**ΑΣΚΗΣΗ 2**

Τμημα: Α5

Συνεργατες:

Αλεξιος Λαζανας 1100605

Σταματια Καλημερη 1103080

Καταχωρητες που δοθηκαν στο εργαστηριο:

ACC: 0000

PC: 0001

X: 0010

Ψευδογλωσσα των ζητουμενων μικροπρογραμματων:

LDA #Κ:

PC+1->PC,MAR

MDR+0->ACC

PC+1->PC,MAR

NEXT(PC)

LDX #K:

PC+1->PC,MAR

MDR+0->X

PC+1->PC,MAR

NEXT(PC)

LDA ($K)

PC+1->PC,MAR

MDR+0->ACC

ACC+0->MAR

MDR+0->ACC

ACC+0->MAR

MDR+0->ACC

PC+1->PC,MAR

NEXT(PC)

LDAX

X+0->MAR

MDR+0->ACC

PC+1->PC,MAR

NEXT(PC)

MOVEAX

X+0->ACC

PC+1->PC,MAR

NEXT(PC)

LDA K(Χ)

PC+1->PC,MAR

MDR+0->ACC

ACC+X->ACC

ACC+0->MAR

MDR+0->ACC

PC+1->PC,MAR

NEXT(PC)

STA $K

PC+1->PC,MAR

MDR+0->X

X+0->MAR

ACC+0->NOP,MWE

PC+1->PC,MAR

NEXT(PC)

|  |  |  |
| --- | --- | --- |
| **Mapper** | | |
| Κώδικας εντολής | Opcode/Θέση | Περιεχόμενα |
| LDA #Κ | **00H** | 2H |
| LDX #Κ | **01H** | 7H |
| LDA ($K) | **02H** | AH |
| LDAX | **03H** | 12H |
| LDA K(Χ) | **04H** | 16H |
| MOVEAX | **05H** | 1dH |
| STA $Κ | **06H** | 20H |

|  |  |  |
| --- | --- | --- |
| **Main Memory** | | |
| Κώδικας εντολής | Θέση | Περιεχόμενο |
| LDA #8 | 0000 | **00H** |
| 0001 | 08H |
| STA $0C | 0010 | 21H |
| 0011 | 1100 |
| LDX #6 | 0100 | **01H** |
| 0101 | 0110 |
| STA $0D | 0110 | 21H |
|  | 0111 | 1011 |
| LDAX | 1000 | **03H** |
| LDA 7(Χ) | 1001 | **04H** |
|  | 1010 | 0111 |
| MOVEAX | 1011 | **05H** |
|  | 1100 | **00H** |
|  | 1101 | **00H** |

ΜΙΚΡΟΠΡΟΓΡΑΜΜΑΤΑ

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **BOOTSTRAP** | BRA | BIN | CON | I | I | I | APORT | BPORT | DDATA | SH~ | SELB | MWE~ | MARCLK | MSTATUS | LDS~ | PCE~ | CARRYE~ | MDE~ | DDATAE~ | **ADDRESS** |
|  | (4:0) | (2:0) | (2:0) | (2:0) | (5:3) | (8:6) | (3:0) | (3:0) | (1:0) |  |  |  |  |  |  |  |  |  |  |  |
| SW+0->PC,MAR | xxxxx | 000 | χχχ | 111 | 000 | 011 | χχχχ | 0001 | χχ | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 1 | 1 | 1 | m00 |
| NEXT(PC) | xxxxx | 000 | χχχ | χχχ | χχχ | 001 | χχχχ | χχχχ | χχ | χ | 1 | 1 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | m01 |

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **LDA #Κ** | BRA | BIN | CON | I | I | I | APORT | BPORT | DDATA | SH~ | SELB | MWE~ | MARCLK | MSTATUS | LDS~ | PCE~ | CARRYE~ | MDE~ | DDATAE~ | **ADDRESS** |
|  | (4:0) | (2:0) | (2:0) | (2:0) | (5:3) | (8:6) | (3:0) | (3:0) | (1:0) |  |  |  |  |  |  |  |  |  |  |  |
| PC+1->PC,MAR | xxxxx | 000 | χχχ | 101 | 000 | 011 | 0001 | 0001 | 01 | Χ | 1 | 1 | 1 | 0 | 1 | 1 | 1 | 1 | 0 | m02 |
| MDR+0->ACC | xxxxx | 000 | χχχ | 111 | 000 | 011 | χχχχ | 0000 | χχ | Χ | 1 | 1 | 0 | 0 | 1 | 1 | 1 | 0 | 1 | m03 |
| PC+1->PC,MAR | xxxxx | 000 | χχχ | 101 | 000 | 011 | 0001 | 0001 | 01 | Χ | 1 | 1 | 1 | 0 | 1 | 1 | 1 | 1 | 0 | m04 |
| NEXT(PC) | xxxxx | 000 | χχχ | χχχ | χχχ | 001 | χχχχ | χχχχ | χχ | χ | 1 | 1 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | m05 |

