

15.561

Information Technology Essentials

Thomas Malone

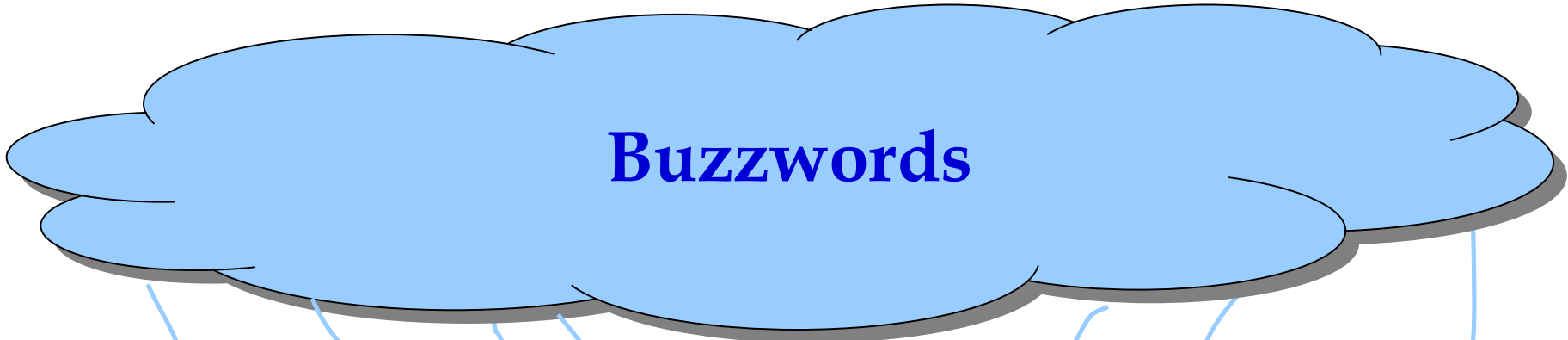
Acknowledgments:

Slides marked "SM" are adapted from Stuart Madnick, MIT.

Slides marked "CD" are adapted from Chris Dellarocas, U. Md.

Why bother?

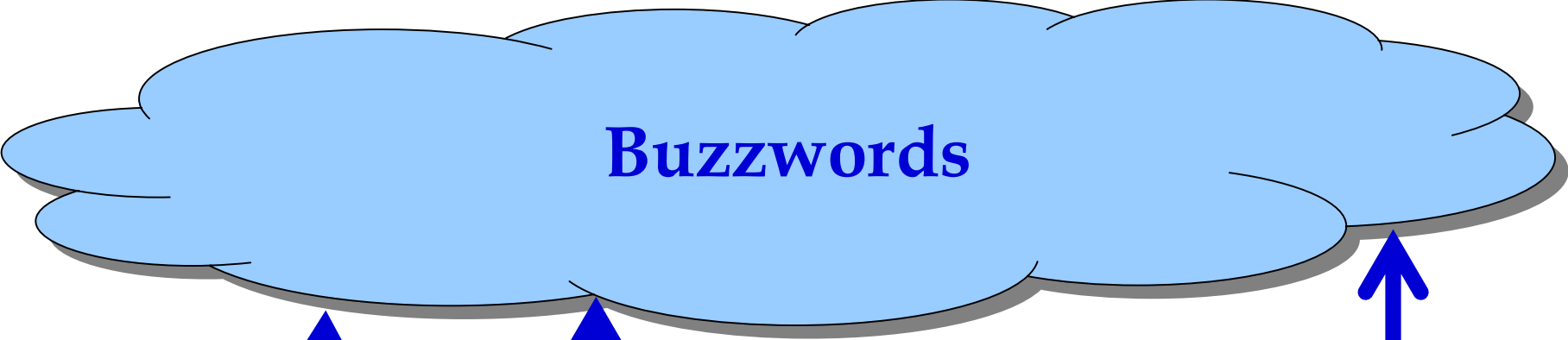
- **Why should you, as a manager, care about information technology?**



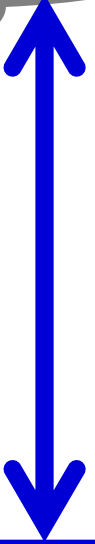
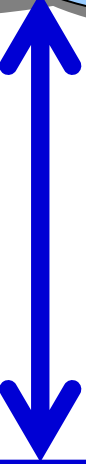
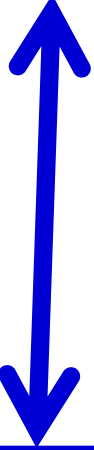
Buzzwords



????????????????????????????????????



