Homework #5 (1)

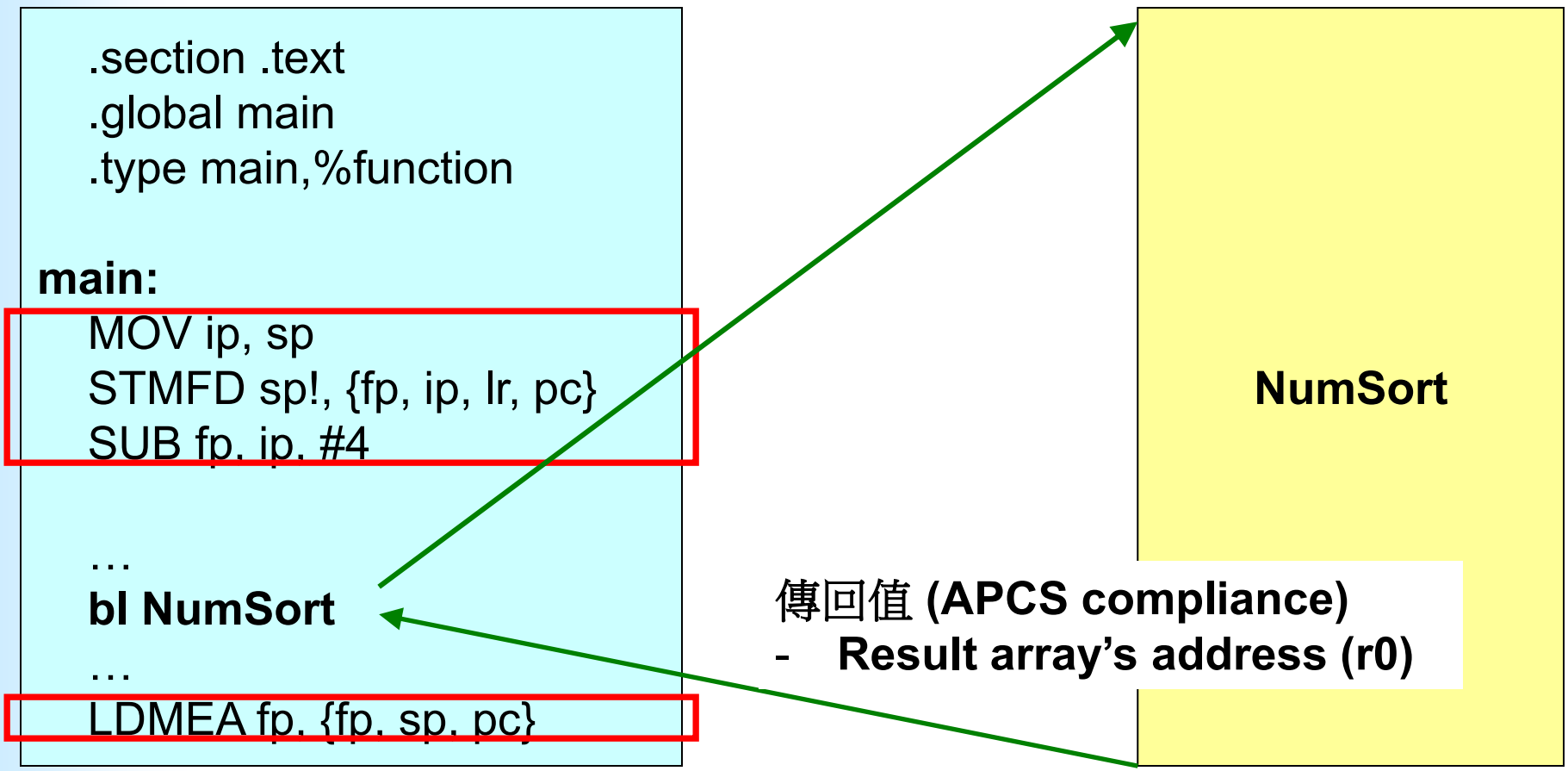
- Write a function called **NumSort** to sort an integer array from the smallest to the biggest.
- APCS compliance
- Two arguments will be passed into your function
  - **Array size**
  - **The address of the first element in array**
- **The result of NumSort**
  - The result array in which each element is sorted from the smallest to the biggest. (原來的integer array裡的值沒有被修改，只是讀取原integer array，排序好的結果存放於**result array**)
- Return value: the address of the result array.

Homework #5 (2)

- Ex: an integer array=[1,10,6,3,20,40,9]
  - Result: **1, 3, 6, 9, 10, 20, 40**
- Ex: an integer array=[12,4,2,45,23,8,50,67]
  - Result: **2, 4, 8, 12, 23, 45, 50, 67**

參數傳遞 (APCS compliance)

- **Array size (r0)**
- **Array address (r1)**



hw5_test.s

```
        .section .text
        .global main
        .type main,%function
main:
        MOV ip, sp
        STMFD sp!, {fp, ip, lr, pc}
        SUB fp, ip, #4

      /* prepare input array */
      …


       /* put array size into r0 */
       /* put array address into r1 */

        bl  NumSort
        /* --- end of your function --- */

        LDMEA fp, {fp, sp, pc}
        .end
```

- array size => r0
- array address => r1

Call **printf()** to print the result array.

Homework #5 (3)

numsort.s

```
.section .text
.global NumSort
.type NumSort,%function

NumSort:
    /* function start */
    STMFD sp!, {r4-r9, fp, ip, lr}

    /* --- begin your function --- */
    /* Get array size from r0 */
    /* Get array address from r1 */

    /* DO NumSort */


    /* put result array's address into r0 */
    /* --- end of your function --- */
    /* function exit */
    LDMFD sp!, {r4-r9, fp, ip, pc}
    .end
```

參數傳遞

Write your function

傳回值

Homework #5 (4)

numsort.s

```
.section .text
.global NumSort
.type NumSort,%function

NumSort:
    /* function start */
    STMFD sp!, {r4-r9, fp, ip, lr}

    /* --- begin your function --- */
    /* Get array size from r0 */
    /* Get array address from r1 */

    /* DO NumSort */

    /* put result array's address into r0 */
    /* --- end of your function --- */
    /* function exit */
    LDMFD sp!, {r4-r9, fp, ip, pc}
    .end
```

- ~~Array size最大為100個elements。~~
- 呼叫**malloc()**，取得result array的記憶體空間與位址

How to Compile Your Program?

- $arm-none-eabi-gcc –g hw5_test.s numsort.s –o hw5.exe

Output

- Ex: an integer array=[1,10,6,3,20,40,9]

輸出畫面範例

Input array: 1, 10, 6, 3, 20, 40, 9

Result array: **1, 3, 6, 9, 10, 20, 40**

Homework #5 (5)

- Program should be assembled and linked by gcc
  - 使用於作業一所安裝完成的cross toolchain.
- Program should be executed under **GDB ARM simulator**
- 程式中應有適當的說明（註解）
- You should turn in to **ECOURSE2**
  - "**README.txt**" file: 文字檔，描述你程式的內容、如何編譯程式、如何執行你的程式
  - Your ARM assembly procedure，**檔名為：numsort.s**
  - An ARM assembly program which uses your NumSort procedure，**檔名為：hw5_test.s**
  - Makefile / any file needed in your work
  - 請將欲繳交的檔案壓縮成 <**hw5_學號.tar.bz2**>，上傳壓縮檔
- **Deadline: December 10 (Friday), 2021**