# 15.561 Information Technology Essentials

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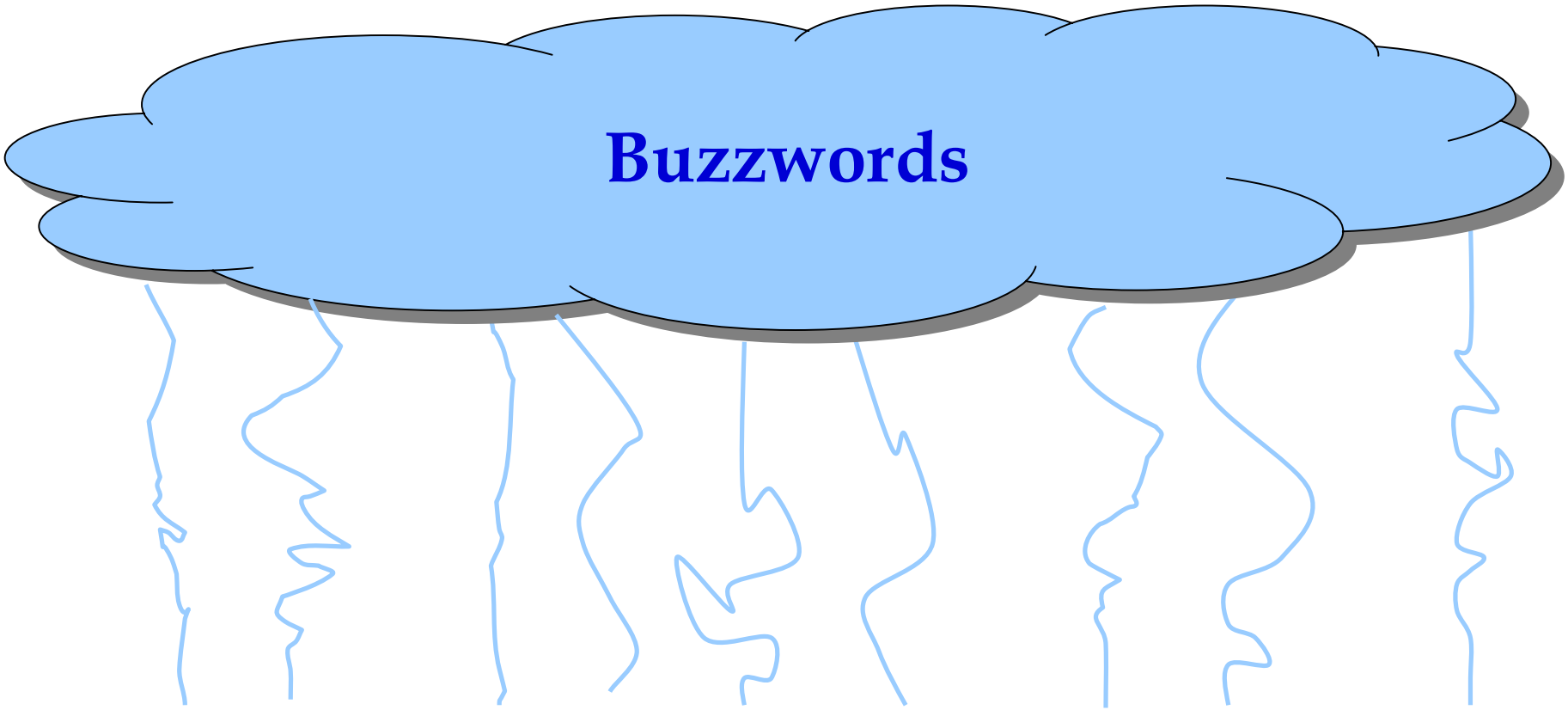
Acknowledgments:
Slides marked “SM” are adapted from Stuart Madnick, MIT.
Slides marked “CD” are adapted from Chris Dellarocas, U. Md.

# Why bother?

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


Buzzwords

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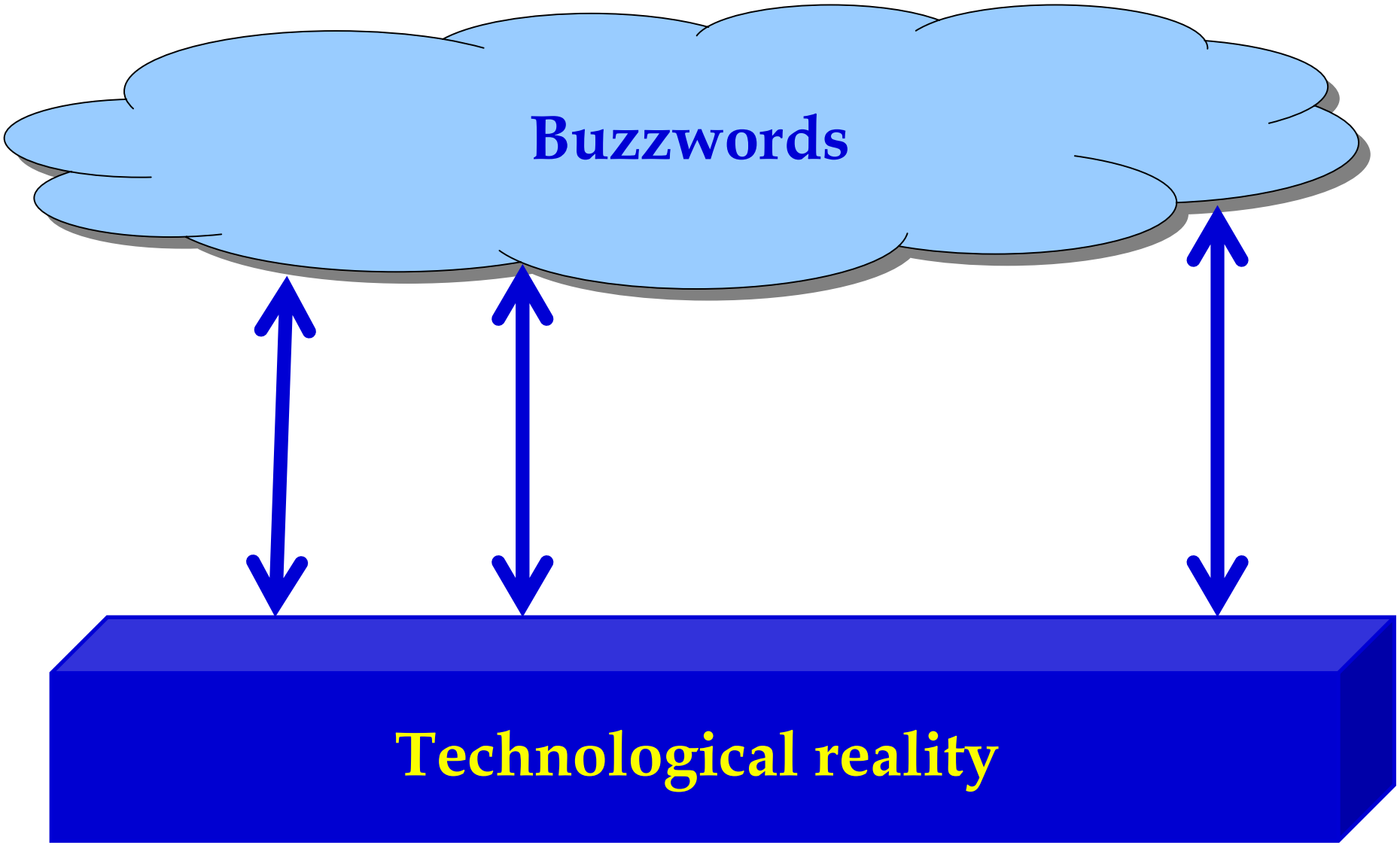