Buzzwords



Technological reality

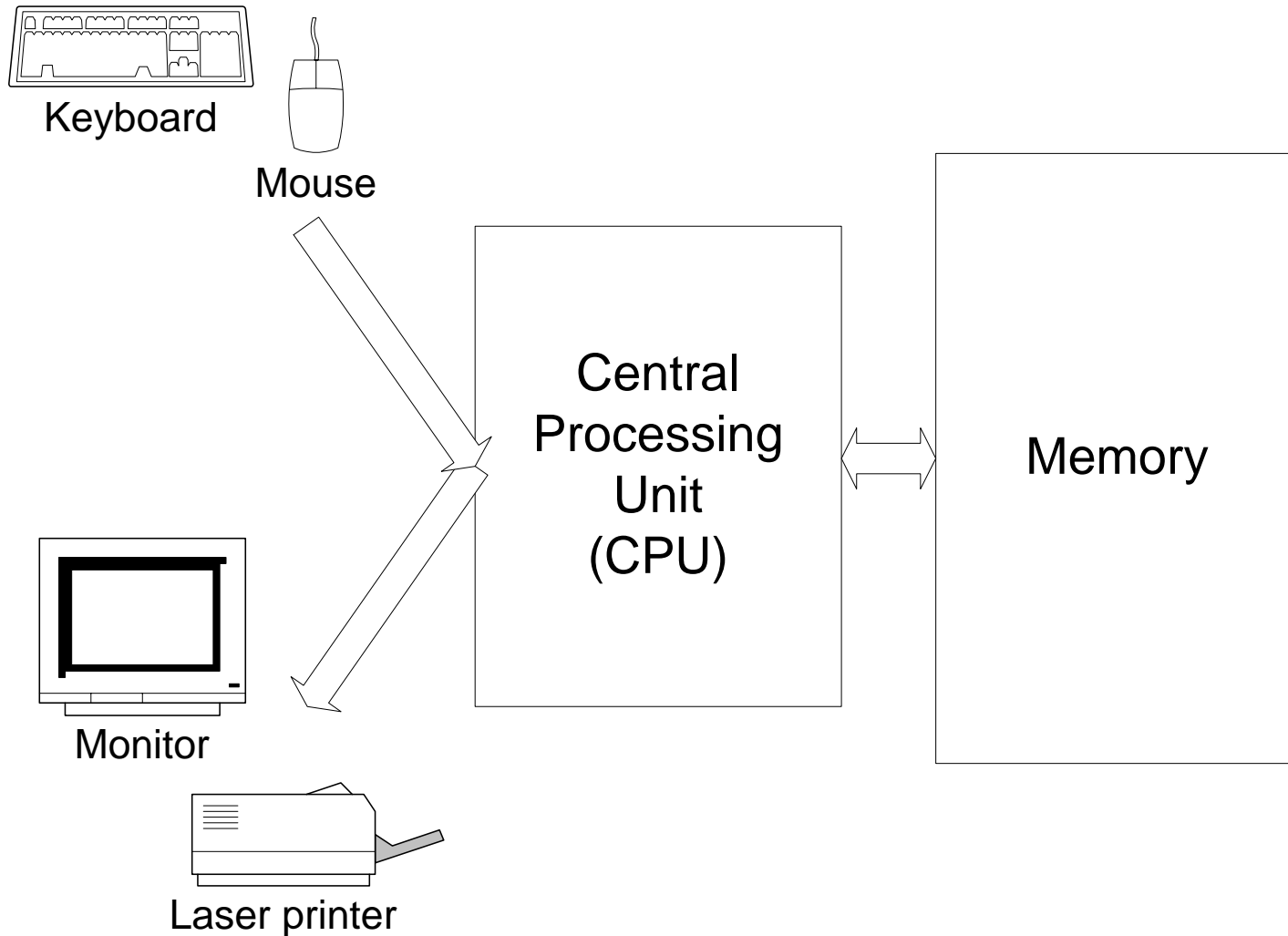
Main Course Objectives

- **Become comfortable with the technologies that are shaping business today**
- **Acquire tools that will help you assess technological trends long after you have left Sloan**

