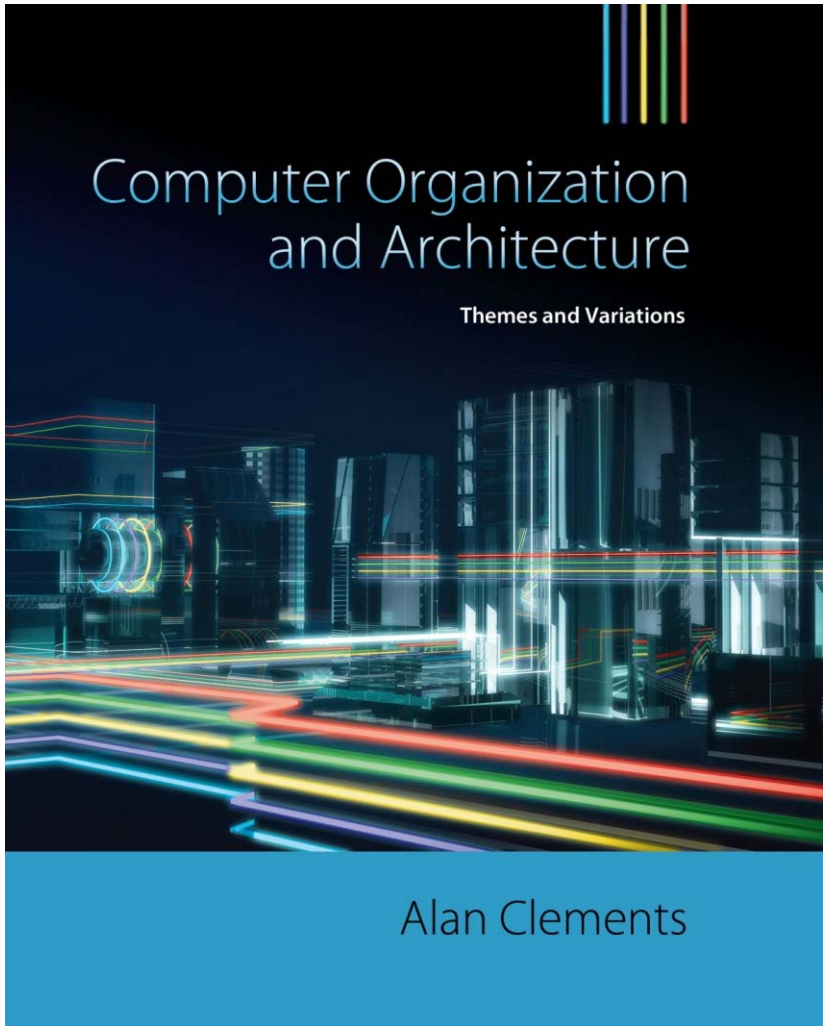
Part 0xD

Chapter 3

Architecture and Organization



CENGAGE Learning

Block Move Instructions Encoding/Decoding

FIGURE 3.58 Encoding ARM's block move instructions

0 0 Data processing instructions

0 1 LDR / STR instructions

1 0 0 LDM / STM instructions

1 0 1 B / BL instructions

Base register

Data direction (**L**oad/store)
0 = store in memory
1 = load into register

Pointer update (**W**rite-back)
0 = don't write back adjusted pointer
1 = write back adjusted pointer

Restore PSR
0 = don't load PRS or force user mode
1 = load PSR or force user mode

Pointer direction (**U**p/down)
0 = decrement pointer
1 = increment pointer

Pointer adjust (**P**re-post-increment)
0 = post operation: use pointer then adjust
1 = pre operation: adjust pointer then use pointer

PSR means Processor Status Register

During this course, it will always be 0

Should be "Pre-post-update"

Block Move Instructions Encoding Example

ARM Instruction: STMFD **r13!,{r0-r4,r10}**

Condition = 1110 (always – unconditional)

P = 1 (**DB**: adjust pointer then use pointer)

U = 0 (**DB**: decrement)

S = 0 (user mode)

W = 1 (write-back adjusted pointer)