Buzzwords
Technological reality

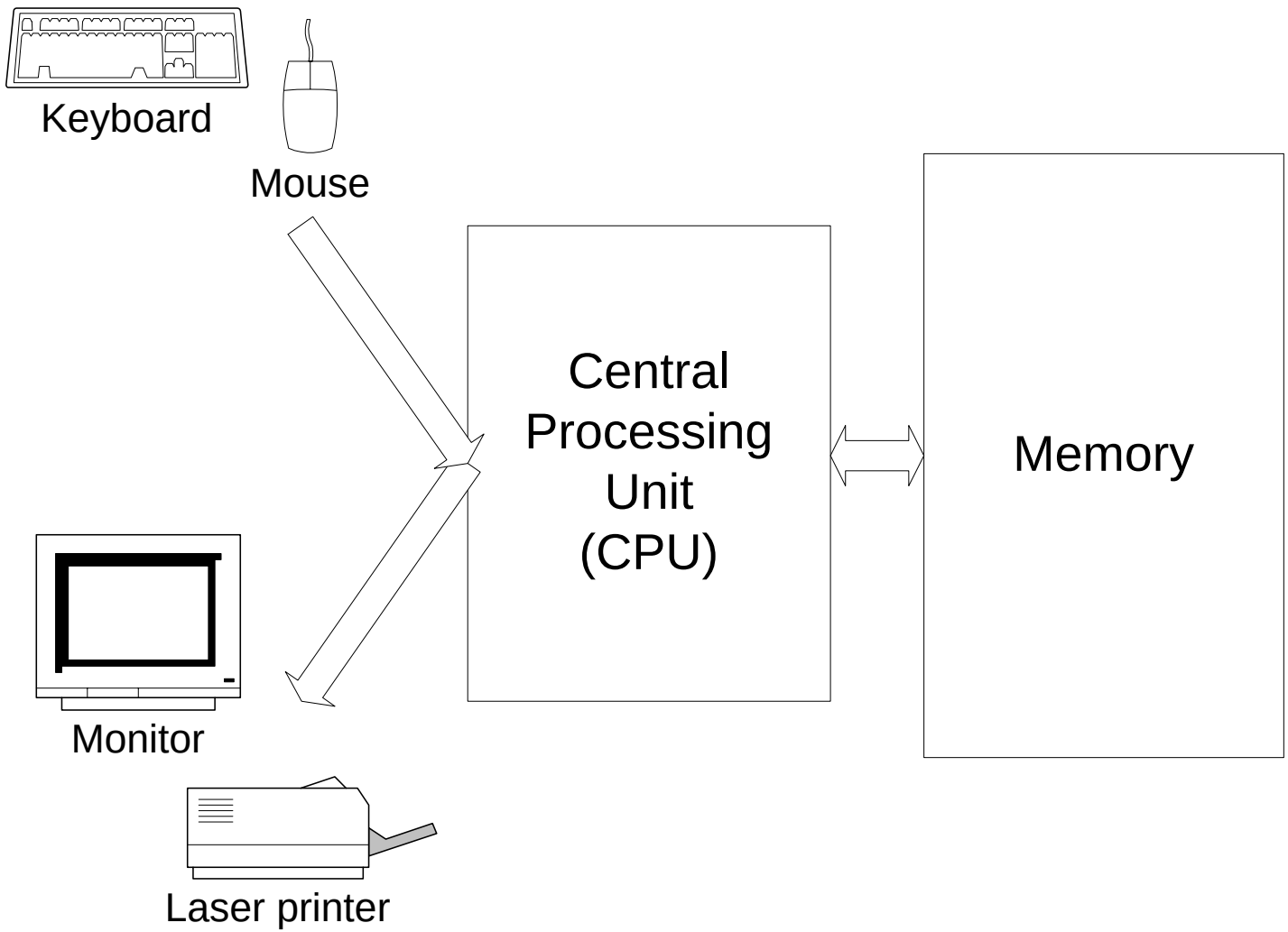
# Main Course Objectives

- **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**

