]) {
    int i, y=0;
    for (i=0; i<7; i++)
        y += x[i];
    return y;
}
```

```
int sum(int *x) {
    int i, y=0;
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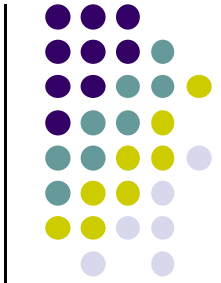
```

函式參數的陣列宣告



```
int x[7]={1,2,3,4,5,6,7};
int result = sum(x);
printf("%d\n", result);
printf("%d\n",sizeof(x));
```

28

```
int sum(int x[7]) {
    int i, y=0;
    for (i=0; i<7; i++)
        y += x[i];
    return y;
}
```

```
int sum(int *x) {
    int i, y=0;
    for (i=0; i<7; i++)
        y += x[i];
    return y;
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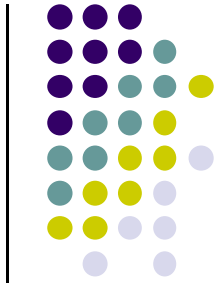
```

函式參數的陣列宣告



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    for (i=0; i<7; i++)
        y += x[i];
    printf("%d\n",sizeof(x));
    return y;
}
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int sum(int *x) {
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    for (i=0; i<7; i++)
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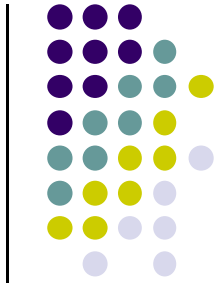
函式參數的陣列宣告



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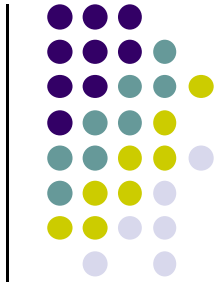
    for (i=0; i<7; i++)
        y += x[i];
    printf("%d\n",sizeof(x));
    return y;
}
```

8

```
int sum(int *x) {
    int i, y=0;
    for (i=0; i<7; i++)
        y += x[i];
    return y;
}
```

函式參數的陣列宣告



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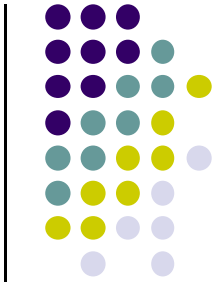
```

8

```
int sum(int *x) {
    int i, y=0;
    for (i=0; i<7; i++)
        y += x[i];
    return y;
}
```

咦! 這個陣列語法是假的

函式參數的陣列宣告



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    return y;
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8

```
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    for (i=0; i<7; i++)
        y += x[i];
    printf("%d\n",sizeof(x));
    return y;
}
```

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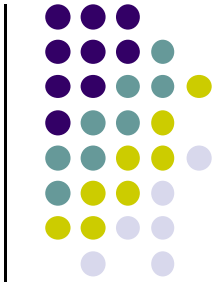
函式參數的陣列宣告



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咦! 這個陣列語法是假的

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int sum(int *x) {
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        y += x[i];
    printf("%d\n",sizeof(x));
    return y;
}
```

8

其實是指標耶!?!

函式參數的陣列宣告

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int result = sum(x);
printf("%d\n", result);
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int sum(int x[7]) {
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    for (i=0; i<7; i++)
        y += x[i];
    printf("%d\n",sizeof(x));
    return y;
}
```

8

```
int sum(int *x) {
    int i, y=0;
    for (i=0; i<7; i++)
        y += x[i];
    printf("%d\n",sizeof(x));
    return y;
}
```

8

仔細比較一下

```
int sum(int x[7]) {
    int i, y=0, z[3];
    for (i=0; i<7; i++)
        y += x[i];
    printf("%d %d\n", sizeof(x), sizeof(z));
    func(&x, &z);
    return y;
}
```

函式參數的陣列宣告