Course overview

- **Technology**
- **Applications of Technology**

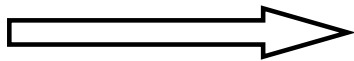
A Typical Computer



A Simplified Computer

INPUT/OUTPUT

INPUT CONVEYOR



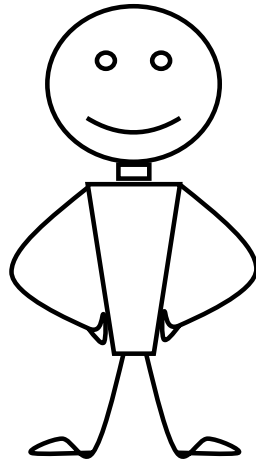
+030

+400

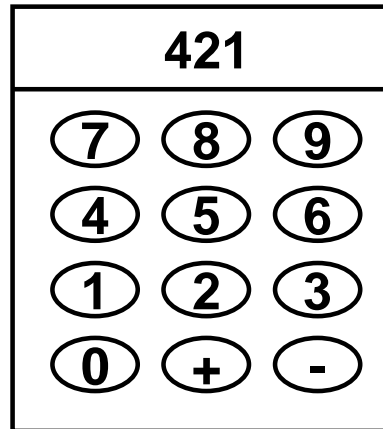


OUTPUT
CONVEYOR

PROCESSOR



LITTLE
MAN

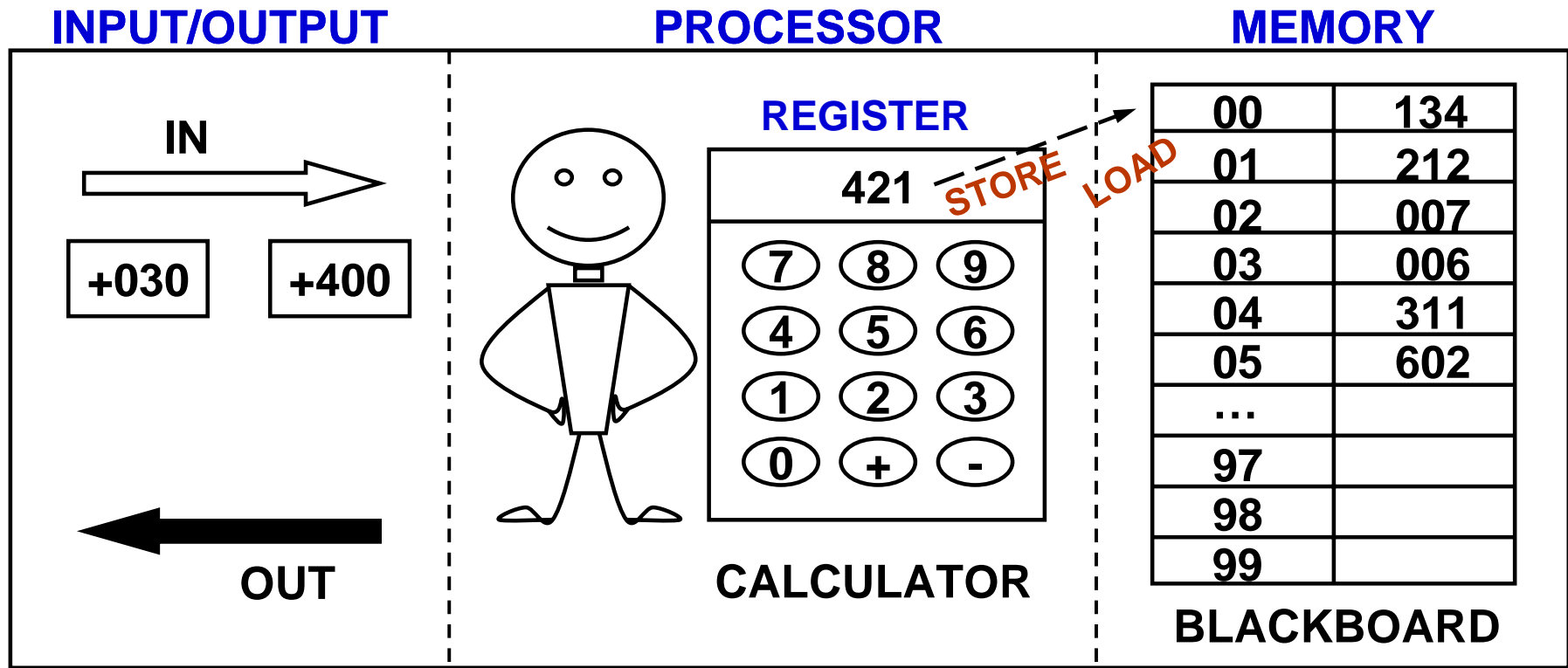


CALCULATOR

MEMORY

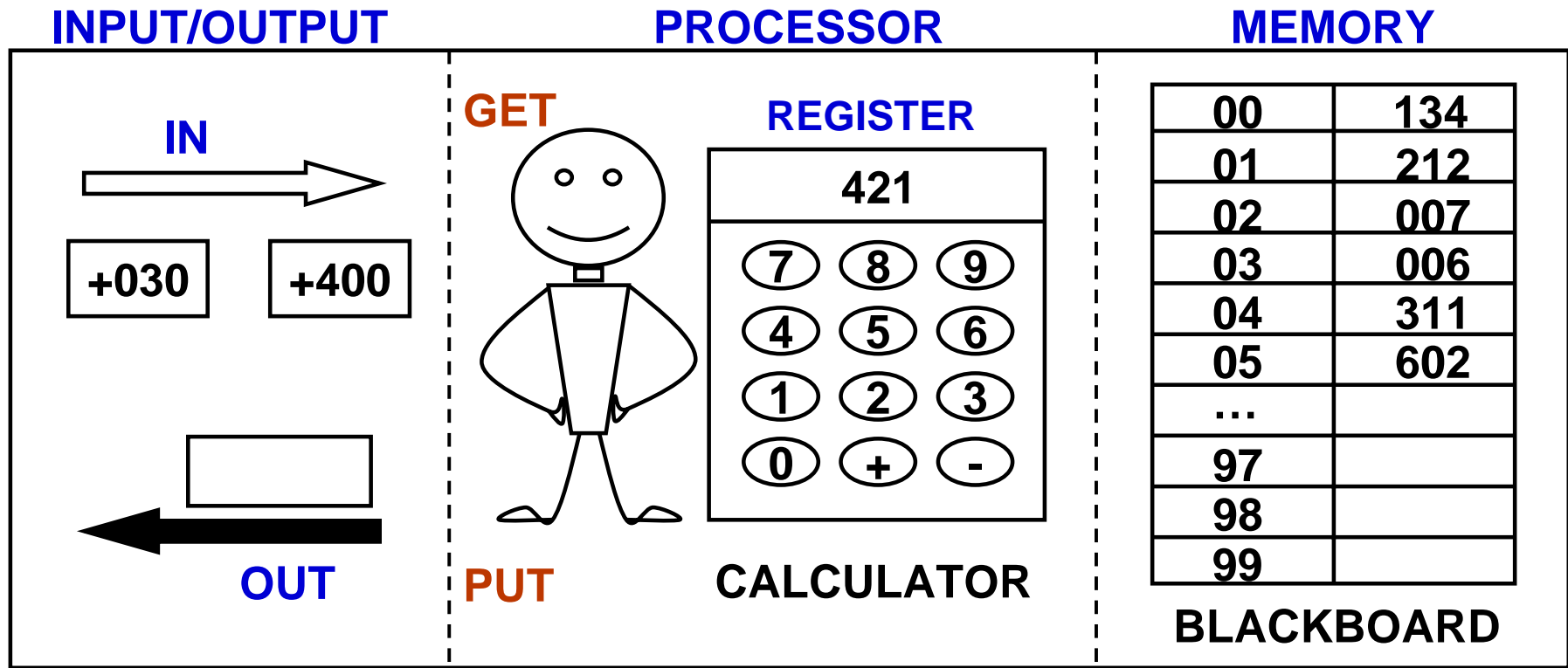
00	134
01	212
02	007
03	006
04	311
05	602
...	
97	
98	
99	