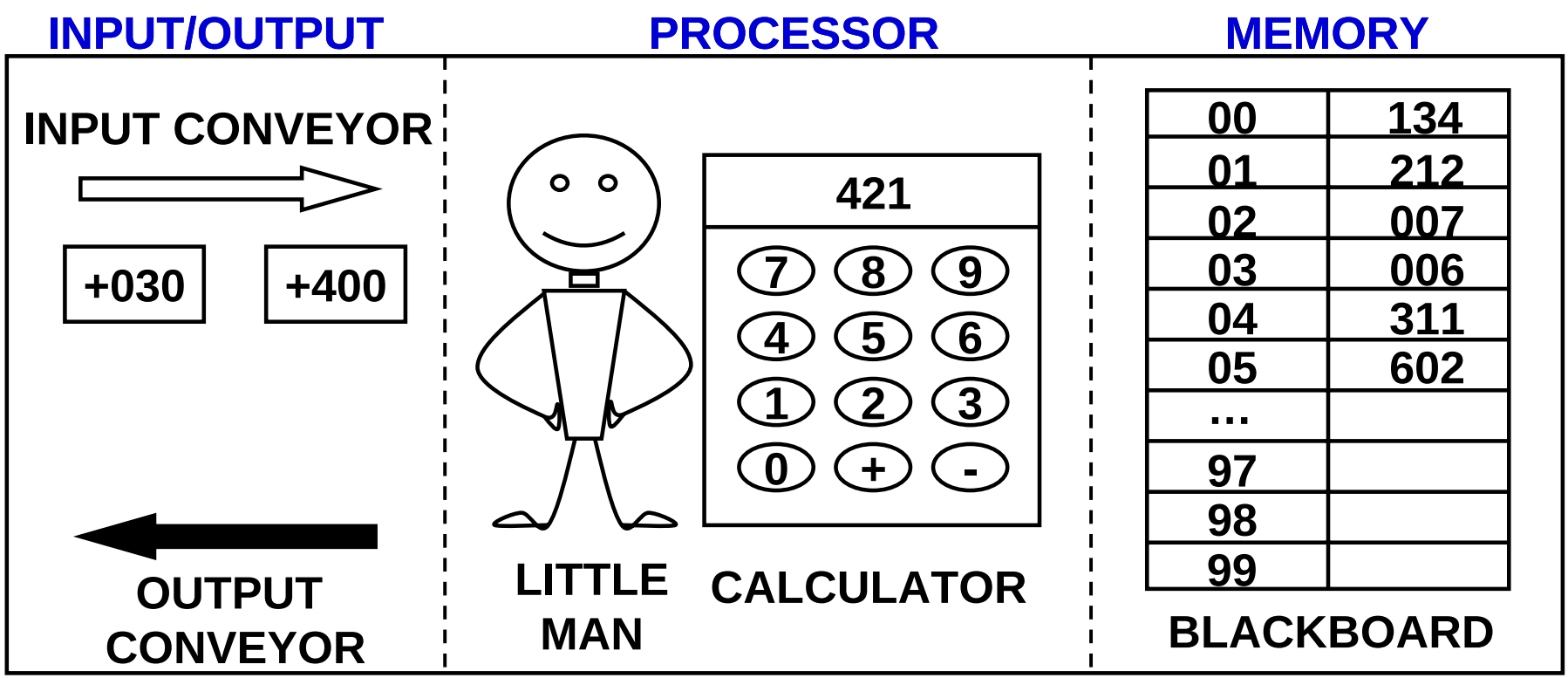
# Course overview

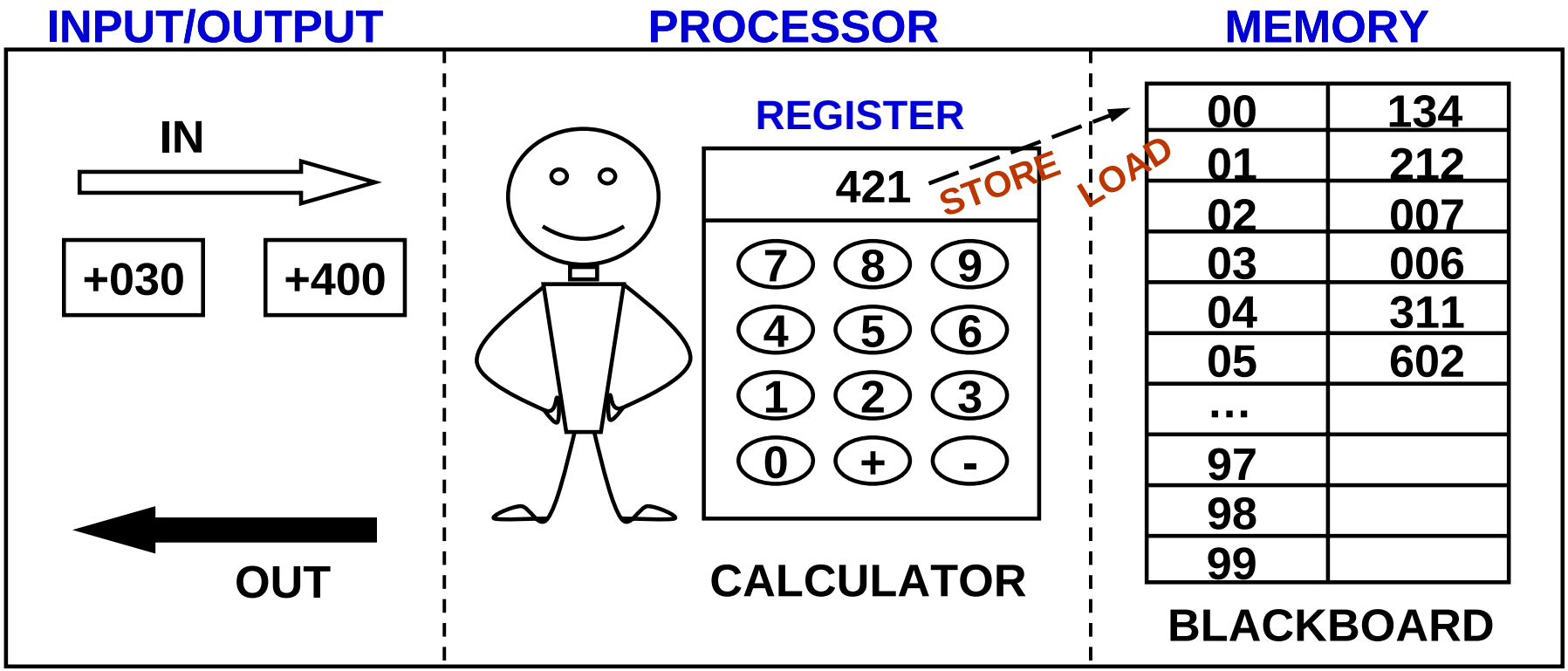
- Technology
- Applications of Technology

