

# Example:

# Matrix Multiplication

# Example (1)

```
/* ===== */
/*      DATA section      */
/* ===== */

.data

/* --- variable a --- */
.type a, %object
a:
    .word 1
    .word 2

/* --- variable b --- */
.type b, %object
b:
    .word 3

/* --- variable c --- */
.type c, %object
c:
    .space 8, 0
```

$$a = \begin{bmatrix} 1 & 2 \end{bmatrix}$$

$$b = \begin{bmatrix} 3 \end{bmatrix}$$

$$c = b \times a$$

$$c = \begin{bmatrix} ? & ? \end{bmatrix}$$

# Example (1)

```
/* ===== */
/*      DATA section      */
/* ===== */

.data

/* --- variable a --- */
a:
    .word 1
    .word 2

/* --- variable b --- */
b:
    .word 3

/* --- variable b --- */
c:
    .space 8, 0
```

$$a = \begin{bmatrix} 1 & 2 \end{bmatrix}$$

$$b = \begin{bmatrix} 3 \end{bmatrix}$$

$$c = b \times a$$

$$c = \begin{bmatrix} ? & ? \end{bmatrix}$$

```

/* ===== */
/*          DATA section          */
/* ===== */

.data

/* --- variable a --- */
a:
    .word 1
    .word 2

/* --- variable b --- */
b:
    .word 3

/* --- variable b --- */
c:
    .space 8, 0

```

```

/* ===== */
/*          TEXT section          */
/* ===== */

.section .text
.global main
.type main,%function

.matrix:
    .word a
    .word b
    .word c

main:
    ldr r0, .matrix
    ldr r1, [r0], #4

    ...

```

# Linker幫忙把位址填好

```
/* ===== */
/*      DATA section      */
/* ===== */

.data

/* --- variable a --- */
a:
    .word 1
    .word 2

/* --- variable b --- */
b:
    .word 3

/* --- variable b --- */
c:
    .space 8, 0
```

```
/* ===== */
/*      TEXT section      */
/* ===== */

.section .text
.global main
.type main,%function

.matrix:
    .word a
    .word b
    .word c

main:
    ldr r0, .matrix
    ldr r1, [r0], #4

...
```

```

/* ===== */
/*      DATA section      */
/* ===== */

.data

/* --- variable a --- */
0x100
.word 1
.word 2

/* --- variable b --- */
0x108
.word 3

/* --- variable b --- */
0x10c
.space 8, 0

```

```

/* ===== */
/*      TEXT section      */
/* ===== */

.section .text
.global main
.type main,%function

.matrix:
0x100 /* .word */
0x108 /* .word */
0x10c /* .word */

main:

ldr r0, .matrix
ldr r1, [r0], #4

...

```

## Example (2)

```
/* ===== */
/*      TEXT section      */
/* ===== */
```

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

```
.matrix:
```

```
.word a
.word b
.word c
```

```
main:
```

```
ldr r0, .matrix
ldr r1, [r0], #4    /* r1 := mem32[r0] */
/* r0 := r0 + 4    */
```

```
ldr r2, [r0]
```

```
ldr r0, .matrix + 4
ldr r3, [r0]        /* r3 := mem32[r0] */
```

```
ldr r4, .matrix + 8
```

```
mul r5, r3, r1
mul r6, r3, r2
```

```
str r5, [r4], #4    /* mem32[r4] := r5 */
/* r4 := r4 + 4    */
```

```
str r6, [r4]
nop
```

抓到a的地址，放入r0

抓到第一个a的值

抓到第二个a的值

## Example (2)

```
/* ===== */
/*          TEXT section          */
/* ===== */
```

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

```
.matrix:
```

```
.word a
.word b
.word c
```

```
main:
```

```
ldr r0, .matrix
ldr r1, [r0], #4    /* r1 := mem32[r0] */
                   /* r0 := r0 + 4 */
ldr r2, [r0]
```

```
ldr r0, .matrix + 4
ldr r3, [r0]        /* r3 := mem32[r0] */
```

```
ldr r4, .matrix + 8
```

```
mul r5, r3, r1
mul r6, r3, r2
```

```
str r5, [r4], #4    /* mem32[r4] := r5 */
                   /* r4 := r4 + 4 */
```

```
str r6, [r4]
nop
```

抓到b的地址，放入r0

抓到第一个b的值

抓到c的地址，放入r4



## Example (2)

```
/* ===== */
/*      TEXT section      */
/* ===== */
```

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

```
.matrix:
```

```
.word a
.word b
.word c
```

```
main:
```

```
ldr r0, .matrix
ldr r1, [r0], #4    /* r1 := mem32[r0] */
/* r0 := r0 + 4    */
```

```
ldr r2, [r0]
```

```
ldr r0, .matrix + 4
ldr r3, [r0]        /* r3 := mem32[r0] */
```

```
ldr r4, .matrix + 8
```

```
mul r5, r3, r1
mul r6, r3, r2
```

```
str r5, [r4], #4    /* mem32[r4] := r5 */
/* r4 := r4 + 4    */
```

```
str r6, [r4]
```

```
nop
```

將結果存入第一個c的位置

將結果存入第二個c的位置