```
int x[7]={1,2,3,4,5,6,7};
int result = sum(x);
printf("%d\n", result);
printf("%d\n",sizeof(x));
```

28

```
int sum(int x[7]) {
    int i, y=0;
    for (i=0; i<7; i++)
        y += x[i];
    printf("%d\n",sizeof(x));
    return y;
}
```

8

```
int sum(int *x) {
    int i, y=0;
    for (i=0; i<7; i++)
        y += x[i];
    printf("%d\n",sizeof(x));
    return y;
}
```

8

仔細比較一下

```
int sum(int x[7]) {
    int i, y=0, z[3];
    for (i=0; i<7; i++)
        y += x[i];
    printf("%d %d\n", sizeof(x), sizeof(z));
    func(&x, &z);
    return y;
}
```

函式參數的陣列宣告

```
int x[7]={1,2,3,4,5,6,7};
int result = sum(x);
printf("%d\n", result);
printf("%d\n",sizeof(x));
```

28

```
int sum(int x[7]) {
    int i, y=0;
    for (i=0; i<7; i++)
        y += x[i];
    printf("%d\n",sizeof(x));
    return y;
}
```

8

```
int sum(int *x) {
    int i, y=0;
    for (i=0; i<7; i++)
        y += x[i];
    printf("%d\n",sizeof(x));
    return y;
}
```

8

仔細比較一下

```
int sum(int x[7]) {
    int i, y=0, z[3];
    for (i=0; i<7; i++)
        y += x[i];
    printf("%d %d\n", sizeof(x), sizeof(z));
    func(&x, &z);
    return y;
}
```

8 12

函式參數的陣列宣告

```
int x[7]={1,2,3,4,5,6,7};
int result = sum(x);
printf("%d\n", result);
printf("%d\n",sizeof(x));
```
28

```
int sum(int x[7]) {
    int i, y=0;
    for (i=0; i<7; i++)
        y += x[i];
    printf("%d\n",sizeof(x));
    return y;
}
```
8

```
int sum(int *x) {
    int i, y=0;
    for (i=0; i<7; i++)
        y += x[i];
    printf("%d\n",sizeof(x));
    return y;
}
```
8

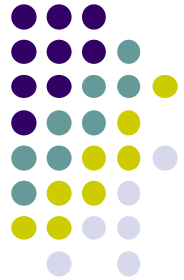
仔細比較一下

```
int sum(int x[7]) {
    int i, y=0, z[3];
    for (i=0; i<7; i++)
        y += x[i];
    printf("%d %d\n", sizeof(x), sizeof(z));
    func(&x, &z);
    return y;
}
```
8 12

```
void func(int **x, int(*z)[3])
{
...
}
```

範例

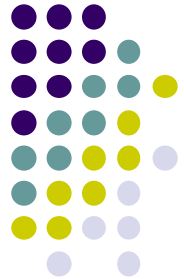
```
int main() {
    int x[4], y[5][4];
    func(x, x, y, y);
}
```



範例

```
int main() {
    int x[4], y[5][4];
    func(x, x, y, y);
}
```

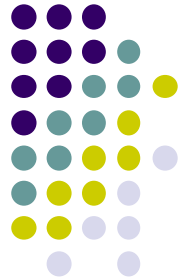
```
void func(int x[4], int *const xptr,
```



範例

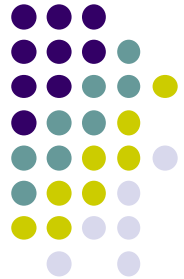
```
int main() {
    int x[4], y[5][4];
    func(x, x, y, y);
}
```

```
void func(int x[4], int *const xptr,
          int y[5][4], int (*const yptr)[4]) {
```



範例

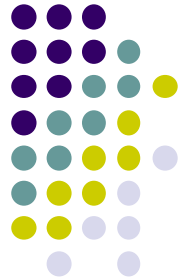
```
int main() {
    int x[4], y[5][4];
    func(x, x, y, y);
}
```