BLACKBOARD



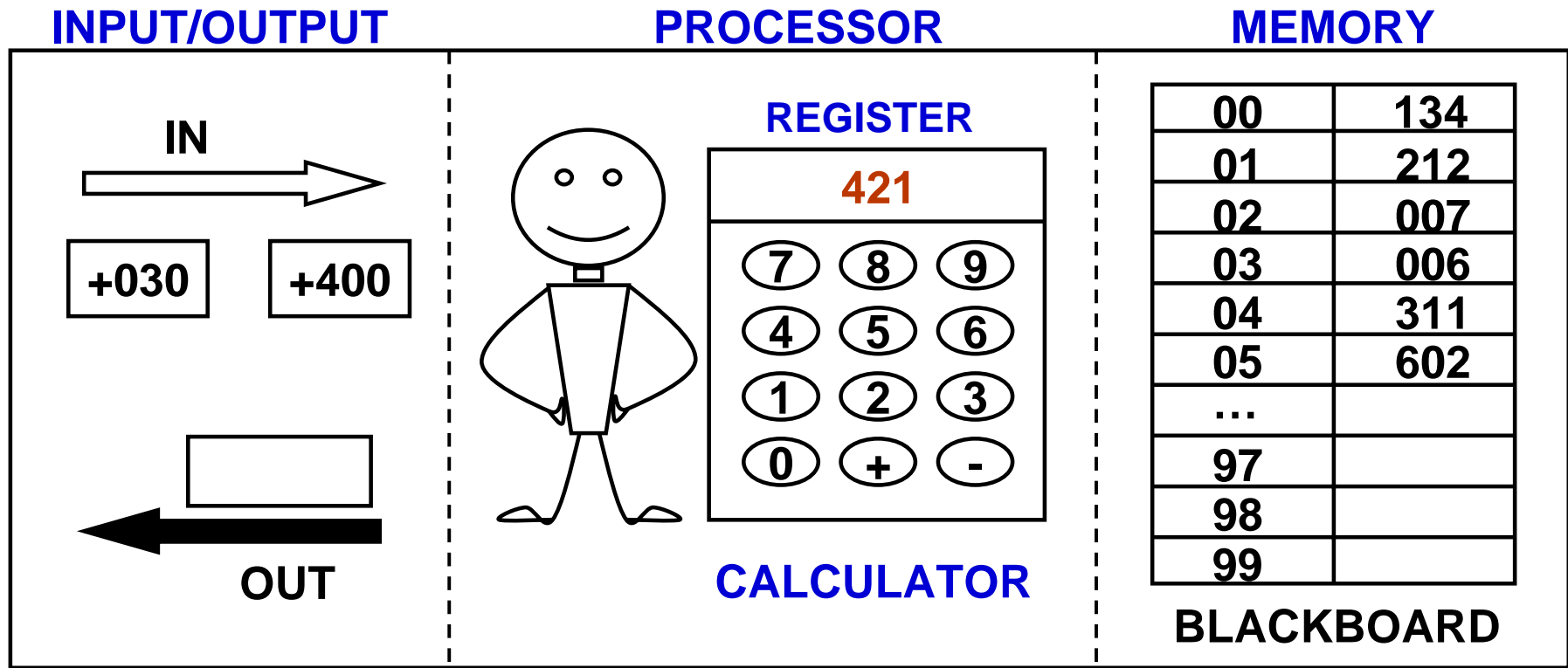
MEMORY

- There are 100 “locations” on the blackboard
- Each location identified by number from 00 to 99
- Each location has room for one 3-digit number
- Load moves number from blackboard to register. Example: LOAD 01
- Store moves number from register to blackboard. Example: STORE 00



INPUT/OUTPUT

- Input and Output conveyors hold 3-digit numbers
- GET moves number from INPUT to REGISTER
- PUT moves number from REGISTER to OUTPUT



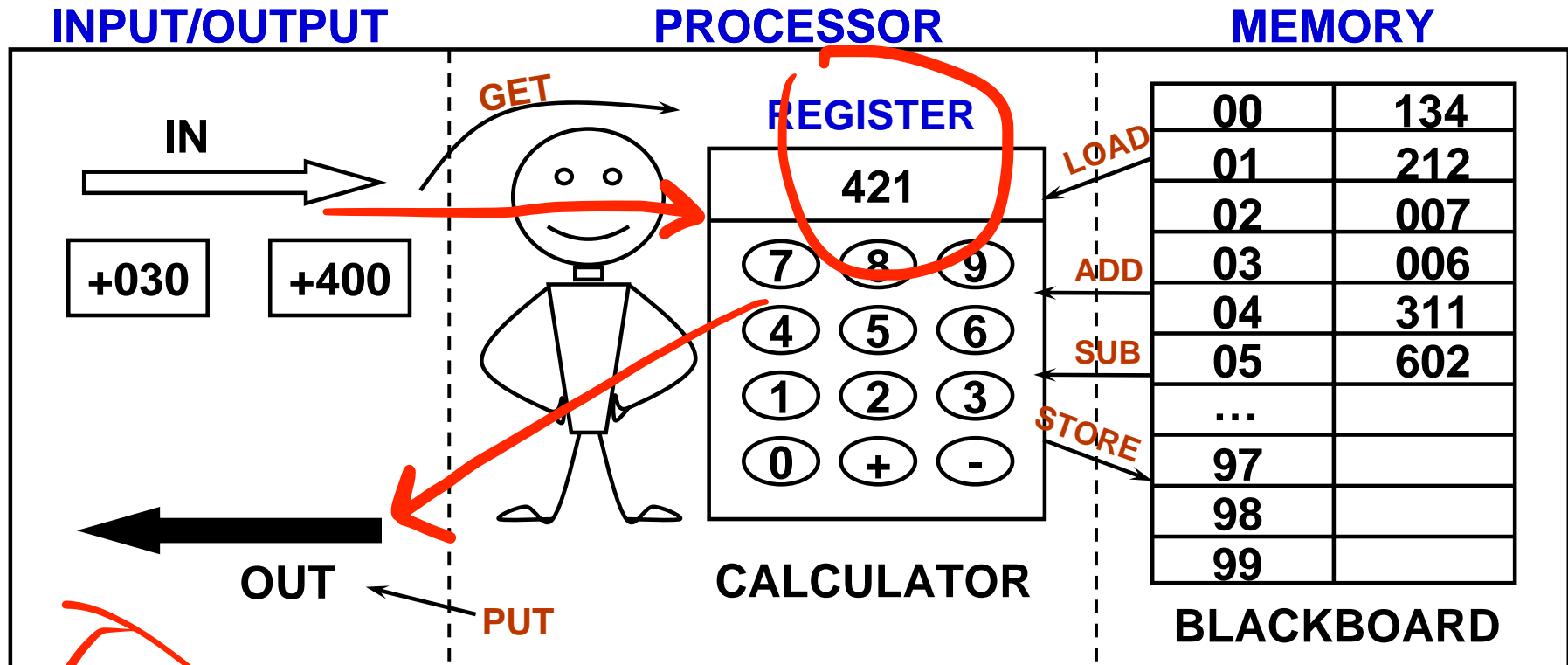
PROCESSOR/CALCULATOR

- Register has room for one 3-digit number
- Calculator can add and subtract numbers from memory to register

