

ECE 220

Lecture x0000 - 01/16

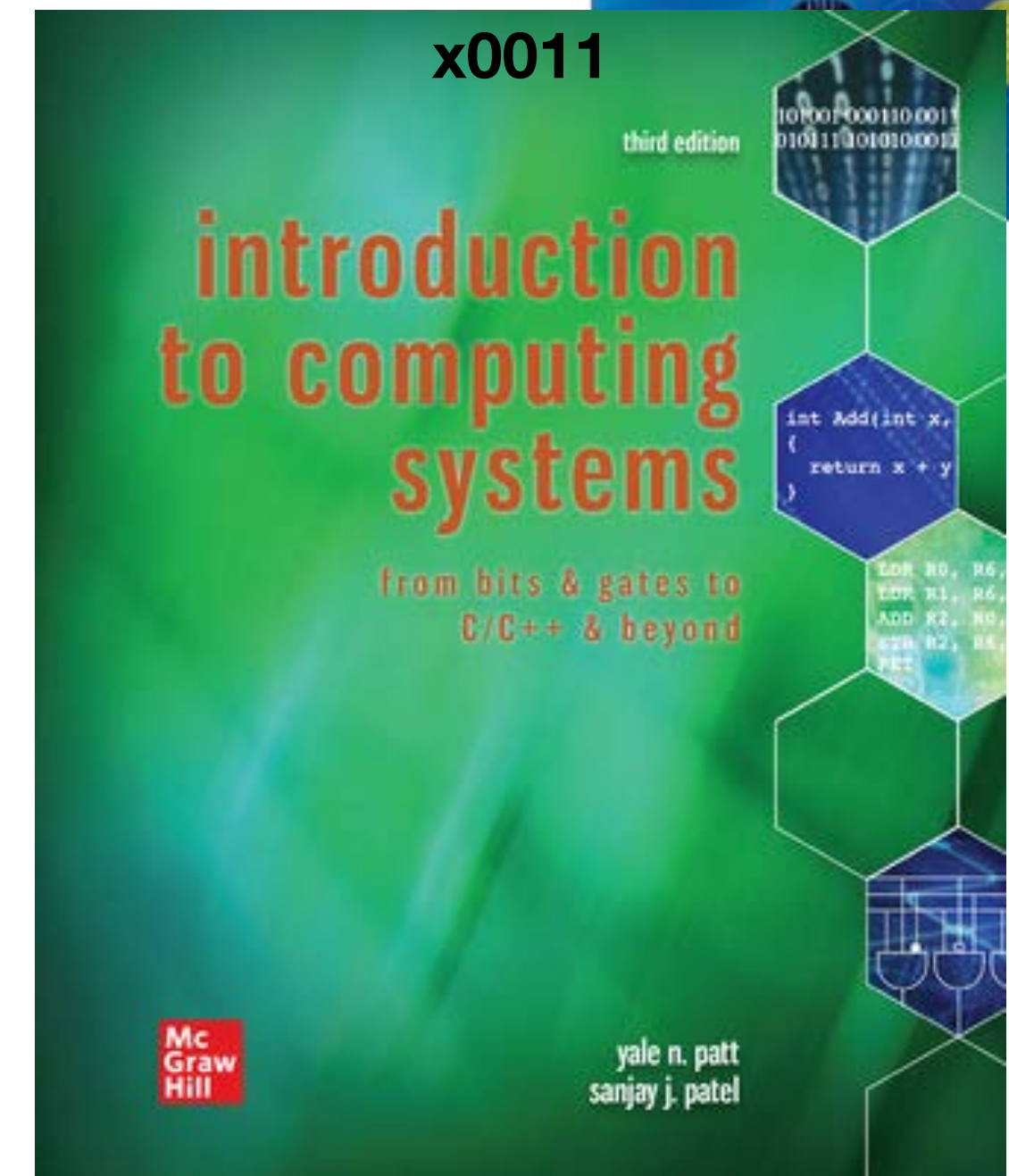