```
void func(int x[4], int *const xptr,
                int y[5][4], int (*const yptr)[4]) {
   printf("%d\n", sizeof(xptr));
```

範例

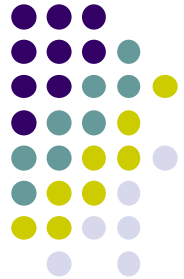
```
int main() {
    int x[4], y[5][4];
    func(x, x, y, y);
}
```



```
void func(int x[4], int *const xptr,
                int y[5][4], int (*const yptr)[4]) {
   printf("%d\n", sizeof(xptr));        8
```

範例

```
int main() {
    int x[4], y[5][4];
    func(x, x, y, y);
}
```

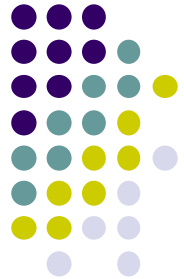


```
void func(int x[4], int *const xptr,
                int y[5][4], int (*const yptr)[4]) {
    printf("%d\n", sizeof(xptr));
    printf("%d\n", sizeof(*xptr));
```

8

範例

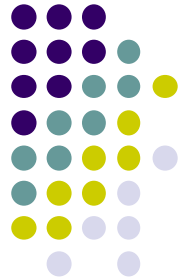
```
int main() {
    int x[4], y[5][4];
    func(x, x, y, y);
}
```



```
void func(int x[4], int *const xptr,
                int y[5][4], int (*const yptr)[4]) {
    printf("%d\n", sizeof(xptr));        8
    printf("%d\n", sizeof(*xptr));       4
```

範例

```
int main() {
    int x[4], y[5][4];
    func(x, x, y, y);
}
```



```
void func(int x[4], int *const xptr,
                int y[5][4], int (*const yptr)[4]) {
    printf("%d\n", sizeof(xptr));        8
    printf("%d\n", sizeof(*xptr));       4
    printf("%d\n", sizeof(x));
```

範例

```
int main() {
    int x[4], y[5][4];
    func(x, x, y, y);
}
```

```
void func(int x[4], int *const xptr,
                int y[5][4], int (*const yptr)[4]) {
    printf("%d\n", sizeof(xptr));        8
    printf("%d\n", sizeof(*xptr));       4
    printf("%d\n", sizeof(x));           8
```

int*, not int[4]

範例

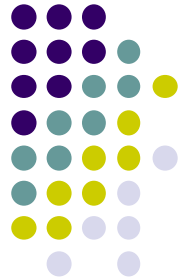
```
int main() {
    int x[4], y[5][4];
    func(x, x, y, y);
}
```

```
void func(int x[4], int *const xptr,
                int y[5][4], int (*const yptr)[4]) {
    printf("%d\n", sizeof(xptr));          8
    printf("%d\n", sizeof(*xptr));         4
    printf("%d\n", sizeof(x));             8
    printf("%d\n", sizeof(*x));
```

int*, not int[4]

範例

```
int main() {
    int x[4], y[5][4];
    func(x, x, y, y);
}
```



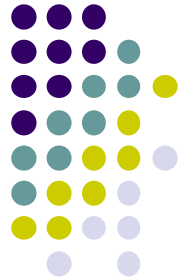
```
void func(int x[4], int *const xptr,
                int y[5][4], int (*const yptr)[4]) {
    printf("%d\n", sizeof(xptr));        8
    printf("%d\n", sizeof(*xptr));       4
    printf("%d\n", sizeof(x));           8
    printf("%d\n", sizeof(*x));          4
}
```

int*, not int[4]

int

範例

```
int main() {
    int x[4], y[5][4];
    func(x, x, y, y);
}
```



```
void func(int x[4], int *const xptr,
                int y[5][4], int (*const yptr)[4]) {
    printf("%d\n", sizeof(xptr));          8
    printf("%d\n", sizeof(*xptr));         4
    printf("%d\n", sizeof(x));             8
    printf("%d\n", sizeof(*x));            4