Examples: ADD 02

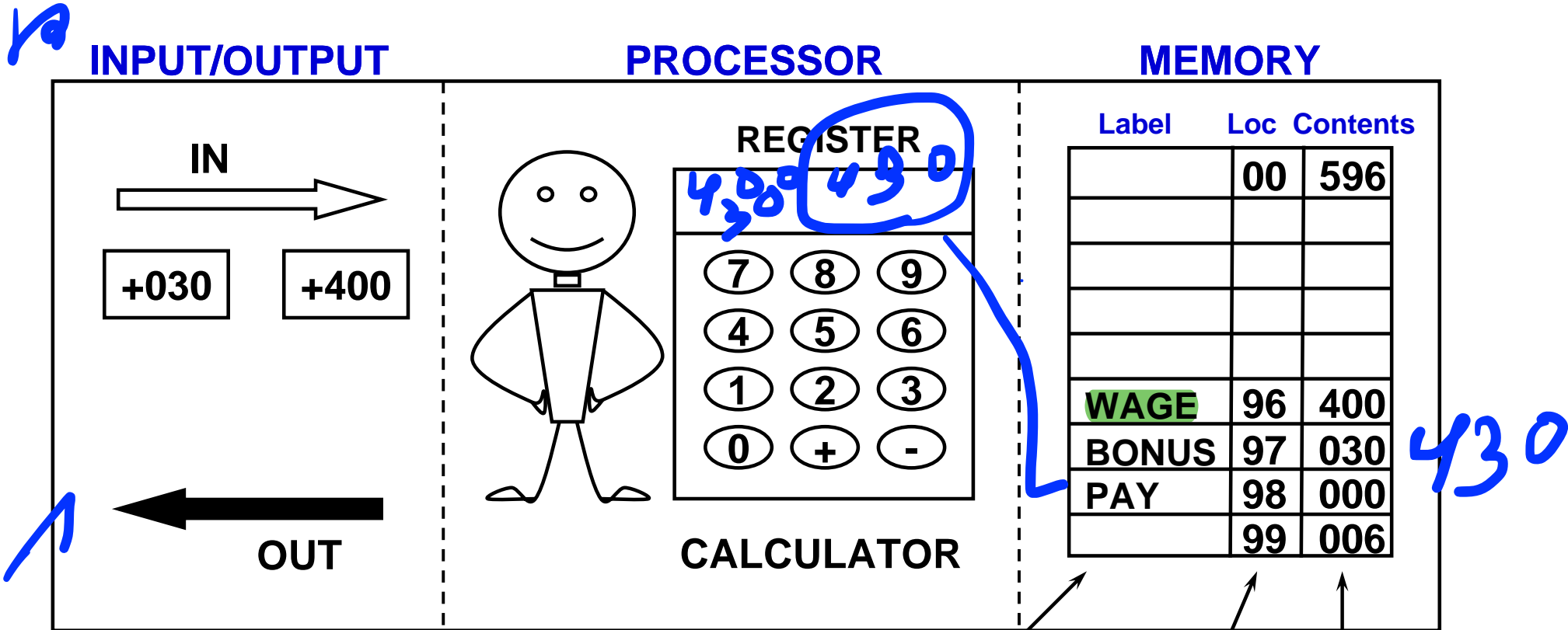
SUBTRACT 03

LMC INSTRUCTIONS



1. **Get**
2. **Put**
3. **Load x (Load 01)**
4. **Store x (Store 05)**
5. **Add x (Add 02)**
6. **Sub x (Sub 03)**
7. **Stop**

SYMBOLIC LMC ADDRESSES



EXAMPLE INSTRUCTION SEQUENCE

Calculate Pay = Wage + Bonus

1. Load Wage
2. Add Bonus
3. Store Pay
4. Stop

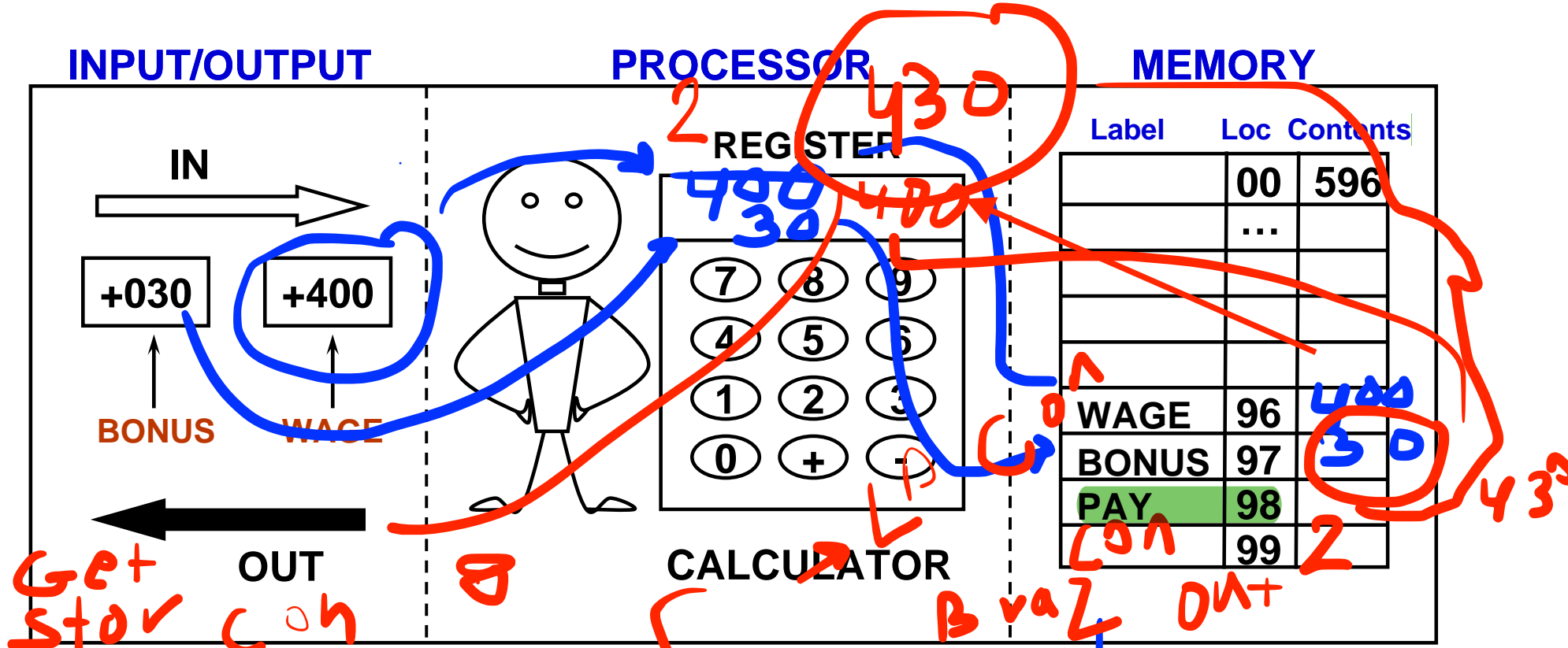
Optional

2-digit
number
(permanent)

3-digit
number
(optional)

Program to:

- 1) Read WAGE and BONUS amount from INPUT
- 2) Compute total PAY
- 3) Output total PAY



STEP INSTRUCTION

1. GET wage

2. stov wage

3. GET BONUS

4. stov BONUS

STEP INSTRUCTION

5. Load WAGE

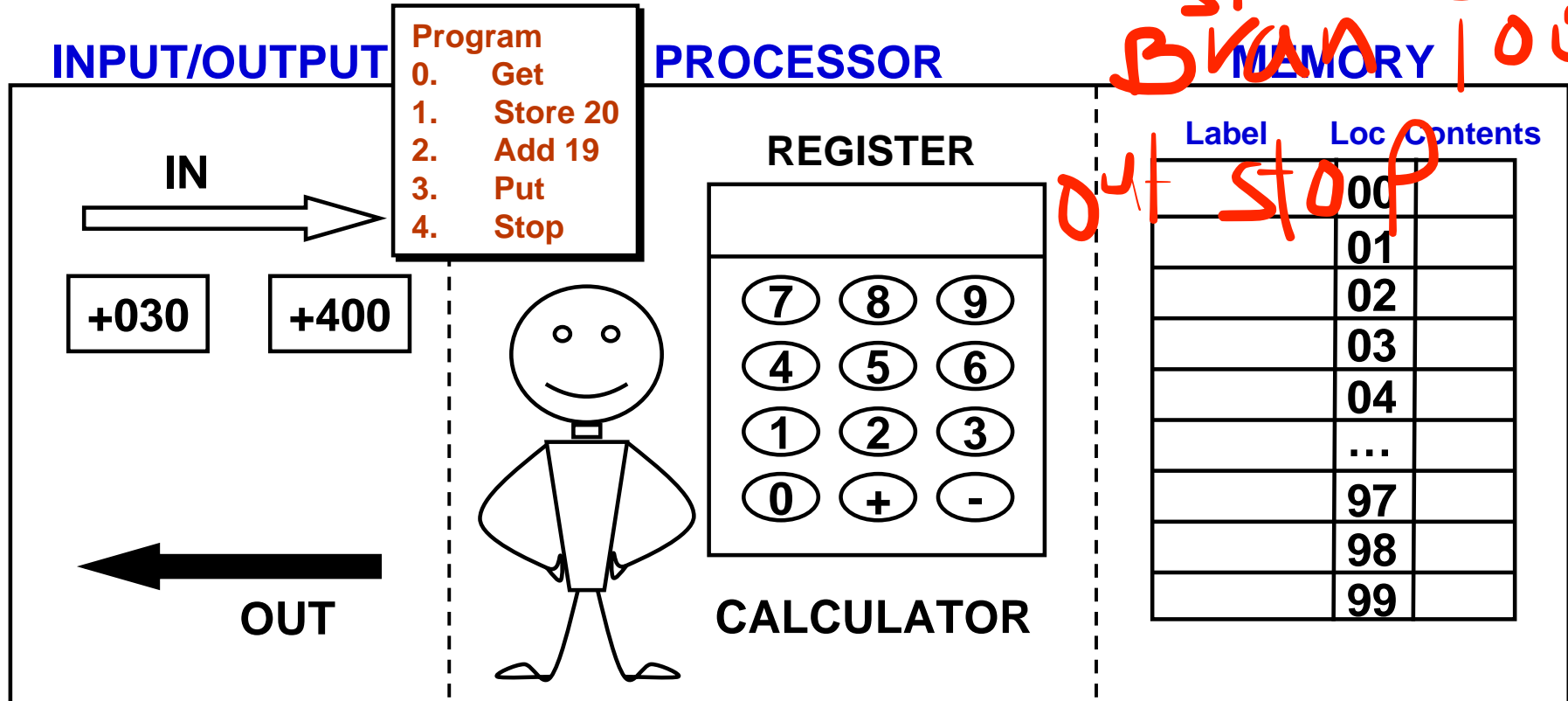
6. ADD BONUS

7. stov PAY

8. ~~stov PAY~~

LMC STORED PROGRAM CONCEPTS

Sub 1
stor con
BVKAN LOOP



ISSUES:

- Where is LMC program stored?
- How does LMC understand instructions like STOP? It only likes numbers.
- How does LMC handle symbolic labels like A, B, C?

ANSWERS (Stored Program Concept):

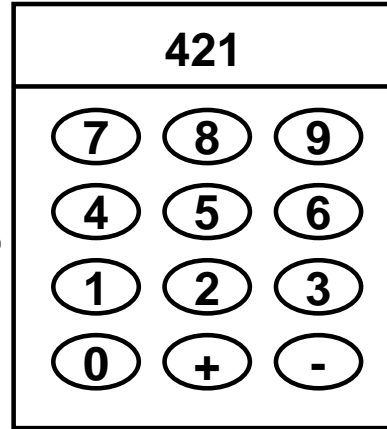
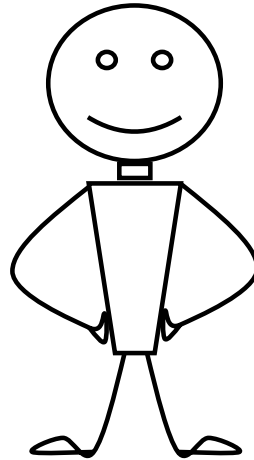
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LMC MACHINE LANGUAGE AND ASSEMBLY LANGUAGE

INPUT/OUTPUT



PROCESSOR



CALCULATOR

MEMORY

00	901
01	398
02	901
03	399
04	598
05	199
06	902
07	000
...	
98	
99	

w
b

BLACKBOARD

INSTRUCTIONS

<u>op-code</u>	<u>symbolic</u>
000	stop
1xx	add
2xx	subtract
3xx	store
5xx	load
901	get
902	put