# A Typical Computer



# A Simplified Computer






## 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

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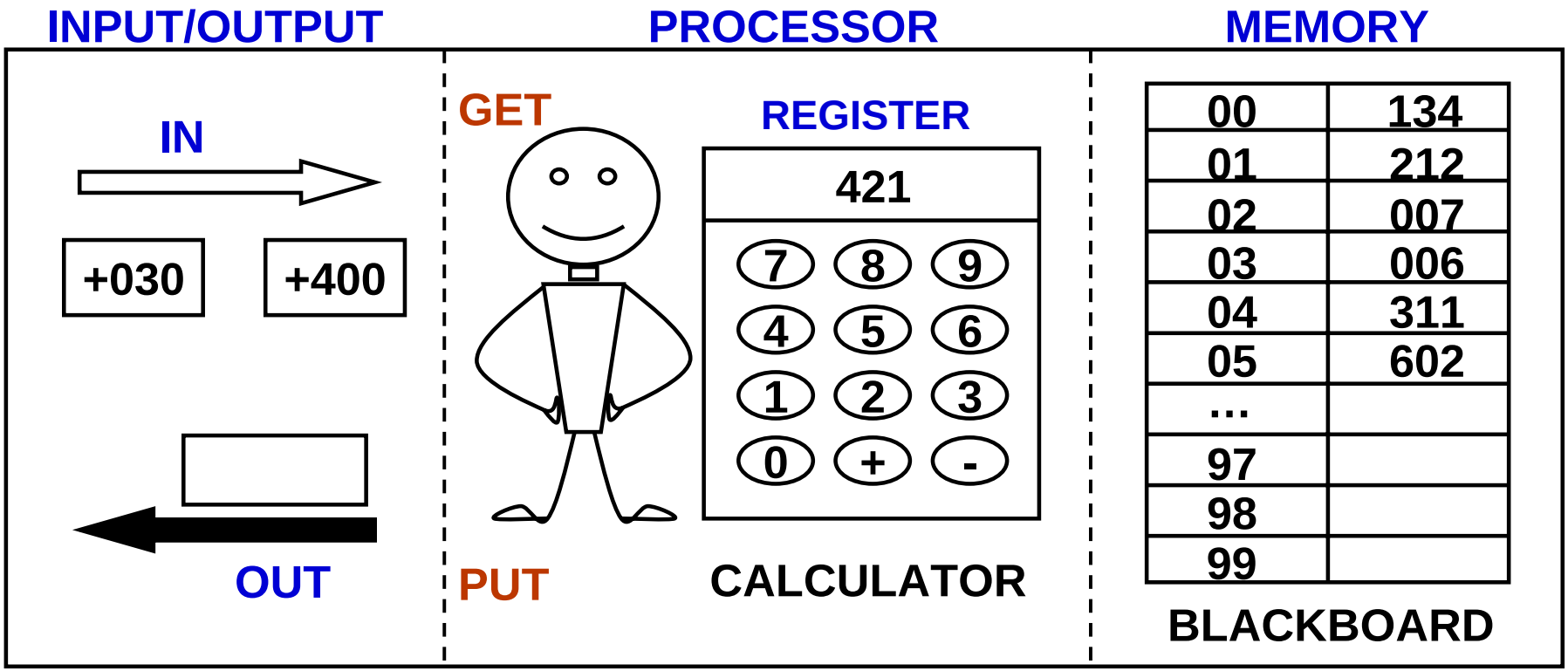
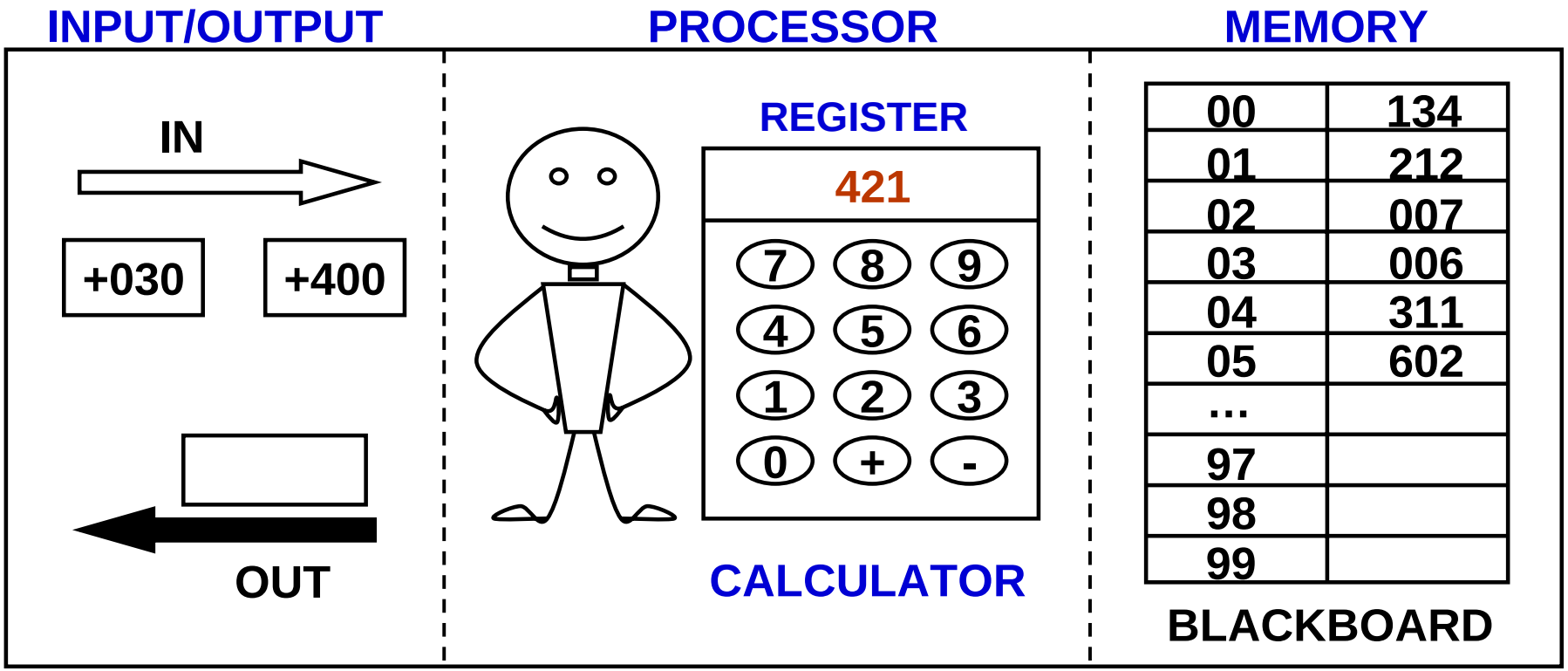