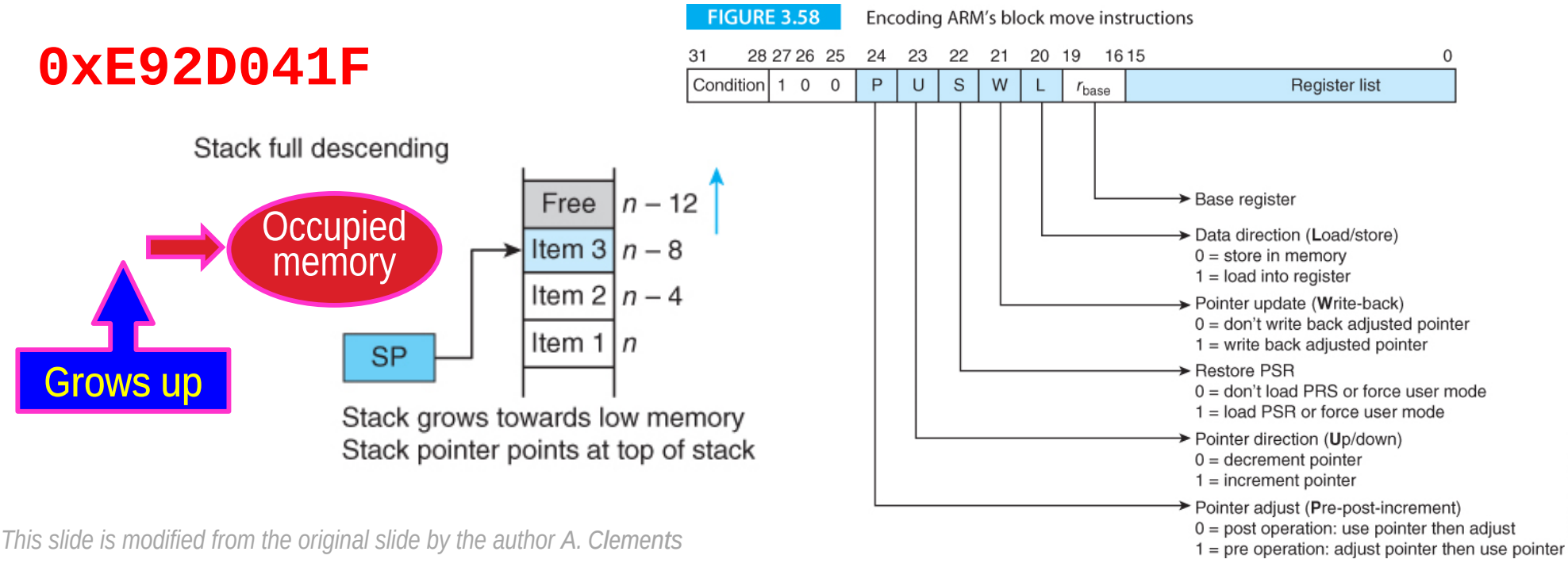
L = 0 (store)

r_{base} = 1101 (r13)

Register list (r15, r14, …., r2, r1, r0) = 0000 0100 0001 1111

1110 1001 0010 1101 0000 0100 0001 1111

0xE92D041F



Block Move Instructions Encoding Example

ARM Instruction: `LDMFD r13!,{r0-r4,r10}`

Condition = 1110 (always – unconditional)

P = 0 (IA: use pointer then adjust)

U = 1 (IA: increment)

S = 0 (user mode)

W = 1 (write-back adjusted pointer)

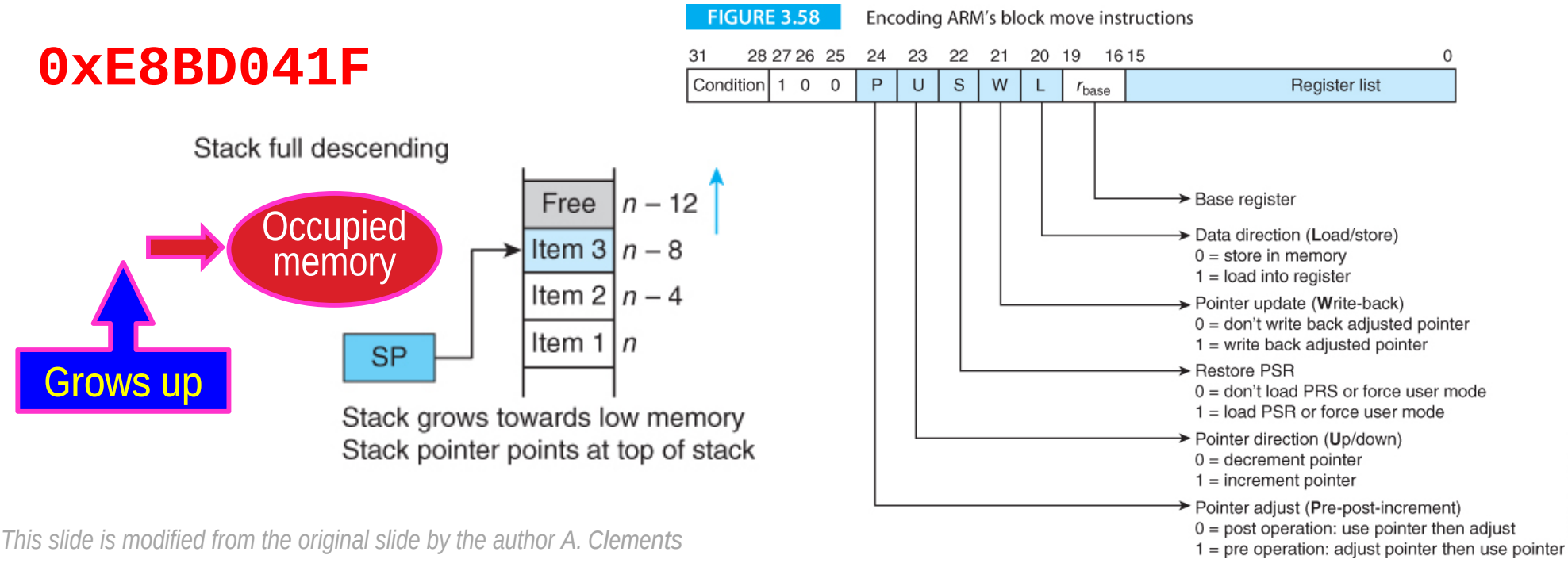
L = 1 (load)