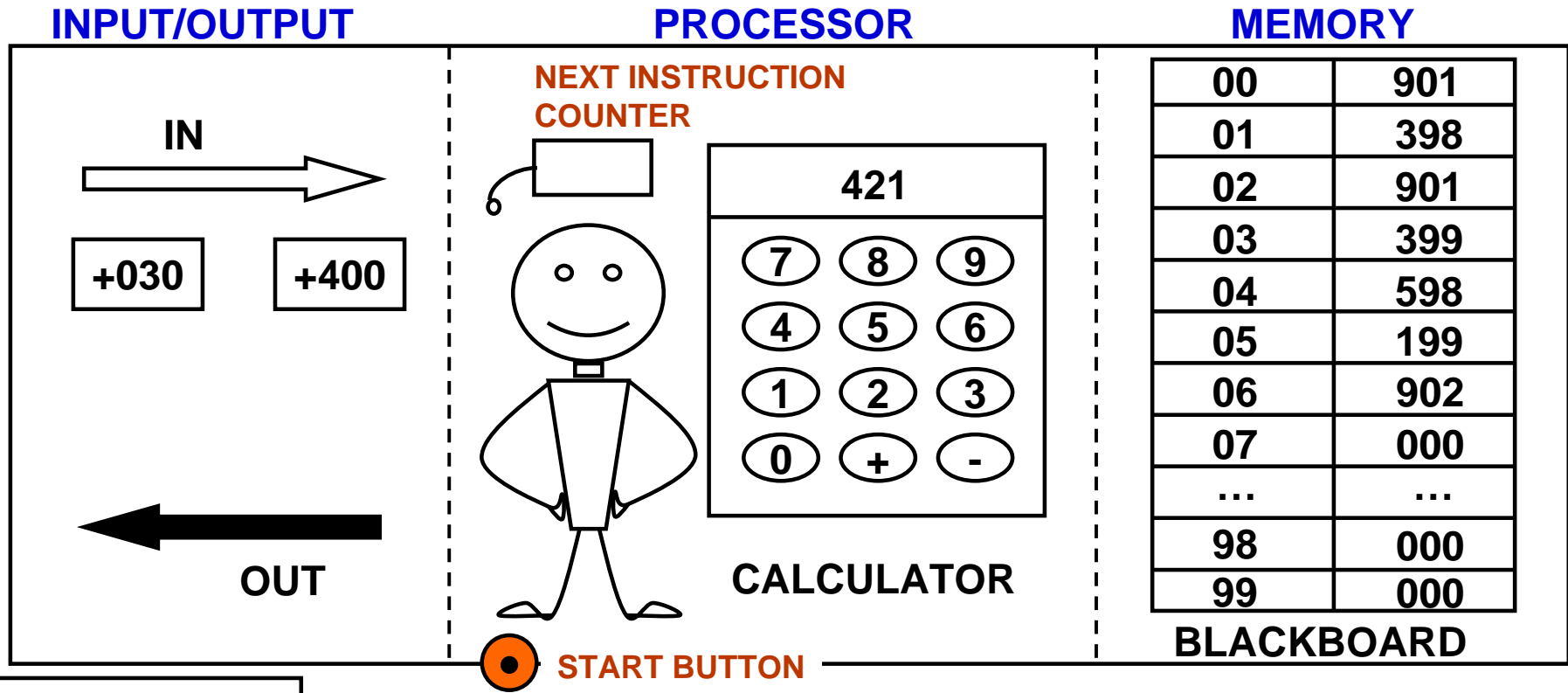
① ASSEMBLY LANG
(Source Program)

<u>STEP</u>	<u>INSTRUCTION</u>
00	get
01	store w
02	get
03	store b
04	load w
05	add b
06	put
07	stop

② MACHINE LANG
(Object Program)

<u>LOC</u>	<u>INSTRUCTION</u>
00	901
01	398
02	901
03	399
04	598
05	199
06	902
07	000

INSTRUCTION SEQUENCING

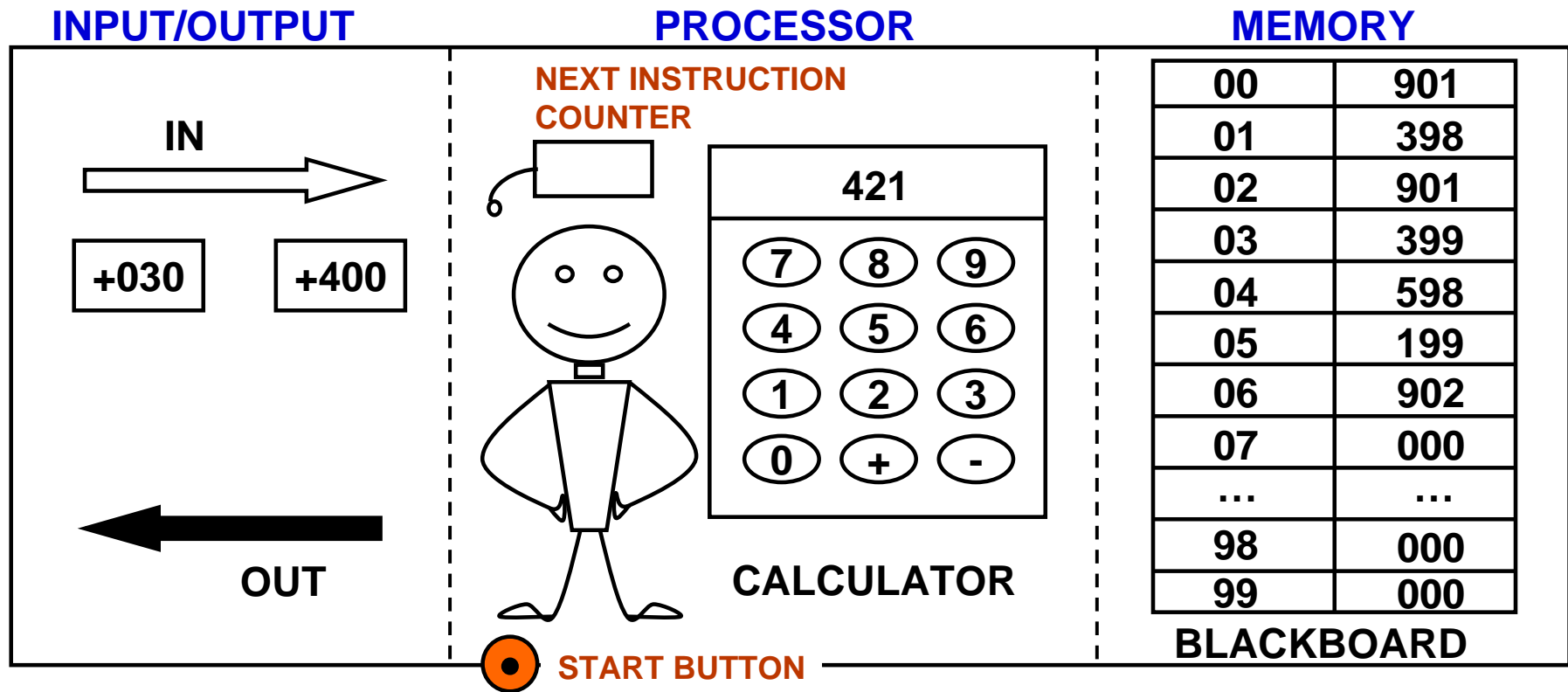


INSTRUCTIONS

<u>op-code</u>	<u>symbolic</u>
000	stop
1xx	add
2xx	subtract
3xx	store
5xx	load
901	get
902	put