## INPUT/OUTPUT

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



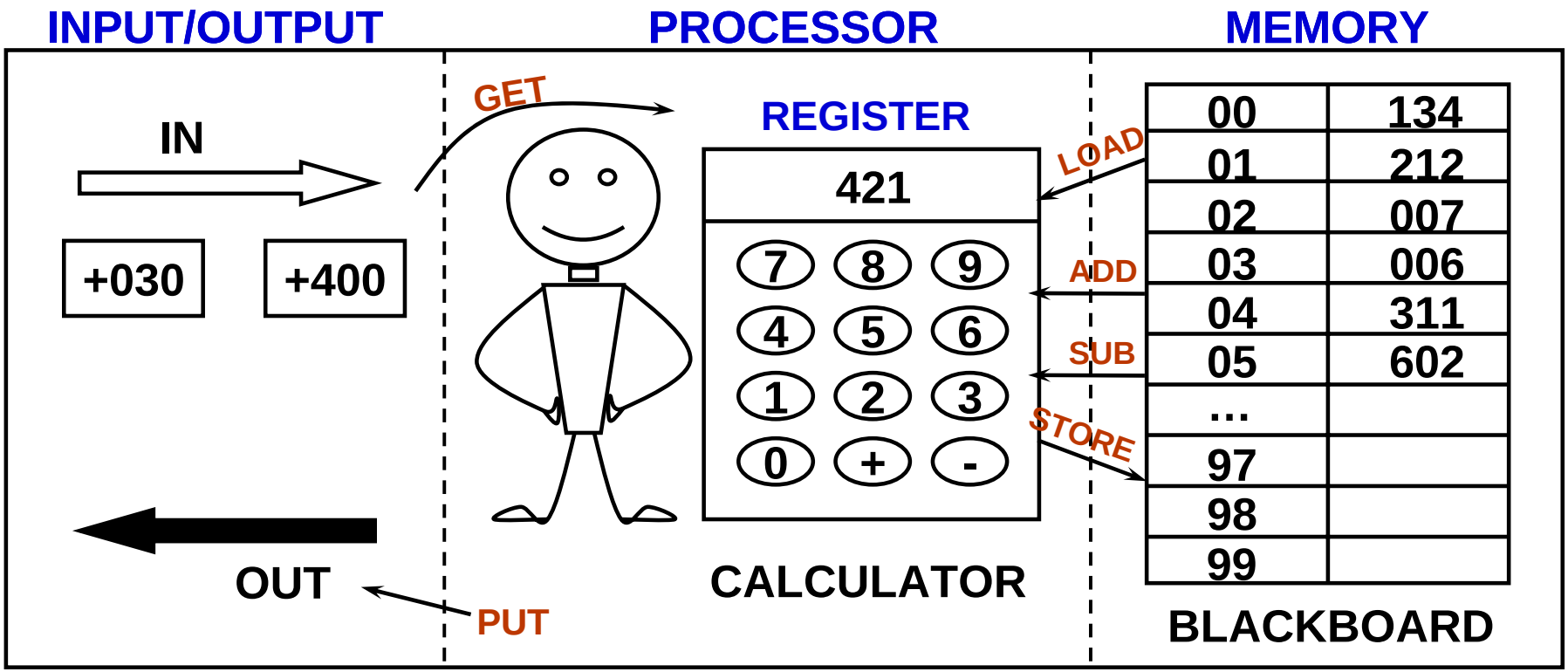

## PROCESSOR/CALCULATOR

- 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

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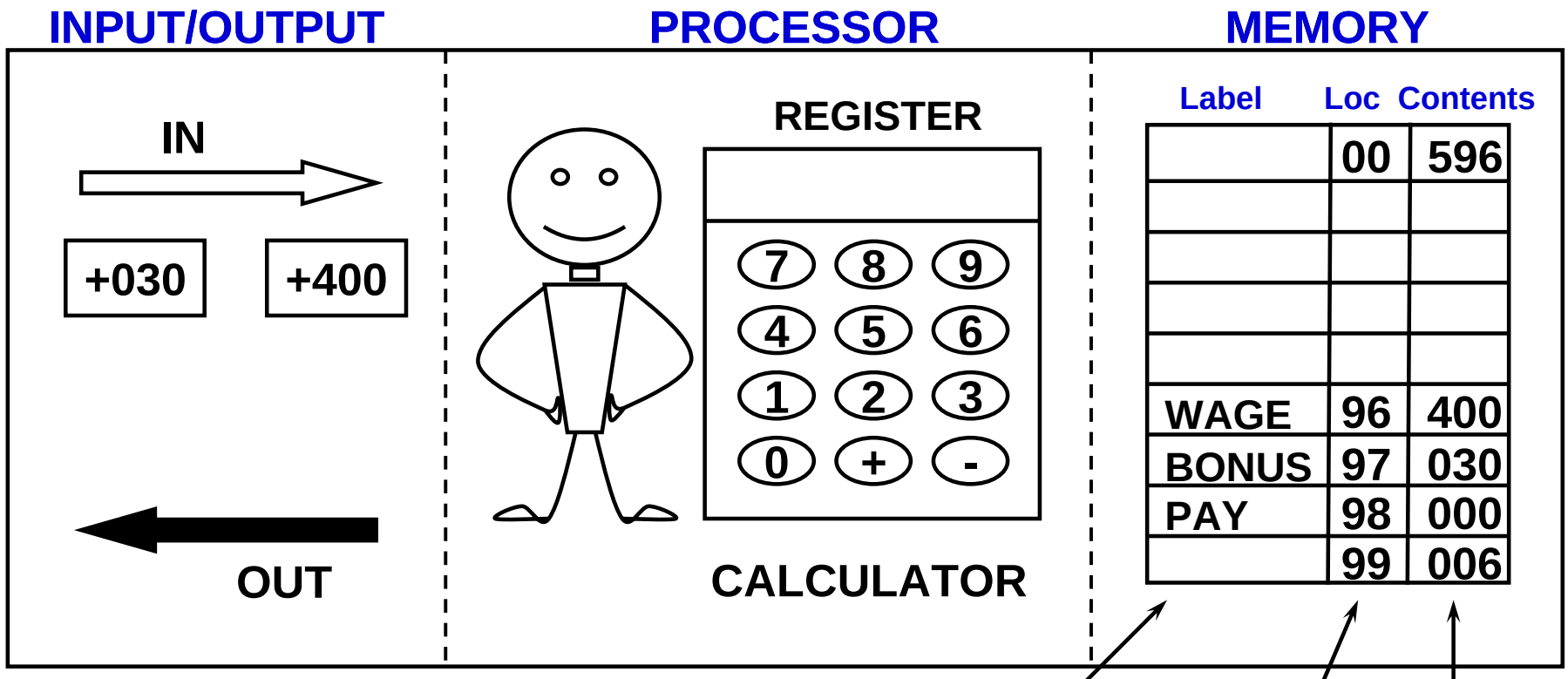
# SYMBOLIC LMC ADDRESSES