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **LDX #Κ** | BRA | BIN | CON | I | I | I | APORT | BPORT | DDATA | SH~ | SELB | MWE~ | MARCLK | MSTATUS | LDS~ | PCE~ | CARRYE~ | MDE~ | DDATAE~ | **ADDRESS** |
|  | (4:0) | (2:0) | (2:0) | (2:0) | (5:3) | (8:6) | (3:0) | (3:0) | (1:0) |  |  |  |  |  |  |  |  |  |  |  |
| X+0->MAR | xxxxx | 000 | xxx | 100 | 000 | 001 | 0010 | xxxx | xx | x | 1 | 1 | 1 | 0 | 1 | 1 | 1 | 1 | 1 | m06 |
| MDR+0->Χ | xxxxx | 000 | χχχ | 111 | 000 | 011 | χχχχ | 0010 | χχ | Χ | 1 | 1 | 0 | 0 | 1 | 1 | 1 | 0 | 1 | m07 |
| PC+1->PC,MAR | xxxxx | 000 | χχχ | 101 | 000 | 011 | 0001 | 0001 | 01 | Χ | 1 | 1 | 1 | 0 | 1 | 1 | 1 | 1 | 0 | m08 |
| NEXT(PC) | xxxxx | 000 | χχχ | χχχ | χχχ | 001 | χχχχ | χχχχ | χχ | χ | 1 | 1 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | m09 |

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **LDA ($K)** | BRA | BIN | CON | I | I | I | APORT | BPORT | DDATA | SH~ | SELB | MWE~ | MARCLK | MSTATUS | LDS~ | PCE~ | CARRYE~ | MDE~ | DDATAE~ | **ADDRESS** |
|  | (4:0) | (2:0) | (2:0) | (2:0) | (5:3) | (8:6) | (3:0) | (3:0) | (1:0) |  |  |  |  |  |  |  |  |  |  |  |
| PC+1->PC,MAR | xxxxx | 000 | χχχ | 101 | 000 | 011 | 0001 | 0001 | 01 | Χ | 1 | 1 | 1 | 0 | 1 | 1 | 1 | 1 | 0 | m0A |
| MDR+0->ACC | xxxxx | 000 | χχχ | 111 | 000 | 011 | χχχχ | 0000 | χχ | Χ | 1 | 1 | 0 | 0 | 1 | 1 | 1 | 0 | 1 | m0B |
| ACC+0->NOP,MAR | xxxxx | 000 | χχχ | 100 | 000 | 001 | 0000 | χχχχ | χχ | 1 | 1 | 1 | 1 | 0 | 1 | 1 | 1 | 1 | 1 | m0C |
| MDR+0->ACC | xxxxx | 000 | χχχ | 111 | 000 | 011 | χχχχ | 0000 | χχ | Χ | 1 | 1 | 0 | 0 | 1 | 1 | 1 | 0 | 1 | m0D |
| ACC+0->NOP,MAR | xxxxx | 000 | χχχ | 100 | 000 | 001 | 0000 | χχχχ | χχ | 1 | 1 | 1 | 1 | 0 | 1 | 1 | 1 | 1 | 1 | m0E |
| MDR+0->ACC | xxxxx | 000 | χχχ | 111 | 000 | 011 | χχχχ | 0000 | χχ | Χ | 1 | 1 | 0 | 0 | 1 | 1 | 1 | 0 | 1 | m0F |
| PC+1->PC,MAR | xxxxx | 000 | χχχ | 101 | 000 | 011 | 0001 | 0001 | 01 | Χ | 1 | 1 | 1 | 0 | 1 | 1 | 1 | 1 | 0 | m10 |
| NEXT(PC) | xxxxx | 000 | χχχ | χχχ | χχχ | 001 | χχχχ | χχχχ | χχ | χ | 1 | 1 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | m11 |

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **LDAX** | BRA | BIN | CON | I | I | I | APORT | BPORT | DDATA | SH~ | SELB | MWE~ | MARCLK | MSTATUS | LDS~ | PCE~ | CARRYE~ | MDE~ | DDATAE~ | **ADDRESS** |
|  | (4:0) | (2:0) | (2:0) | (2:0) | (5:3) | (8:6) | (3:0) | (3:0) | (1:0) |  |  |  |  |  |  |  |  |  |  |  |
| PC+1->PC,MAR | xxxxx | 000 | χχχ | 101 | 000 | 011 | 0001 | 0001 | 01 | Χ | 1 | 1 | 1 | 0 | 1 | 1 | 1 | 1 | 0 | m12 |
| MDR+0->Χ | xxxxx | 000 | χχχ | 111 | 000 | 011 | χχχχ | 0010 | χχ | Χ | 1 | 1 | 0 | 0 | 1 | 1 | 1 | 0 | 1 | m13 |
| PC+1->PC,MAR | xxxxx | 000 | χχχ | 101 | 000 | 011 | 0001 | 0001 | 01 | Χ | 1 | 1 | 1 | 0 | 1 | 1 | 1 | 1 | 0 | m14 |
| NEXT(PC) | xxxxx | 000 | χχχ | χχχ | χχχ | 001 | χχχχ | χχχχ | χχ | χ | 1 | 1 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | m15 |

