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Objective

* Get a handle for manipulating data using the SDK-85 (Student Development Kit)
* Use Appendix F (8085 Instruction Set), specifically the Arithmetic Group, to perform operations on the registers and memory locations of the SDK-85.

Theory

* The SDK-85 (Student Development Kit) is a single board microcomputer system kit using the 8085 processor. It is made by Intel and is now used to teach students about the concepts of microprocessors. Contains the following
  + **Microprocessor**
  + **Memory Element** – This describes both ROM (Read Only Memory) and RAM (Random Access Memory)
    - ROM (Read Only Memory) – Contains system boot up instructions
    - RAM (Random Access Memory) – Has Read/Write capabilities
  + **I/O Unit** – Handles input from user and provides output
* Microprocessors are computer processors that incorporate the functions of a central processing unit on a single integrated circuit (IC) or at most a few integrated circuits. They contain the following:
  + **Combinational logic Unit** ­– are logic circuits implemented by Boolean (logic gates) circuits, where the output is a pure function of the present input only. Think Half-Adders, Full-Adders, Encoders, and Decoders.
  + **Sequential logic Unit** – this is a type of logic circuit whose output depends on previous inputs as well as on the present inputs.
    - Contains Memory
    - Contains a clock

This lab focuses on **Appendix F (the 8085 Instruction Set)**, specifically the **Arithmetic Group**. This is the set of assembly instructions that perform the adds, subtracts, increments, or decrements of data in registers or memory.

PART A

OP Codes

|  |  |
| --- | --- |
| 2000 | 3E |
| 1 | 03 |
| 2 | 32 |
| 3 | 50 |
| 4 | 20 |
| 5 | 3E |
| 6 | 05 |
| 7 | 32 |
| 8 | 51 |
| 9 | 20 |
| 10 | 3E |
| 11 | FB |
| 12 | 32 |
| 13 | 52 |
| 14 | 20 |
| 15 | 3E |
| 16 | FD |
| 17 | 32 |
| 18 | 53 |
| 19 | 20 |
| 20 | 3E |
| 21 | 12 |
| 22 | 32 |
| 23 | 54 |
| 24 | 20 |
| 25 | 3E |
| 26 | 17 |
| 27 | 32 |
| 28 | 55 |
| 29 | 20 |
| 30 | 3E |
| 31 | 18 |
| 32 | 32 |
| 33 | 56 |
| 34 | 20 |
| 35 | 3E |
| 36 | EE |
| 37 | 32 |
| 38 | 57 |
| 39 | 20 |
| 40 | 3E |
| 41 | EF |
| 42 | 32 |
| 43 | 58 |
| 44 | 20 |

FLOWCHART

A ←03

[2050] ←A

A ←05

[2051] ←A

FB ← -05

[2052] ←FB

FD ← -03

[2053] ←FD

A ←12

[2054] ←A

A ←17

[2055] ←A

A ←18

[2056] ←A

EE ← -18

[2057] ←EE

EF ← -17

[2058] ← EF

Part B

|  |  |
| --- | --- |
| 2000 | 3E |
| 2001 | 03 |
| 2002 | 06 |
| 2003 | 05 |
| 2004 | 80 |
| 2005 | 32 |
| 2006 | 59 |
| 2007 | 20 |
| 2008 | 3E |
| 2009 | 03 |
| 200A | 06 |
| 200B | FB |
| 200C | 80 |
| 200D | 32 |
| 200E | 5A |
| 200F | 20 |
| 2010 | 3E |
| 2011 | FD |
| 2012 | 06 |
| 2013 | 05 |
| 2014 | 80 |
| 2015 | 32 |
| 2016 | 5B |
| 2017 | 20 |
| 2018 | 3E |
| 2019 | FD |
| 201A | 06 |
| 201B | FB |
| 201C | 80 |
| 201D | 32 |
| 201E | 5C |
| 201F | 20 |
| 2020 | 3E |
| 2021 | 12 |
| 2022 | 06 |
| 2023 | 17 |
| 2024 | 80 |
| 2025 | 32 |
| 2026 | 5D |
| 2027 | 20 |
| 2028 | 3E |
| 2029 | 12 |
| 202A | 06 |
| 202B | EF |
| 202C | 80 |
| 202D | 32 |
| 202E | 5E |
| 202F | 20 |
| 2030 | 3E |
| 2031 | F8 |
| 2032 | 06 |
| 2033 | EF |
| 2034 | 80 |
| 2035 | 32 |
| 2036 | 5F |
| 2037 | 20 |
| 2038 | 3E |
| 2039 | F8 |
| 203A | 06 |
| 203B | 17 |
| 203C | 80 |
| 203D | 32 |
| 203E | 60 |
| 203F | 20 |
| 2040 | CF |