- INSTRUCTION SEQUENCING
1. LOOK AT COUNTER
 2. GET THAT INSTRUCTION
 3. PERFORM THAT INSTRUCTION
 4. PULL COUNTER CORD
(REPEAT)

INSTRUCTION SEQUENCING



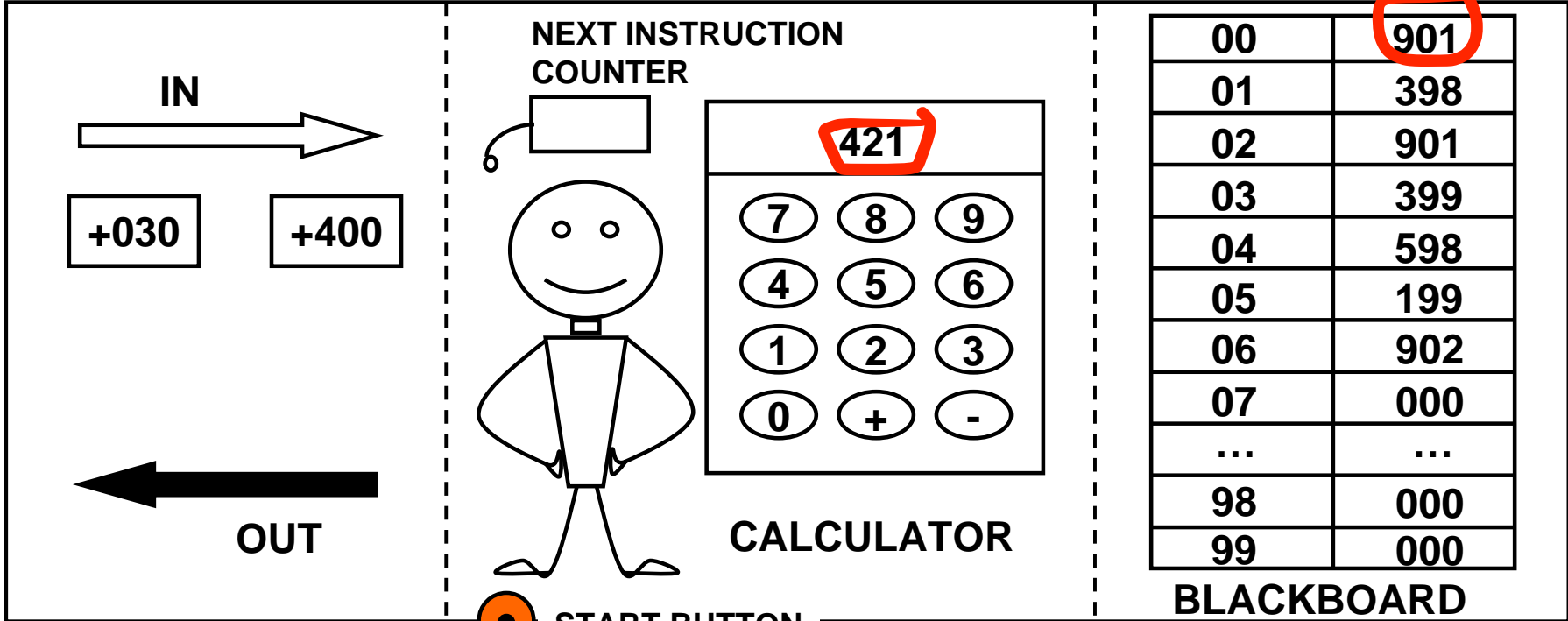
CONTROL FLOW

- BRANCH always puts a new address in the instruction counter
 - BRANCH ZERO puts a new address in the instruction counter if the REGISTER is 0. Otherwise it increases the instruction counter by 1.
- Examples: BRANCH 02
BRANCH ZERO 06

INPUT/OUTPUT

PROCESSOR

MEMORY



START BUTTON

INSTRUCTIONS

<u>op-code</u>	<u>symbolic</u>
000	stop
1xx	add
2xx	subtract
3xx	store
5xx	load
6xx	branch
7xx	branch zero

<u>op-code</u>	<u>symbolic</u>
901	get
902	put

So what are:
MIPS and MHz all about?

BASIC FACTS TO ASK ABOUT ANY COMPUTER

LMC ANSWERS

1. MEMORY

- (A) BASIC UNIT 3 DECIMAL DIGIT NUMBER
- (B) MAXIMUM SIZE 100 LOCATIONS

2. REGISTERS

- (A) HOW MANY 1
- (B) NUMBERS 3 DECIMAL DIGIT NUMBER

3. INSTRUCTIONS

- (A) NUMBER 7 INSTRUCTIONS

INTEL PENTIUM 4 ANSWERS

1. MEMORY

(A) INDUSTRY
BASIC UNIT

8 BINARY DIGITS (BITS) = 1 BYTE



(B) BASIC UNIT

32 BITS = 4 BYTES

(C) TYPICAL SIZE

MEMORY RAM: 128 MB – 1GB

2. REGISTERS

(A) HOW MANY

ABOUT 50 REGISTERS

(B) NUMBERS

VARIOUS TYPES

3. INSTRUCTIONS

(A) NUMBER

ABOUT 500

Conclusions

1. There are many detailed facts about computers.
2. Many of them will change every year of your career.
3. You will never know them all.
4. That's okay.
5. What you need to know is:
 - What kinds of questions to ask
 - How to make sense of the answers.
6. The basic concepts you have learned today will be useful for a long time.