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hw0606：

兩者差別在於記憶體分配是否為連續
第一支程式分配的記憶體為連續
第二支程式分配的記憶體為不連續

驗證：

先將兩個程式輸出的部分註解掉

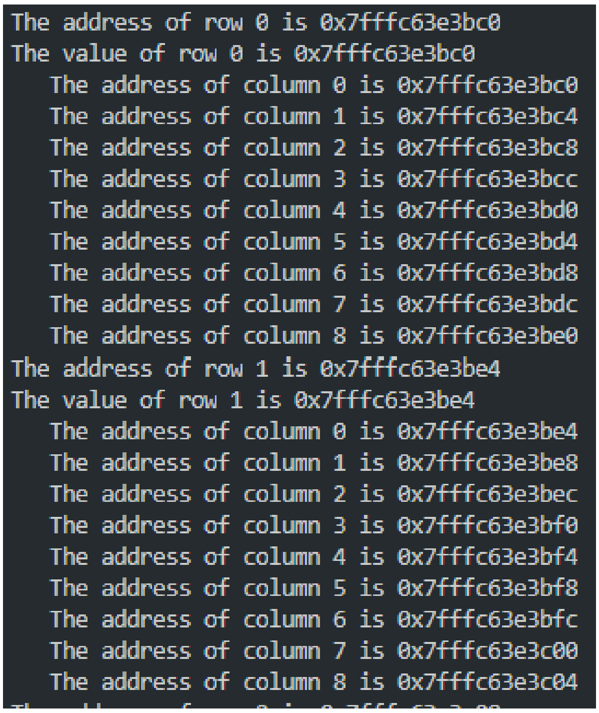
```
    /*for( size_t i = 0 ; i < 9 ; i++ )
    {
        for( size_t j = 0 ; j < 9 ; j++ )
        {
        printf( "%02d ", a[i][j] );
        }

        printf( "\n" );
    }*/
```

再加上下列程式碼

```
    for( size_t i = 0 ; i < 9 ; i++ )
    {
        printf("The address of row %ld is %p\n",i,&a[i]);
        printf("The value of row %ld is %p\n",i,a[i]);
        for( size_t j = 0 ; j < 9 ; j++ )
        {
            printf( "   The address of column %ld is %p\n",j,&a[i][j]);
        }
    }
```

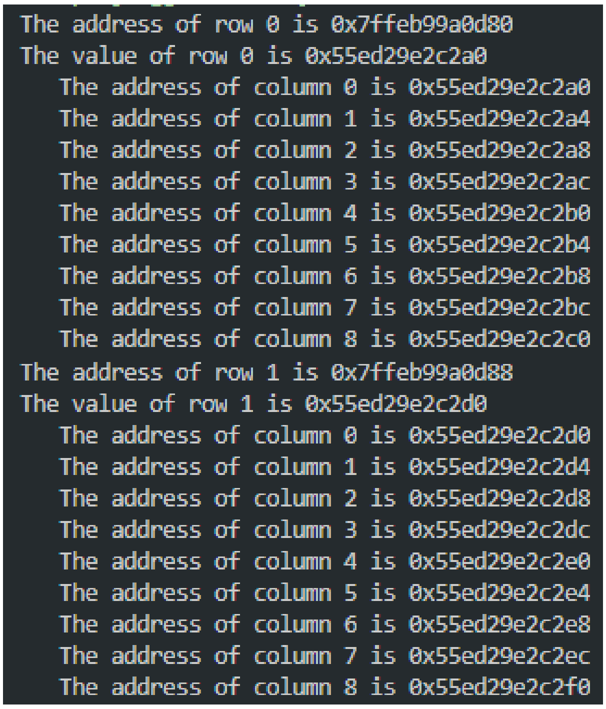
先觀察第一支程式得到的結果
由於輸出內容偏長，在此節錄部分結果



```
The address of row 0 is 0x7fffc63e3bc0
The value of row 0 is 0x7fffc63e3bc0
   The address of column 0 is 0x7fffc63e3bc0
   The address of column 1 is 0x7fffc63e3bc4
   The address of column 2 is 0x7fffc63e3bc8
   The address of column 3 is 0x7fffc63e3bcc
   The address of column 4 is 0x7fffc63e3bd0
   The address of column 5 is 0x7fffc63e3bd4
   The address of column 6 is 0x7fffc63e3bd8
   The address of column 7 is 0x7fffc63e3bdc
   The address of column 8 is 0x7fffc63e3be0
The address of row 1 is 0x7fffc63e3be4
The value of row 1 is 0x7fffc63e3be4
   The address of column 0 is 0x7fffc63e3be4
   The address of column 1 is 0x7fffc63e3be8
   The address of column 2 is 0x7fffc63e3bec
   The address of column 3 is 0x7fffc63e3bf0
   The address of column 4 is 0x7fffc63e3bf4
   The address of column 5 is 0x7fffc63e3bf8
   The address of column 6 is 0x7fffc63e3bfc
   The address of column 7 is 0x7fffc63e3c00
   The address of column 8 is 0x7fffc63e3c04
The address of row 2 is 0x7fffc63e3c08
```

觀察可得：每個記憶體位址皆相差 4bytes，為 int32_t 的大小
因此第一支程式分配到的記憶體為連續

第二支程式的輸出結果節錄：



```
The address of row 0 is 0x7ffeb99a0d80
The value of row 0 is 0x55ed29e2c2a0
   The address of column 0 is 0x55ed29e2c2a0
   The address of column 1 is 0x55ed29e2c2a4
   The address of column 2 is 0x55ed29e2c2a8
   The address of column 3 is 0x55ed29e2c2ac
   The address of column 4 is 0x55ed29e2c2b0
   The address of column 5 is 0x55ed29e2c2b4
   The address of column 6 is 0x55ed29e2c2b8
   The address of column 7 is 0x55ed29e2c2bc
   The address of column 8 is 0x55ed29e2c2c0
The address of row 1 is 0x7ffeb99a0d88
The value of row 1 is 0x55ed29e2c2d0
   The address of column 0 is 0x55ed29e2c2d0
   The address of column 1 is 0x55ed29e2c2d4
   The address of column 2 is 0x55ed29e2c2d8
   The address of column 3 is 0x55ed29e2c2dc
   The address of column 4 is 0x55ed29e2c2e0
   The address of column 5 is 0x55ed29e2c2e4
   The address of column 6 is 0x55ed29e2c2e8
   The address of column 7 is 0x55ed29e2c2ec
   The address of column 8 is 0x55ed29e2c2f0
```

觀察可得：每個 row 的記憶體位址皆相差 8bytes，為 64 位元電腦中指標的大小；每個 column 的記憶體位址皆相差 4bytes，為 int32_t 的大小

觀察程式碼可得知：

起初程式宣告了一個空間為 9 的指標陣列，接著利用迴圈，分配 9 個空間為 9 大小為 int32_t 的記憶體，並將指向每塊記憶體開頭的位址存入指標陣列裡。

由於 malloc 函數所分配的記憶體會在 heap 記憶體區間裡，而函式最初宣告的指標陣列會分配在 stack 區間裡，因此會出現指標陣列每一元素的位址連續，同一 row 裡每個 column 的位址連續，但兩者明顯處於不同的記憶體區間，且彼此也互不連續。