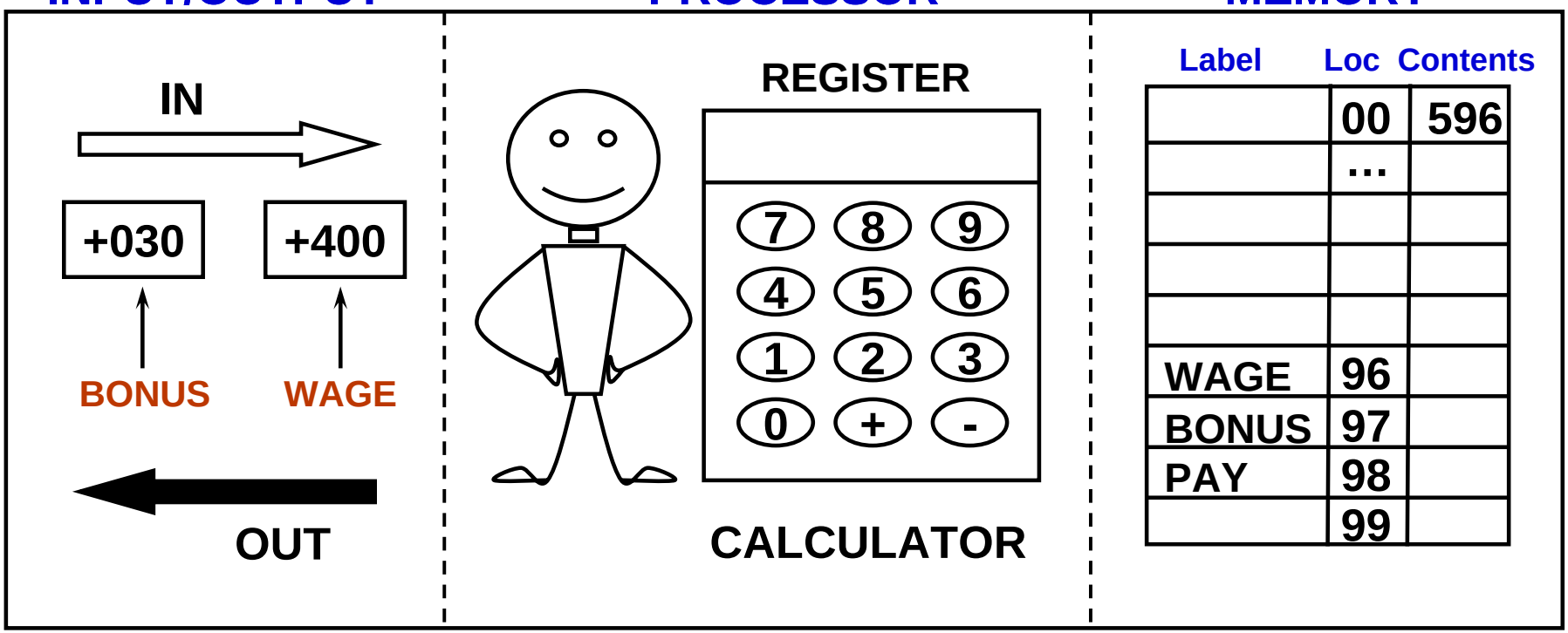

## EXAMPLE INSTRUCTION SEQUENCE

**Calculate Pay = Wage + Bonus**

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

## Program to:

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




| STEP | INSTRUCTION | STEP | INSTRUCTION |
|---|---|---|---|
| 1. | | 5. | |
| 2. | | 6. | |
| 3. | | 7. | |
| 4. | | 8. | |

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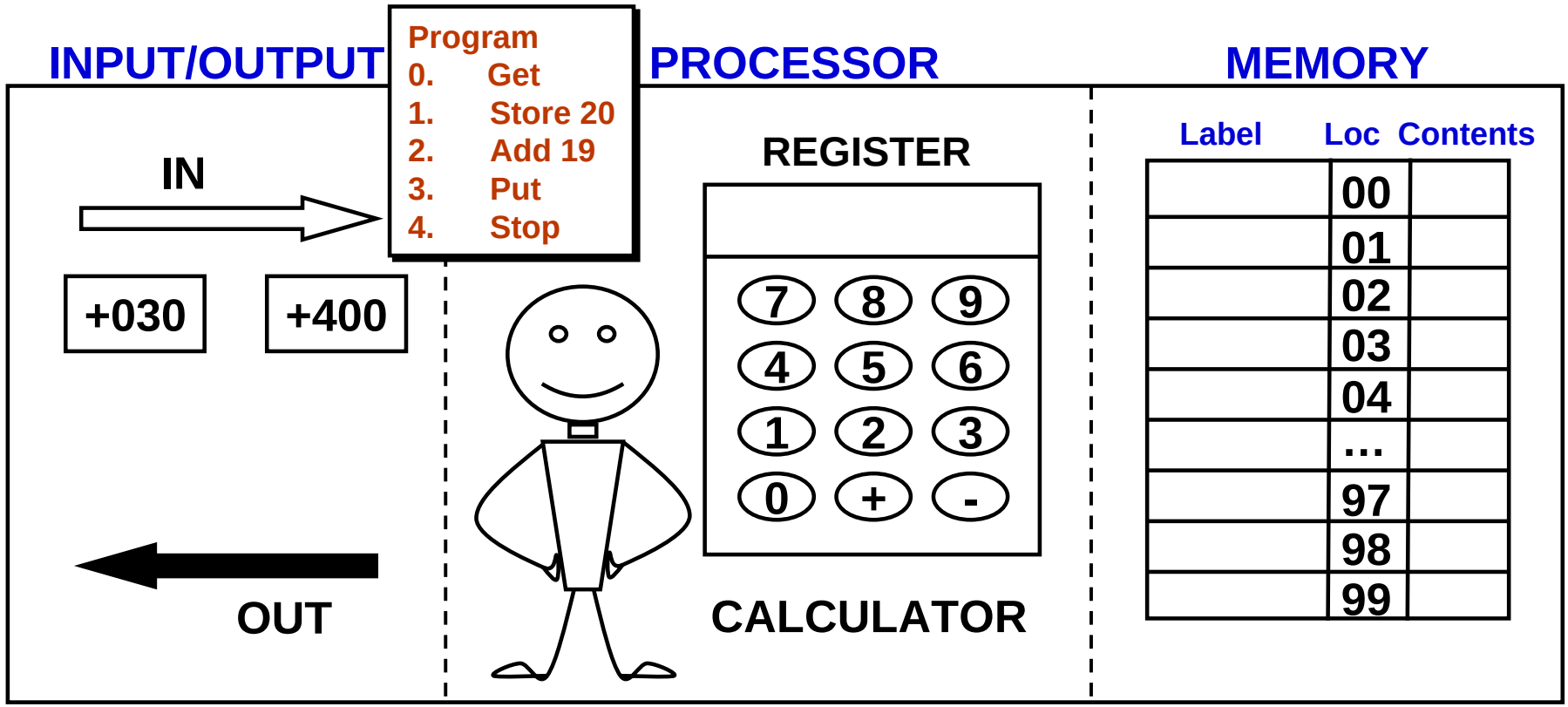
# LMC STORED PROGRAM CONCEPTS