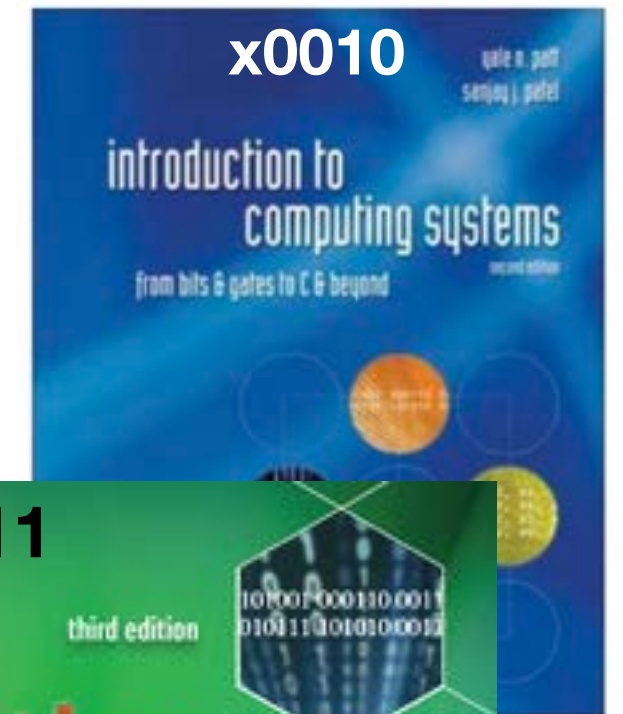
Slides based on material by: Yuting Chen, Yih-Chun Hu & Ujjal Bhowmik