Part C

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| DATA | OP | A | B | 2059 | 205A | 205B | 205C | 205D | 205E | 205F | 2060 |
| 2000 | 3E |  |  |  |  |  |  |  |  |  |  |
| 2002 | 06 | 03 |  |  |  |  |  |  |  |  |  |
| 2004 | 80 | 03 | 05 |  |  |  |  |  |  |  |  |
| 2005 | 32 | 08 | 05 |  |  |  |  |  |  |  |  |
| 2008 | 3E | 08 | 05 | 08 |  |  |  |  |  |  |  |
| 200A | 06 | 03 | 05 | 08 |  |  |  |  |  |  |  |
| 200C | 80 | 03 | FB | 08 |  |  |  |  |  |  |  |
| 200D | 32 | FE | FB | 08 |  |  |  |  |  |  |  |
| 2010 | 3E | FE | FB | 08 | FE |  |  |  |  |  |  |
| 2012 | 06 | FD | FB | 08 | FE |  |  |  |  |  |  |
| 2014 | 80 | FD | 05 | 08 | FE |  |  |  |  |  |  |
| 2015 | 32 | 02 | 05 | 08 | FE |  |  |  |  |  |  |
| 2018 |  | 02 | 05 | 08 | FE | 02 |  |  |  |  |  |
| 201A |  | FD | 05 | 08 | FE | 02 |  |  |  |  |  |
| 201C |  | FD | FB | 08 | FE | 02 |  |  |  |  |  |
| 201D |  | F8 | FB | 08 | FE | 02 |  |  |  |  |  |
| 2020 |  | F8 | FB | 08 | FE | 02 | F8 |  |  |  |  |
| 2022 |  | 12 | FB | 08 | FE | 02 | F8 |  |  |  |  |
| 2024 |  | 12 | 17 | 08 | FE | 02 | F8 |  |  |  |  |
| 2025 |  | 29 | 17 | 08 | FE | 02 | F8 |  |  |  |  |
| 2028 |  | 29 | 17 | 08 | FE | 02 | F8 | 29 |  |  |  |
| 202A |  | 12 | 17 | 08 | FE | 02 | F8 | 29 |  |  |  |
| 202C |  | 12 | EF | 08 | FE | 02 | F8 | 29 |  |  |  |
| 202D |  | FB | EF | 08 | FE | 02 | F8 | 29 |  |  |  |
| 2030 |  | FB | EF | 08 | FE | 02 | F8 | 29 | FB |  |  |
| 2032 |  | F8 | EF | 08 | FE | 02 | F8 | 29 | FB |  |  |
| 2034 |  | F8 | EF | 08 | FE | 02 | F8 | 29 | FB |  |  |
| 2035 |  | E3 | EF | 08 | FE | 02 | F8 | 29 | FB |  |  |
| 2038 |  | E3 | EF | 08 | FE | 02 | F8 | 29 | FB | E3 |  |
| 203A |  | F8 | EF | 08 | FE | 02 | F8 | 29 | FB | E3 |  |
| 203C |  | F8 | 17 | 08 | FE | 02 | F8 | 29 | FB | E3 |  |
| 203D |  | 05 | 17 | 08 | FE | 02 | F8 | 29 | FB | E3 |  |
| 2040 | CF | 05 | 17 | 08 | FE | 02 | F8 | 29 | FB | E3 | 05 |

Part D

* There’s an overflow

Part E

|  |  |  |  |
| --- | --- | --- | --- |
| Flow Chart | Mnemonics | Memory | OP Code |
|  | LDA 2051 | 2000 | 3A |
|  |  | 2001 | 51 |
|  |  | 2002 | 20 |
|  | MOV M, A | 2003 | 77 |
|  | LDA 2050 | 2004 | 3A |
|  |  | 2005 | 50 |
|  |  | 2006 | 20 |
|  | SUB M | 2007 | 96 |

|  |  |  |  |
| --- | --- | --- | --- |
| Flow Chart | Mnemonics | Memory | OP Code |
|  | LDA 2051 | 2000 | 3A |
|  |  | 2001 | 51 |
|  |  | 2002 | 20 |
|  | MOV M, A | 2003 | 77 |
|  | LDA 2053 | 2004 | 3A |
|  |  | 2005 | 53 |
|  |  | 2006 | 20 |
|  | ADD M | 2007 | 86 |

Part F

|  |  |  |  |
| --- | --- | --- | --- |
| Flow Chart | Mnemonics | Memory | OP Code |
|  | LDA 2056 | 2000 | 3A |
|  |  | 2001 | 56 |
|  |  | 2002 | 20 |
|  | MOV C, A | 2003 | 4F |
|  | LDA 2055 | 2004 | 3A |
|  |  | 2005 | 55 |
|  |  | 2006 | 20 |
|  | MOV B, A | 2007 | 47 |
|  | LDA 2054 | 2008 | 3A |
|  |  | 2009 | 54 |
|  |  | 200A | 20 |
|  | ADD B | 200B | 80 |
|  | DAA | 200C | 27 |
|  | STA 2061 | 200D | 32 |
|  |  | 200E | 61 |
|  |  | 200F | 20 |
|  | LDA 2054 | 2010 | 3A |
|  |  | 2011 | 54 |
|  |  | 2012 | 20 |
|  | ADD C | 2013 | 81 |
|  | DAA | 2014 | 27 |
|  | STA 2062 | 2015 | 32 |
|  |  | 2016 | 62 |
|  |  | 2017 | 20 |

