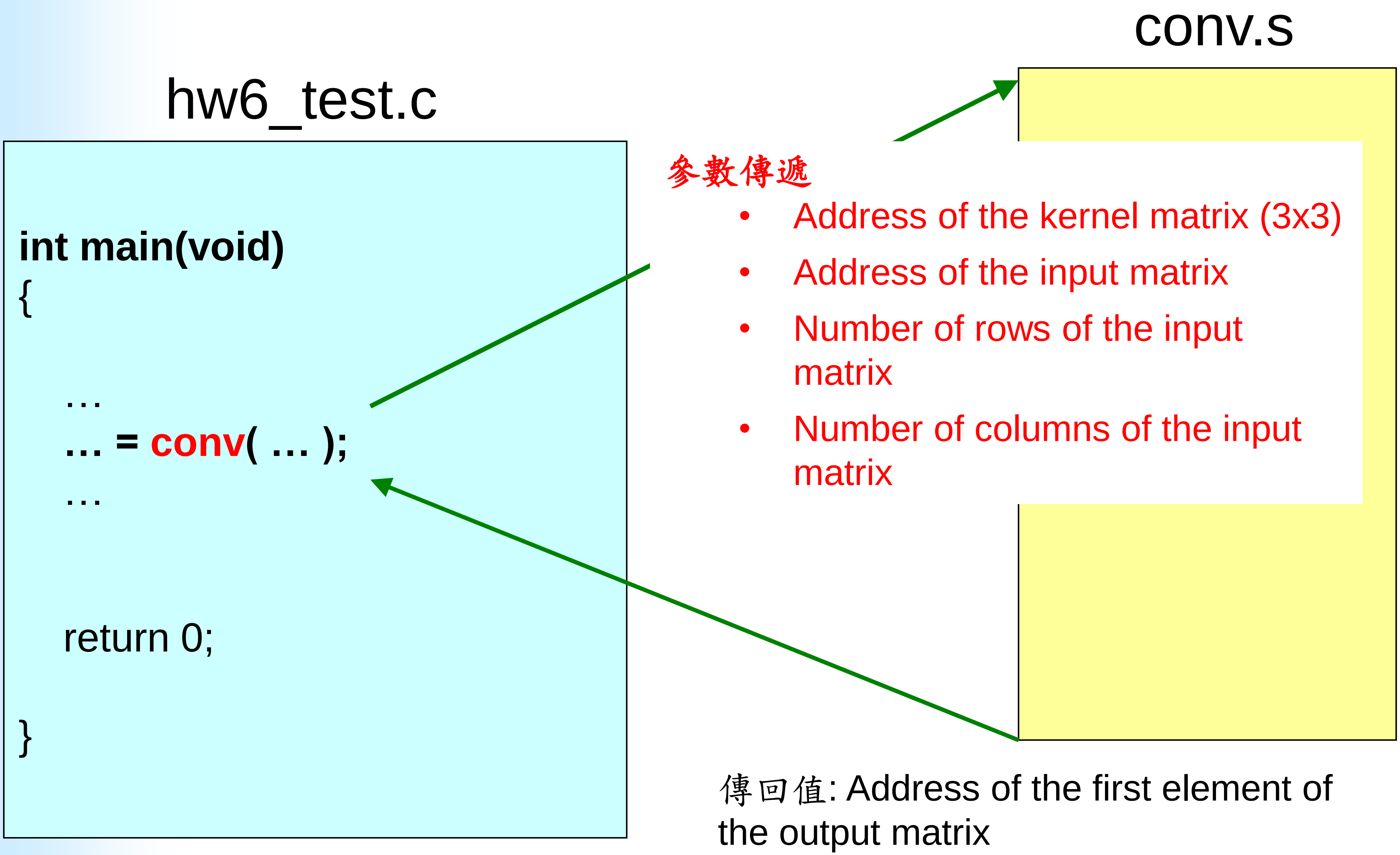
Homework #6 (1)

- Use ARM assembly to write a function called **conv** that does the convolution. **(請參閱作業4)**
- Function **conv**: 4 parameters (遵守APCS規則)
  - Address of the kernel matrix (3x3)
  - Address of the input matrix
  - Number of rows of the input matrix
  - Number of columns of the input matrix
- Function **conv**: return value (遵守APCS規則)
  - Address of the first element of the output matrix

Homework #6 (2)

- input matrix: row>=3, column>=3
- kernel matrix: 3x3
- output matrix: (假設input matrix是nxm)
  - – row: n-3+1
  - – column: m-3+1



conv.s

hw6_test.c

```
int main(void)
{

    …
    … = conv( … );
    …


    return 0;

}
```

參數傳遞

- Address of the kernel matrix (3x3)
- Address of the input matrix
- Number of rows of the input matrix
- Number of columns of the input matrix

傳回值: Address of the first element of the output matrix

hw6_test.c

- 準備input matrix, kernel matrix
- 呼叫conv()
  - Address of the kernel matrix (3x3)
  - Address of the input matrix
  - Number of rows of the input matrix
  - Number of columns of the input matrix
- 輸出output matrix

Homework #6 (3)

conv.s

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

conv:
        /* function start */
        MOV ip, sp
        STMFD sp!, {r4-r10, fp, ip, lr, pc}
        SUB fp, ip, #4

        /* --- begin your function --- */
        /* 傳入值會放在r0, r1, r2, r3 */

        /* 計算 output matrix 的大小 */
        /* call malloc() for memory space of the output matrix */

        /* DO convolution */

        /* 把傳回值 (output的位址) 放在r0 */
        /* --- end of your function --- */
        /* function exit */
        LDMEA fp, {r4-r10, fp, sp, pc}
        .end
```

請留意callee saved registers

參數傳遞

Do convolution

Homework #6 (4)

conv.s

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

conv:
        /* function start */
        MOV ip, sp
        STMFD sp!, {r4-r10, fp, ip, lr, pc}
        SUB fp, ip, #4
```

請留意callee saved registers

中間的程式碼不應該使用**r11~r15**暫存器

```
        /* --- end of your function --- */
        /* function exit */
        LDMEA fp, {r4-r10, fp, sp, pc}
        .end
```

How to Compile Your Program?

```
$ arm-none-eabi-gcc -g -O0 hw6_test.c conv.s -o hw6.exe
```

Homework #6 (5)

- Program should be assembled and linked by gcc
  - 使用於作業一所安裝完成的cross compiler與cross binutils
- 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 **ECOURSE**
  - “**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：conv.s**
  - A C program which uses your conv function，**檔名為：hw6_test.c**
  - Makefile
  - Any file needed in your work
- **Deadline: December 15 (Sunday), 24:00, 2019**