Course logistics

- Lectures: Tuesdays & Thursday
 - Three sections offered by different instructors
 - Prof. T. Moon (1100, BL2), Prof. U. Bhowmik (1230, BL) and **this one** (1500, BL3).
- Labs: Fridays
 - Starts on the hour, every hour from 0800 hrs until 1750 hrs
- Office hours: Schedule posted to website

Course logistics

- Course Website (and syllabus)
- Grading: Gradescope + autograder
- Discussions: EdStem
- Quizzes: CBTF
- Machine problems (MPs): Github
- Textbook: Patt & Patel (3rd Ed)



Course logistics

- MPs: 12 in total, lowest dropped
- Quizzes (in-person in CBTF): 6 total, lowest dropped
- Exams (in-person, on-paper): 02/15 and 03/28
- Labs: make up points lost on MPs

Group	Weight
Labs	0%
Machine Problems	15%
Midterms	40%
Final Exam	25%
Quizzes	20%
Total	100%

Syllabus

Lecture x0000

Computation

Von Neumann model

- Five major components:
 1. Memory
 2. Input
 3. Output
 4. Processing unit
 5. Control unit

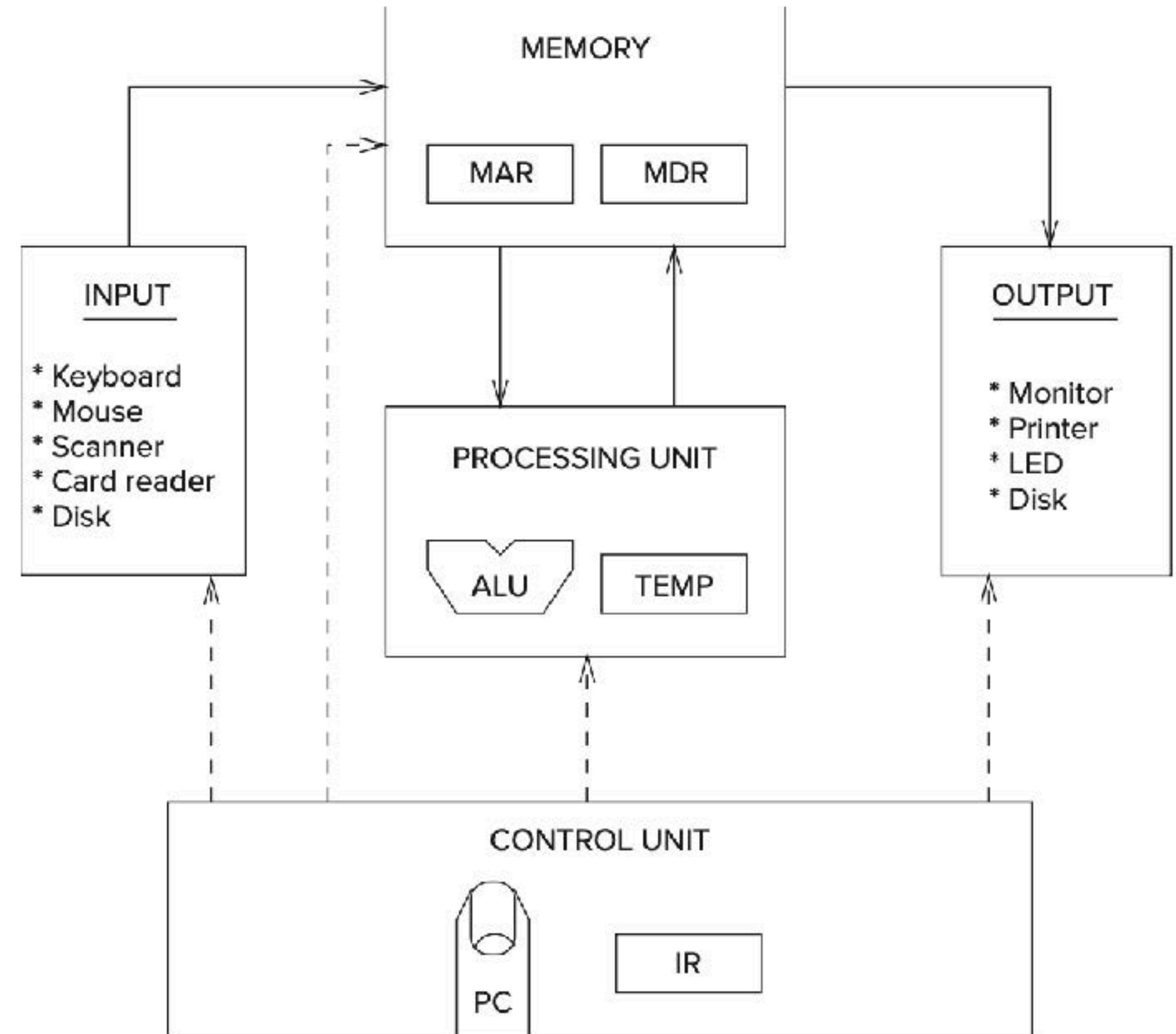


Figure 4.1 - P&P 3rd Ed.

LC3 Review

- Eight GPRs - denoted `R0`, `R1`, ..., `R7`
- Data type: 16-bit 2's complement integers
- Addressing: Locations `x0000` - `xFFFF` contain 16 bits each
- Addressing modes:
 - Immediate, register, PC-relative, base + offset, indirect