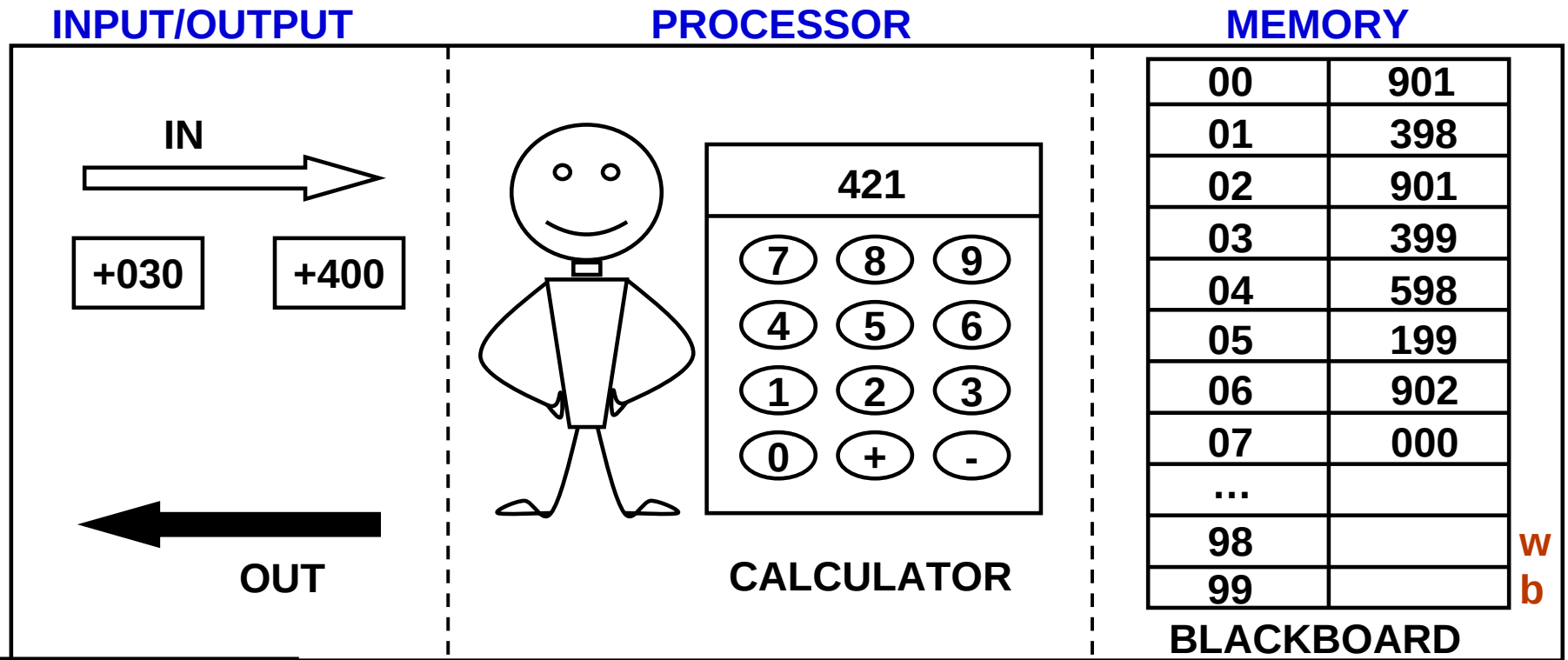

**ISSUES:**

- **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):**

-

# LMC MACHINE LANGUAGE AND ASSEMBLY LANGUAGE




**INSTRUCTIONS**

| op-code | symbolic |
|---|---|
| 000 | stop |
| 1xx | add |
| 2xx | subtract |
| 3xx | store |
| 5xx | load |
| 901 | get |
| 902 | put |

① ASSEMBLY LANG (Source Program)

| STEP | INSTRUCTION |
|---|---|
| 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)

| LOC | INSTRUCTION |
|---|---|
| 00 | 901 |
| 01 | 398 |
| 02 | 901 |
| 03 | 399 |
| 04 | 598 |
| 05 | 199 |
| 06 | 902 |
| 07 | 000 |

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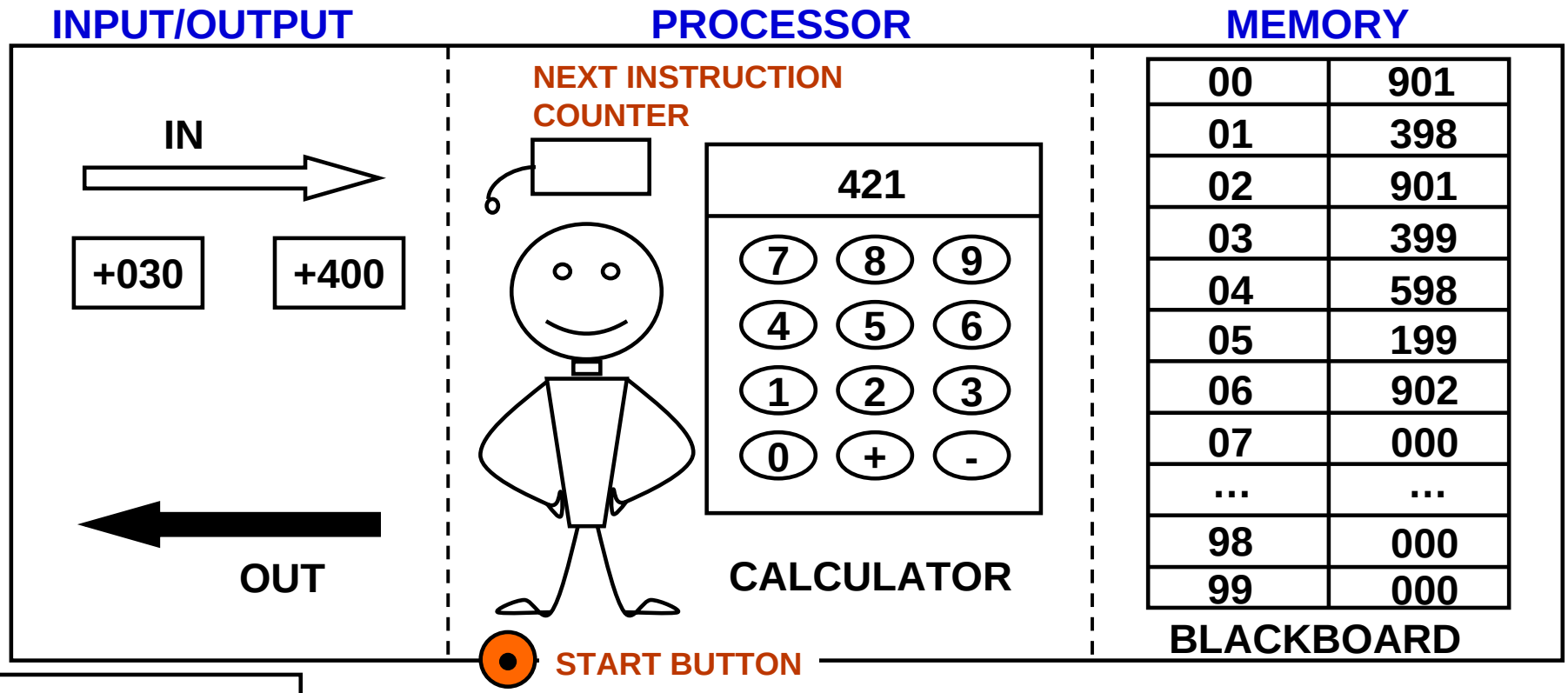
# INSTRUCTION SEQUENCING




**INSTRUCTIONS**

| op-code | symbolic |
|---|---|
| 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)