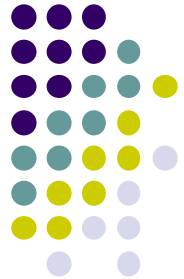
    printf("%d\n", sizeof(yptr));
```

int*, not int[4]

int

範例

```
int main() {
    int x[4], y[5][4];
    func(x, x, y, y);
}
```



```
void func(int x[4], int *const xptr,
                int y[5][4], int (*const yptr)[4]) {
    printf("%d\n", sizeof(xptr));          8
    printf("%d\n", sizeof(*xptr));         4
    printf("%d\n", sizeof(x));             8
    printf("%d\n", sizeof(*x));            4

    printf("%d\n", sizeof(yptr));          8
```

int*, not int[4]

int

範例

```
int main() {
    int x[4], y[5][4];
    func(x, x, y, y);
}
```

```
void func(int x[4], int *const xptr,
                int y[5][4], int (*const yptr)[4]) {
    printf("%d\n", sizeof(xptr));        8
    printf("%d\n", sizeof(*xptr));       4
    printf("%d\n", sizeof(x));           8
    printf("%d\n", sizeof(*x));          4

    printf("%d\n", sizeof(yptr));        8
    printf("%d\n", sizeof(*yptr));
```

int*, not int[4]

int

範例

```
int main() {
    int x[4], y[5][4];
    func(x, x, y, y);
}
```

```
void func(int x[4], int *const xptr,
                int y[5][4], int (*const yptr)[4]) {
    printf("%d\n", sizeof(xptr));
    printf("%d\n", sizeof(*xptr));
    printf("%d\n", sizeof(x));
    printf("%d\n", sizeof(*x));

    printf("%d\n", sizeof(yptr));
    printf("%d\n", sizeof(*yptr));
```

8
4
8
4

8
16

int*, not int[4]
int

int[4]

範例

```
int main() {
    int x[4], y[5][4];
    func(x, x, y, y);
}
```

```
void func(int x[4], int *const xptr,
                int y[5][4], int (*const yptr)[4]) {
    printf("%d\n", sizeof(xptr));          8
    printf("%d\n", sizeof(*xptr));         4
    printf("%d\n", sizeof(x));             8
    printf("%d\n", sizeof(*x));            4

    printf("%d\n", sizeof(yptr));          8
    printf("%d\n", sizeof(*yptr));         16
    printf("%d\n", sizeof(yptr[0]));
```

int*, not int[4]

int

int[4]

範例

```
int main() {
    int x[4], y[5][4];
    func(x, x, y, y);
}
```

```
void func(int x[4], int *const xptr,
          int y[5][4], int (*const yptr)[4]) {
    printf("%d\n", sizeof(xptr));
    printf("%d\n", sizeof(*xptr));
    printf("%d\n", sizeof(x));
    printf("%d\n", sizeof(*x));

    printf("%d\n", sizeof(yptr));
    printf("%d\n", sizeof(*yptr));
    printf("%d\n", sizeof(yptr[0]));
```

8
4
8 int*, not int[4]
4 int

8
16 int[4]
16 int[4]

範例

```
int main() {
    int x[4], y[5][4];
    func(x, x, y, y);
}
```

```
void func(int x[4], int *const xptr,
          int y[5][4], int (*const yptr)[4]) {
    printf("%d\n", sizeof(xptr));          8
    printf("%d\n", sizeof(*xptr));         4
    printf("%d\n", sizeof(x));             8     int*, not int[4]
    printf("%d\n", sizeof(*x));            4     int

    printf("%d\n", sizeof(yptr));          8
    printf("%d\n", sizeof(*yptr));         16    int[4]
    printf("%d\n", sizeof(yptr[0]));       16    int[4]