LC3 - Review

Instruction set

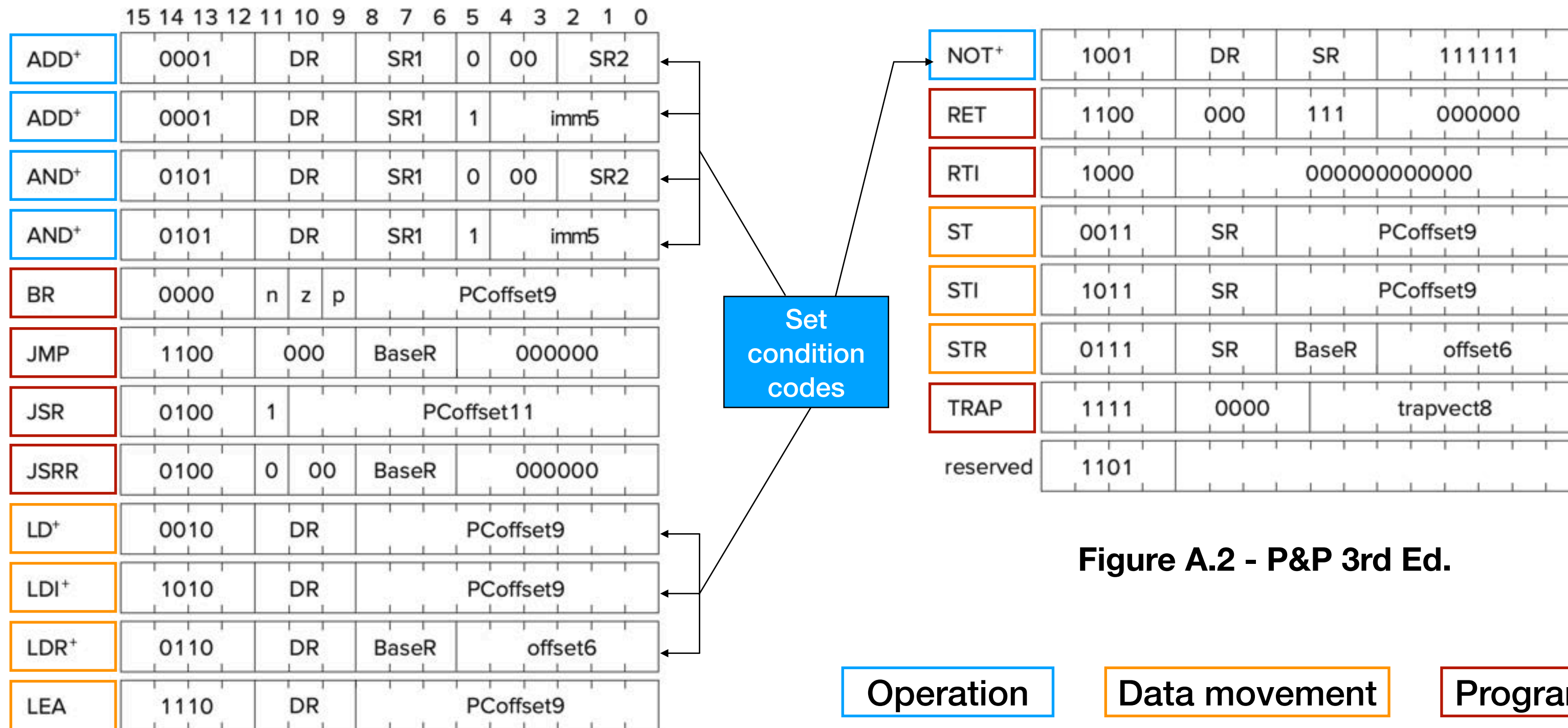


Figure A.2 - P&P 3rd Ed.

Exercise

```
.ORIG x3000
LD  R1, LABEL
LDI R2, LABEL
LDR R3, R2, #1
LEA R4, LABEL
LABEL .FILL x4001
.END
```

What are the values of R1, R2, R3 & R4 at each step?

Assume

```
; x4001 x6001
; .....
; x6001 x7001
; x6002 x7002
```

Exercise

- Write a program to perform the multiplication 5×4 .

LC3 - Review

Pseudo-ops

- Looks like instruction but the “opcode” starts with a dot.
- Assembler instructions/directives that make our lives easier.