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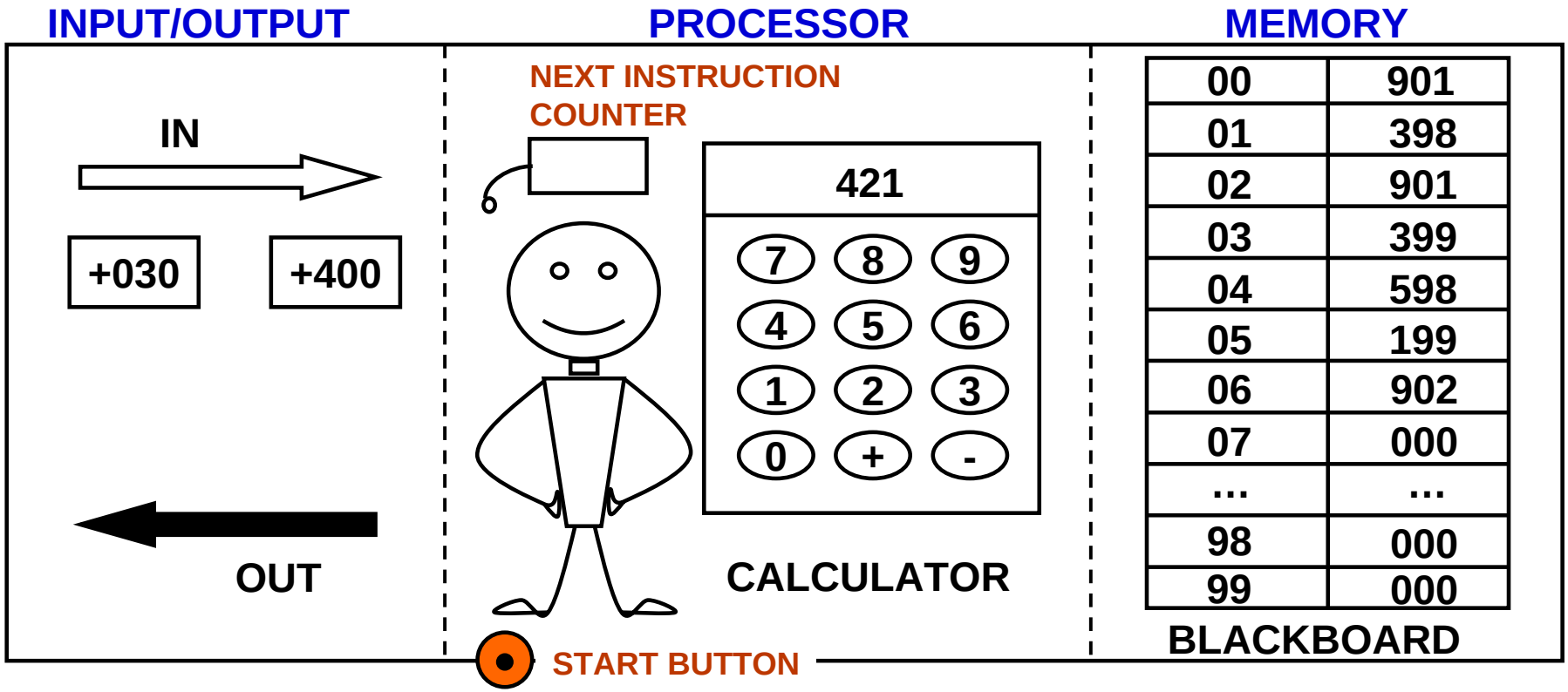
# INSTRUCTION SEQUENCING




## 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

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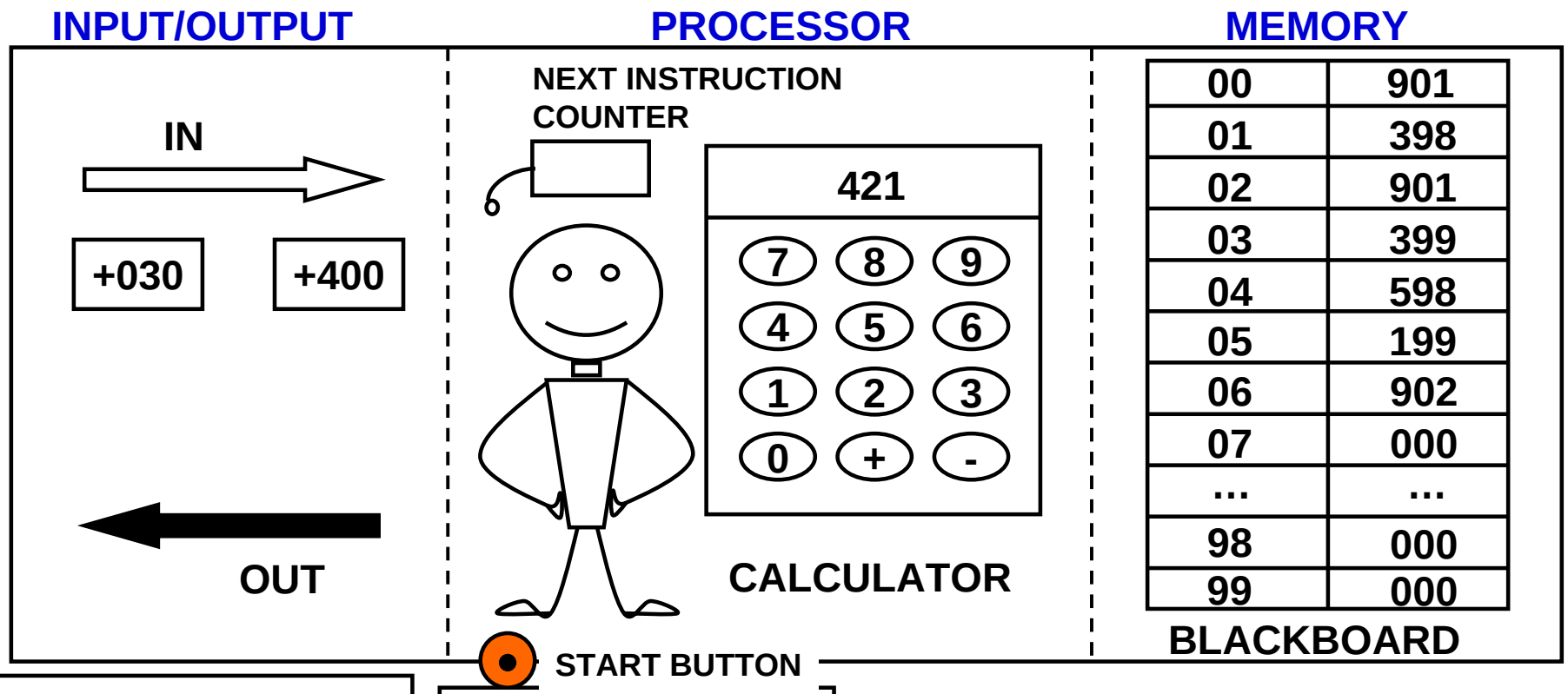


**INSTRUCTIONS**

| op-code | symbolic |
|---|---|
| 000 | stop |
| 1xx | add |
| 2xx | subtract |
| 3xx | store |
| 5xx | load |
| 6xx | branch |
| 7xx | branch zero |

| op-code | symbolic |
|---|---|
| 901 | get |
| 902 | put |

**So what are:**
**MIPS and MHz all about?**

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# 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.