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **MOVEAX** | BRA | BIN | CON | I | I | I | APORT | BPORT | DDATA | SH~ | SELB | MWE~ | MARCLK | MSTATUS | LDS~ | PCE~ | CARRYE~ | MDE~ | DDATAE~ | **ADDRESS** |
|  | (4:0) | (2:0) | (2:0) | (2:0) | (5:3) | (8:6) | (3:0) | (3:0) | (1:0) |  |  |  |  |  |  |  |  |  |  |  |
| X+0->ACC | xxxxx | 000 | χχχ | 100 | 000 | 011 | 0010 | 0000 | XX | Χ | 1 | 1 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | m1d |
| PC+1->PC,MAR | xxxxx | 000 | χχχ | 101 | 000 | 011 | 0001 | 0001 | 01 | Χ | 1 | 1 | 1 | 0 | 1 | 1 | 1 | 1 | 0 | m1e |
| NEXT(PC) | xxxxx | 000 | χχχ | χχχ | χχχ | 001 | χχχχ | χχχχ | χχ | χ | 1 | 1 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | m1f |

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **LDA K(Χ)** | BRA | BIN | CON | I | I | I | APORT | BPORT | DDATA | SH~ | SELB | MWE~ | MARCLK | MSTATUS | LDS~ | PCE~ | CARRYE~ | MDE~ | DDATAE~ | **ADDRESS** |
|  | (4:0) | (2:0) | (2:0) | (2:0) | (5:3) | (8:6) | (3:0) | (3:0) | (1:0) |  |  |  |  |  |  |  |  |  |  |  |
| PC+1->PC,MAR | xxxxx | 000 | χχχ | 101 | 000 | 011 | 0001 | 0001 | 01 | Χ | 1 | 1 | 1 | 0 | 1 | 1 | 1 | 1 | 0 | m16 |
| MDR+0->ACC | xxxxx | 000 | χχχ | 111 | 000 | 011 | χχχχ | 0000 | χχ | Χ | 1 | 1 | 0 | 0 | 1 | 1 | 1 | 0 | 1 | m17 |
| ACC+X->ACC | xxxxx | 000 | χχχ | 001 | 000 | 011 | 0000 | 0010 | χχ | X | 1 | 1 | 1 | 0 | 1 | 1 | 1 | 1 | 1 | m18 |
| ACC+0->NOP,MAR | xxxxx | 000 | χχχ | 100 | 000 | 001 | 0000 | χχχχ | χχ | 1 | 1 | 1 | 1 | 0 | 1 | 1 | 1 | 1 | 1 | m19 |
| MDR+0->ACC | xxxxx | 000 | χχχ | 111 | 000 | 011 | χχχχ | 0000 | χχ | Χ | 1 | 1 | 0 | 0 | 1 | 1 | 1 | 0 | 1 | m1a |
| PC+1->PC,MAR | xxxxx | 000 | χχχ | 101 | 000 | 011 | 0001 | 0001 | 01 | Χ | 1 | 1 | 1 | 0 | 1 | 1 | 1 | 1 | 0 | m1b |
| NEXT(PC) | xxxxx | 000 | χχχ | χχχ | χχχ | 001 | χχχχ | χχχχ | χχ | χ | 1 | 1 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | m1c |

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **STA $K** | BRA | BIN | CON | I | I | I | APORT | BPORT | DDATA | SH~ | SELB | MWE~ | MARCLK | MSTATUS | LDS~ | PCE~ | CARRYE~ | MDE~ | DDATAE~ | **ADDRESS** |
|  | (4:0) | (2:0) | (2:0) | (2:0) | (5:3) | (8:6) | (3:0) | (3:0) | (1:0) |  |  |  |  |  |  |  |  |  |  |  |
| PC+1->PC,MAR | xxxxx | 000 | χχχ | 101 | 000 | 011 | 0001 | 0001 | 01 | Χ | 1 | 1 | 1 | 0 | 1 | 1 | 1 | 1 | 0 | m20 |
| MDR+0->X | xxxxx | 000 | χχχ | 111 | 000 | 011 | χχχχ | 0010 | χχ | Χ | 1 | 1 | 0 | 0 | 1 | 1 | 1 | 0 | 1 | m21 |
| X+0->NOP,MAR | xxxxx | 000 | χχχ | 100 | 000 | 001 | 0010 | χχχχ | χχ | 1 | 1 | 1 | 1 | 0 | 1 | 1 | 1 | 1 | 1 | m22 |
| ACC+0->NOP,MWE | xxxxx | 000 | χχχ | 100 | 000 | 001 | 0000 | χχχχ | χχ | 1 | 1 | 1 | 1 | 0 | 1 | 1 | 1 | 1 | 1 | m23 |
| PC+1->PC,MAR | xxxxx | 000 | χχχ | 101 | 000 | 011 | 0001 | 0001 | 01 | Χ | 1 | 1 | 1 | 0 | 1 | 1 | 1 | 1 | 0 | m24 |
| NEXT(PC) | xxxxx | 000 | χχχ | χχχ | χχχ | 001 | χχχχ | χχχχ | χχ | χ | 1 | 1 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | m25 |