<i>Opcode</i>	<i>Operand</i>	<i>Meaning</i>
.ORIG	address	Starting address of program
.END		End of program
.BLKW	n	Allocate n words of storage
.STRINGZ	n-character string	Allocate n+1 locations, initialize with characters and null terminator

LC3 - Review

Microarchitecture

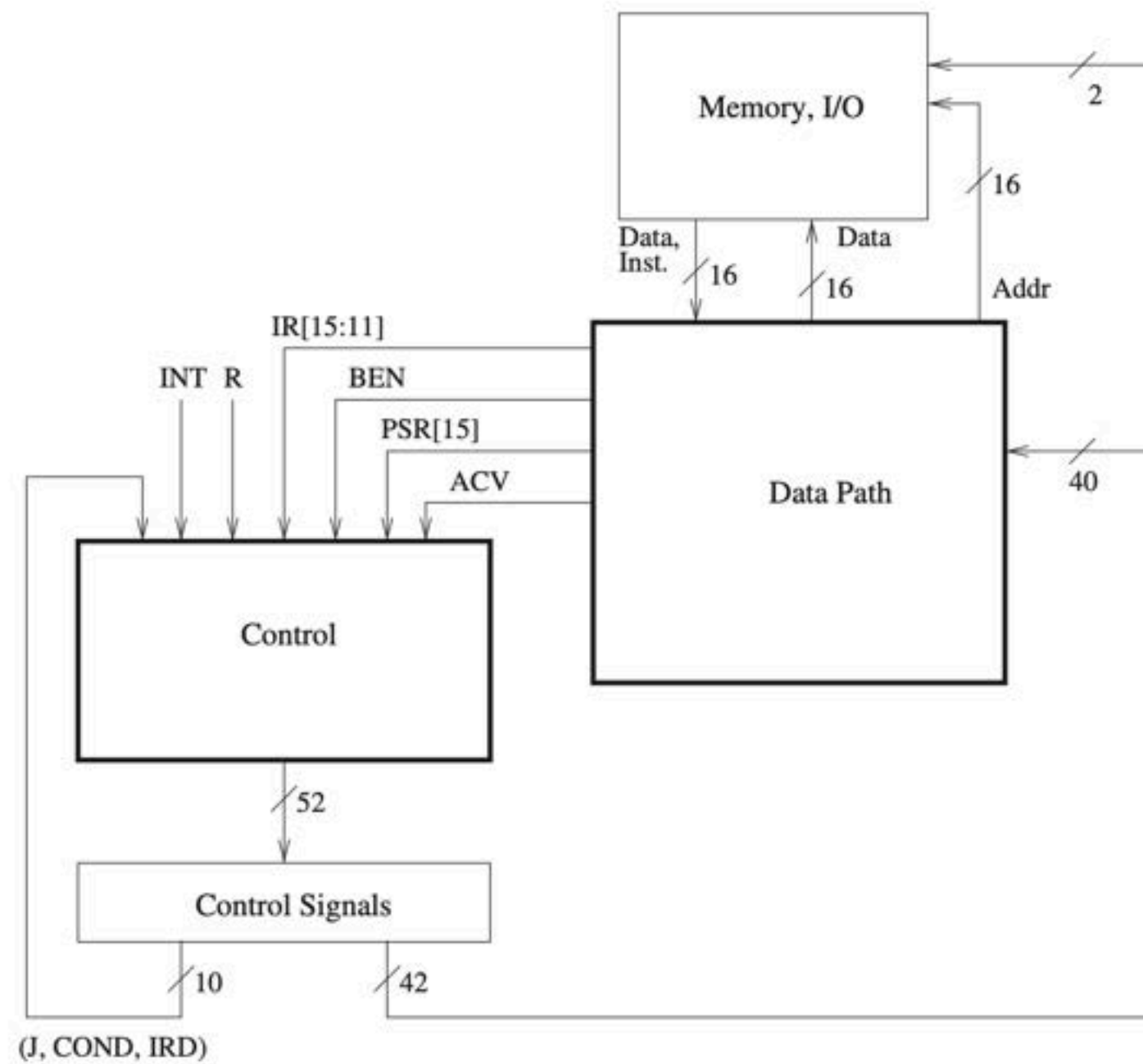


Figure C.1 - P&P 3rd Ed.