    printf("%d\n", sizeof(y));
```

範例

```
int main() {
    int x[4], y[5][4];
    func(x, x, y, y);
}
```

```
void func(int x[4], int *const xptr,
          int y[5][4], int (*const yptr)[4]) {
    printf("%d\n", sizeof(xptr));
    printf("%d\n", sizeof(*xptr));
    printf("%d\n", sizeof(x));
    printf("%d\n", sizeof(*x));

    printf("%d\n", sizeof(yptr));
    printf("%d\n", sizeof(*yptr));
    printf("%d\n", sizeof(yptr[0]));

    printf("%d\n", sizeof(y));
```

8

4

8 — int*, not int[4]

4 — int

8

16 — int[4]

16 — int[4]

8 — int(*)[4], not int[5][4]

範例

```
int main() {
    int x[4], y[5][4];
    func(x, x, y, y);
}
```

```
void func(int x[4], int *const xptr,
          int y[5][4], int (*const yptr)[4]) {
    printf("%d\n", sizeof(xptr));
    printf("%d\n", sizeof(*xptr));
    printf("%d\n", sizeof(x));
    printf("%d\n", sizeof(*x));

    printf("%d\n", sizeof(yptr));
    printf("%d\n", sizeof(*yptr));
    printf("%d\n", sizeof(yptr[0]));

    printf("%d\n", sizeof(y));
    printf("%d\n", sizeof(*y));
```

8

4

8 — int*, not int[4]

4 — int

8

16 — int[4]

16 — int[4]

8 — int(*)[4], not int[5][4]

範例

```
int main() {
    int x[4], y[5][4];
    func(x, x, y, y);
}
```

```
void func(int x[4], int *const xptr,
          int y[5][4], int (*const yptr)[4]) {
    printf("%d\n", sizeof(xptr));
    printf("%d\n", sizeof(*xptr));
    printf("%d\n", sizeof(x));
    printf("%d\n", sizeof(*x));

    printf("%d\n", sizeof(yptr));
    printf("%d\n", sizeof(*yptr));
    printf("%d\n", sizeof(yptr[0]));

    printf("%d\n", sizeof(y));
    printf("%d\n", sizeof(*y));
```

8
4
8 — int*, not int[4]
4 — int

8
16 — int[4]
16 — int[4]

8 — int(*)[4], not int[5][4]
16 — int[4]

範例

```
int main() {
    int x[4], y[5][4];
    func(x, x, y, y);
}
```

```
void func(int x[4], int *const xptr,
                int y[5][4], int (*const yptr)[4]) {
    printf("%d\n", sizeof(xptr));          8
    printf("%d\n", sizeof(*xptr));         4
    printf("%d\n", sizeof(x));             8      int*, not int[4]
    printf("%d\n", sizeof(*x));            4      int

                                           8
    printf("%d\n", sizeof(yptr));          16     int[4]
    printf("%d\n", sizeof(*yptr));         16     int[4]
    printf("%d\n", sizeof(yptr[0]));

                                           8      int(*)[4], not int[5][4]
    printf("%d\n", sizeof(y));             16     int[4]
    printf("%d\n", sizeof(*y));
    printf("%d\n", sizeof(y[0]));
}
```

範例

```
int main() {
    int x[4], y[5][4];
    func(x, x, y, y);
}
```

```
void func(int x[4], int *const xptr,
                int y[5][4], int (*const yptr)[4]) {
    printf("%d\n", sizeof(xptr));          8
    printf("%d\n", sizeof(*xptr));         4
    printf("%d\n", sizeof(x));             8      int*, not int[4]
    printf("%d\n", sizeof(*x));            4      int

                                           8
    printf("%d\n", sizeof(yptr));          16     int[4]
    printf("%d\n", sizeof(*yptr));         16     int[4]
    printf("%d\n", sizeof(yptr[0]));

                                           8      int(*)[4], not int[5][4]
    printf("%d\n", sizeof(y));             16     int[4]
    printf("%d\n", sizeof(*y));            16     int[4]
    printf("%d\n", sizeof(y[0]));
}
```