Part G

|  |  |  |  |
| --- | --- | --- | --- |
| Flow Chart | Mnemonics | Memory | OP Code |
|  | LDA 2054 | 2000 | 3A |
|  |  | 2001 | 54 |
|  |  | 2002 | 20 |
|  | MOV C, A | 2003 | 4F |
|  | LDA 2055 | 2004 | 3A |
|  |  | 2005 | 55 |
|  |  | 2006 | 20 |
|  | SUB C | 2007 | 91 |
|  | DAA | 2008 | 27 |
|  | STA 2063 | 2009 | 32 |
|  |  | 200A | 63 |
|  |  | 200B | 20 |
|  | LDA 2055 | 200C | 3A |
|  |  | 200D | 55 |
|  |  | 200E | 20 |
|  | MOV C, A | 200F | 4F |
|  | LDA 2054 | 2010 | 3A |
|  |  | 2011 | 54 |
|  |  | 2012 | 20 |
|  | SUB C | 2013 | 91 |
|  | DAA | 2014 | 27 |
|  | STA 2064 | 2015 | 32 |
|  |  | 2016 | 64 |
|  |  | 2017 | 20 |
|  | LDA 2050 | 2018 | 3A |
|  |  | 2019 | 50 |
|  |  | 201A | 20 |
|  | MOV C, A | 201B | 4F |
|  | LDA 2054 | 201C | 3A |
|  |  | 201D | 54 |
|  |  | 201E | 20 |
|  | SUB C | 201F | 91 |
|  | DAA | 2020 | 27 |
|  | STA 2065 | 2021 | 32 |
|  |  | 2022 | 65 |
|  |  | 2023 | 20 |

Part H

|  |  |  |  |
| --- | --- | --- | --- |
| Flow Chart | Mnemonics | Memory | OP Code |
|  | LXI H, 0793 | 2000 | 21 |
|  |  | 2001 | 93 |
|  |  | 2002 | 07 |
|  | LXI D, 0805 | 2003 | 11 |
|  |  | 2004 | 05 |
|  |  | 2005 | 08 |
|  | DAD D | 2006 | 19 |
|  | DAA | 2007 | 27 |
|  | MOV A, H | 2008 | 7C |
|  | STA 2065 | 2009 | 32 |
|  |  | 200A | 65 |
|  |  | 200B | 20 |
|  | MOV A, L | 200C | 7D |
|  | STA 2066 | 200D | 32 |
|  |  | 200E | 66 |
|  |  | 200F | 20 |
|  | LXI H, 0793 | 2010 | 21 |
|  |  | 2011 | 93 |
|  |  | 2012 | 07 |
|  | LXI B, 0585 | 2013 | 01 |
|  |  | 2014 | 85 |
|  |  | 2015 | 05 |
|  | DAD B | 2016 | 09 |
|  | DAA | 2017 | 27 |
|  | MOV A, H | 2018 | 7C |
|  | STA 2067 | 2019 | 32 |
|  |  | 201A | 67 |
|  |  | 201B | 20 |
|  | MOV A, L | 201C | 7D |
|  | STA 2068 | 201D | 32 |
|  |  | 201E | 68 |
|  |  | 201F | 20 |

Part I

|  |  |  |  |
| --- | --- | --- | --- |
| Flow Chart | Mnemonics | Memory | OP Code |
|  | LXI H, 1793 | 2000 | 21 |
|  |  | 2001 | 93 |
|  |  | 2002 | 17 |
|  | LXI D, 3805 | 2003 | 11 |
|  |  | 2004 | 05 |
|  |  | 2005 | 38 |
|  | DAD D | 2006 | 19 |
|  | DAA | 2007 | 27 |
|  | MOV A, H | 2008 | 7C |
|  | STA 2069 | 2009 | 32 |
|  |  | 200A | 69 |
|  |  | 200B | 20 |
|  | MOV A, L | 200C | 7D |
|  | STA 206A | 200D | 32 |
|  |  | 200E | 6A |
|  |  | 200F | 20 |
|  | LXI H, 0793 | 2010 | 21 |
|  |  | 2011 | 93 |
|  |  | 2012 | 77 |
|  | LXI B, 6585 | 2013 | 01 |
|  |  | 2014 | 85 |
|  |  | 2015 | 65 |
|  | DAD B | 2016 | 09 |
|  | DAA | 2017 | 27 |
|  | MOV A, H | 2018 | 7C |
|  | STA 2065 | 2019 | 32 |
|  |  | 201A | 6C |
|  |  | 201B | 20 |
|  | MOV A, L | 201C | 7D |
|  | STA 206D | 201D | 32 |
|  |  | 201E | 6D |
|  |  | 201F | 20 |

Conclusion

* We didn’t have enough time to test the code. This can be considered if errors were to pop up. However, we do feel as though we have a firm grasp of what was going on within this lab. Therefore, we assume that we did pretty well in solving the problems presented within this lab.