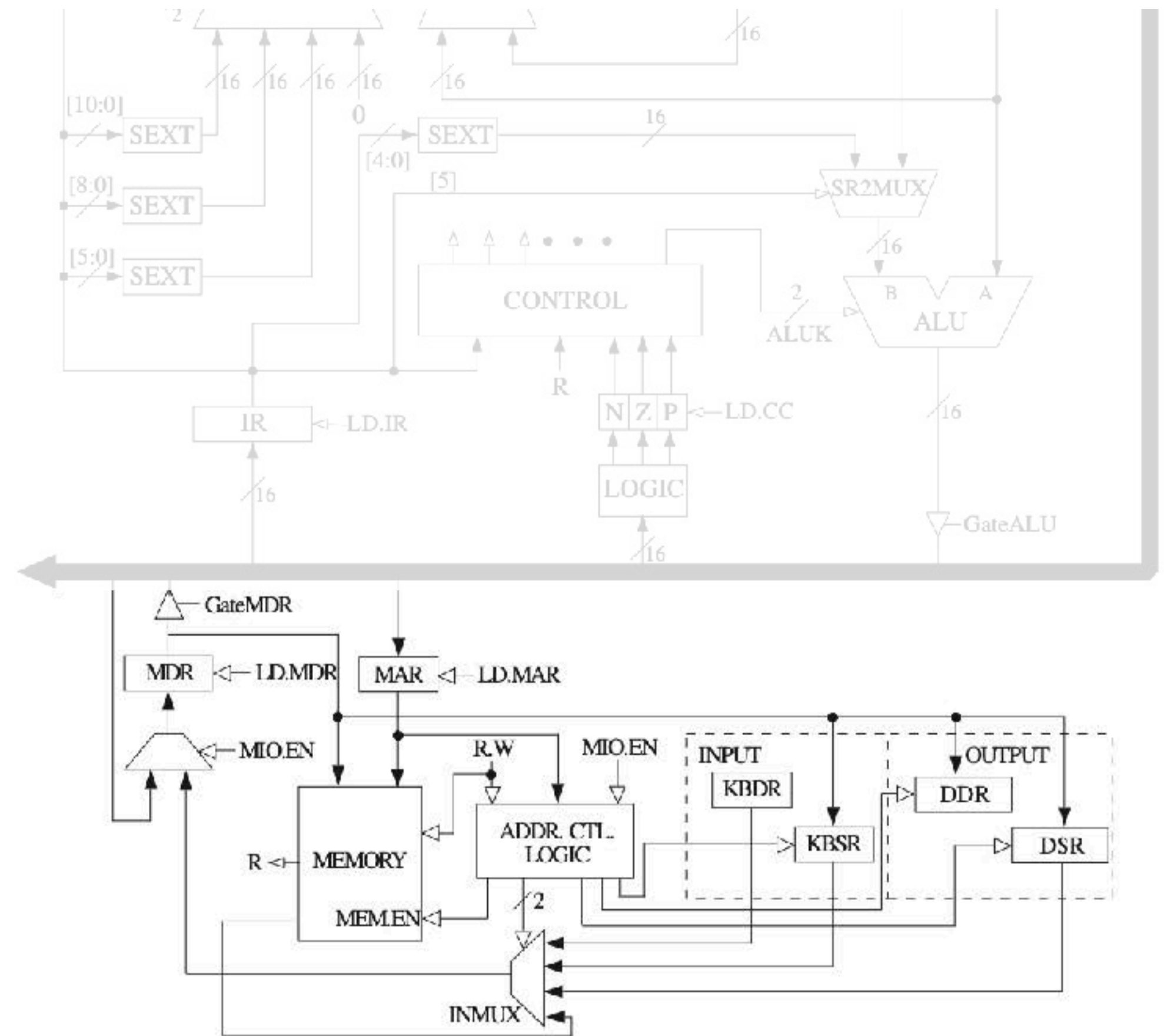


Figure C.3 - P&P 3rd Ed.