r_{base} = 1101 (r13)

Register list (r15, r14, …., r2, r1, r0) = 0000 0100 0001 1111

1110 1000 1011 1101 0000 0100 0001 1111

0xE8BD041F



Block Move Instructions Decoding Example

Decode the ARM machine language **0x08855555**

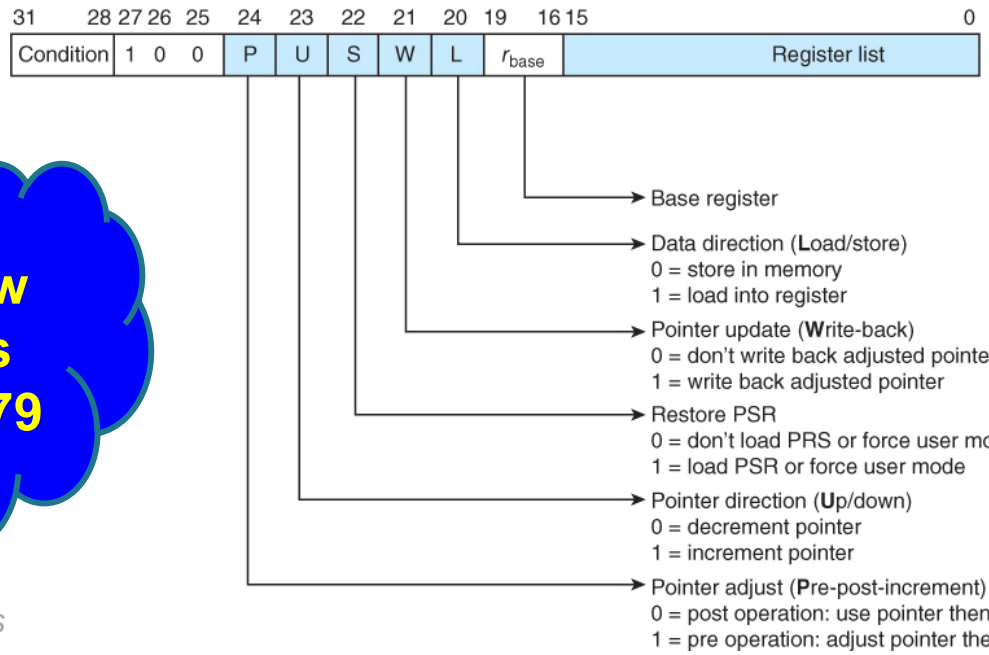
```
    0000 1000 1000 0101 0101 0101 0101 0101
Condition = 0000 (EQ)
    P = 0 (IA: use pointer then adjust)
    U = 1 (IA: increment)
    S = 0 (user mode)
    W = 0 (do not write-back adjusted pointer)
    L = 0 (store)
    r_base = 0101 (r5)
    Register list (r15, r14, ...., r2, r1, r0) = 0101 0101 0101 0101
```

ARM Instruction: `STMEQIA r5,{r0,r2,r4,r6,r8,r10,r12,r14}`

It can also be
STMIAEQ
STMEQEA
STMEAEQ

Review slides 177--179

FIGURE 3.58 Encoding ARM's block move instructions



Block Move Instructions Decoding Example

Decode the ARM machine language **0x99922222**

1001 1001 1001 0010 0010 0010 0010 0010

Condition = 1001 (LS)

P = 1 (IB: adjust pointer then use pointer)

U = 1 (IB: increment)

S = 0 (user mode)

W = 0 (do not write-back adjusted pointer)

L = 1 (load)

r_{base} = 0010 (r2)

Register list (r15, r14, …., r2, r1, r0) = 0010 0010 0010 0010

ARM Instruction: LDMLSIB **r2**,{r1,r5,r9,r13}

It can also be
LDMIBLS
LDMLSED
LDMEDLS

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FIGURE 3.58 Encoding ARM's block move instructions