ΕΡΓΑΣΤΗΡΙΟ ΑΡΧΙΤΕΚΤΟΝΙΚΗΣ ΥΠΟΛΟΓΙΣΤΩΝ

ΕΡΓΑΣΤΗΡΙΑΚΗ ΑΣΚΗΣΗ 1

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**ΑΣΚΗΣΗ 1**

# 7(hex) -> x2

addi x2, x0, 0x7

# 73(hex) -> x5

addi x5, x0 , 0x73

# F38(hex) -> x6

addi x6, x0 , 0xF38 # given that this is a negative

# signed number , there will be a sign extension

**ΑΣΚΗΣΗ 2**

# x3 <- unsigned 45800

lui x3, 0x00046

addi x3, x3, 0x000800

# x4 <- unsigned FF000900

lui x4, 0xFF001

addi x4, x4 , 0x1900

# x5 <- unsigned F38

lui x5, 0x0001

addi x5, x5, 0xF38

**ΑΣΚΗΣΗ 3**

addi x0, x0,0x000 # fortwsh tou 0 ston kataxwrhth kai

# apothikeush sthn dieuthunsh 100

sb x0,0x100(x0)

addi x1, x1, 0x001 # fortwsh tou 1 ston kataxwrhth kai

# apothikeush sthn dieuthunsh 104

sb x1, 0x104(x0)

addi x2, x2,0x002 # fortwsh tou 2 ston kataxwrhth kai

# apothikeush sthn dieuthunsh 108

sb x2 ,0x108(x0)

addi x3, x3,0x003 # fortwsh tou 3 ston kataxwrhth kai

# apothikeush sthn dieuthunsh 10c

sb x3, 0x10c(x0)

**ΑΣΚΗΣΗ 4**

lui x1,0x87654 # fortwsh tou 87654321 ston kataxwrhth

addi x1, x1,0x321

sw x1,0x010(x0)

lui x2,0x22222 # fortwsh tou 22222222 ston kataxwrhth

addi x2, x2,0x222

sw x2,0x014(x0)

lui x3,0x33333 # fortwsh tou 33333333 ston kataxwrhth

addi x3, x3,0x333

sw x3,0x018(x0)

**ΑΣΚΗΣΗ 5**

lui x1, 0x80000

lui x3, 0x9967A # sumplhrwma ws pros 2

addi x3, x3, 0x196

lui x4, 0x7E083 # unsigned arithmos

addi x4, x4, 0x924

lui x5, 0x00000 # Register <-> GToEq flag

# Test: x3[MSB]=1

and x2, x1, x3

beq x1, x2, greater\_than\_or\_equal

# Test: x4[MSB]=1

and x2, x1, x4

beq x1, x2, greater\_than\_or\_equal

# Test: x4 - x3 >= 0

bge x4, x3, greater\_than\_or\_equal

blt x4, x3, less\_than

greater\_than\_or\_equal:

addi x5, x5, 0x0001

beq x5, x5, halt

less\_than:

beq x5, x5, halt

halt:

**ΑΣΚΗΣΗ 6**

# x1 -> address register

# x2 -> data register 1

# x3 -> data register 2

# x4 -> loop counter (0x10F - 0x100 + 0x1) / 0x4 = 0x4 = 4

# x5 -> register that holds shifting number

sub x1, x1, x1 # katharizw to x1

addi x1, x1, 0x100 # fortwnw ston x1 to 0x100

sub x4, x4, x4 # katharizw ton x4

addi x4, x4, 0x4 # fortwnw ston x4 to 0x4

sub x5, x5, x5 # katharizw to x5

addi x5, x5, 0x3 # fortwnw ston x5 to 0x3

loop:

sub x2, x2, x2 # katharizw to x2

or x2, x1, x2 # antigrafh ths dieuthunshs tou x1 sto x2

addi x2, x2, 0x3 # prosthetw 3 sto x2

sub x3, x3, x3 # katharizw ton x3

or x3, x2, x3 # x3 <- x2

srl x3, x3, x5 # upologizw thn diairesh

sll x3, x3, x5

sub x2, x2,

sw x2, 0(x1) # apothikeush

addi x1, x1, 4 # epomenh thesh mnhmhs

addi x4, x4, -1 # meiwnw ton counter

blt x0, x4, loop

**ΑΣΚΗΣΗ 7**

##### Array A ##### a erwthma ###

lui x8, 0x00002 # dieuthunsh mnhmhs apo opou ksekiname na apothikeuoume

# fortwsh tuxaiwn leksewn stous kataxwrhtes #

lui x1, 0x000AF

addi x1, x1, 0x586

lui x2, 0x00002

addi x2, x2, 0x345

lui x3, 0x00EF1

addi x3, x3, 0x934

lui x4, 0x00005

addi x4, x4, 0x672

lui x5, 0x00098

addi x5, x5, 0x4FA

lui x6, 0x00056

addi x6, x6, 0x440

lui x7, 0x0023B

addi x7, x7, 0xEBC

# apothikeush twn timwn stis dieuthunseis

sw x1, 0(x8)

sw x2, 4(x8)

sw x3, 8(x8)

sw x4, 12(x8)

sw x5, 16(x8)

sw x6, 20(x8)

sw x7, 24(x8)

##### Array B ##### b erwthma

lui x8, 0x00002 # dieuthunsh mnhmhs apo opou ksekiname na apothikeuoume

# times gia to array A

lui x9, 0x00003 # dieuthunsh mnhmhs apo opou ksekiname na apothikeuoume

# times gia to array B

lui x10, 0 # metrhths epanalhpsewn

addi x10, x10, 1

lui x11, 0

addi x11, x11, 7 # metrhths(7 sto sunolo opws kai ta stoixeia tou Array A)

loop\_array\_B:

lw x12, 0(x8) # fortwsh stoixeiou apo to array A

srli x12, x12, 16 # diairesh x1 me 16

sw x12, 0(x9) # apothikeush tou stoixeiou sto array B

addi x8, x8, 4 # epomeno stoixeio tou array A

addi x9, x9, 4 # epomeno stoixeio tou array B

sub x11, x11, x10 # an loop counter =/ 0, tote ektelw to label pali

blt x0, x11, loop\_array\_B

##### Array C #####

lui x8, 0x00002 # Base address gia to Array A (stoixeia)

lui x9, 0x00003 # Base address gia to Array B (upoloipo diaireshs)

sub x10, x10, x10 # katharizw ton counter gia na mhn xrhsimopoihsw allon register

lui x10, 0x00004 # Base address gia to Array C (phliko diaireshs)

lui x11, 0 # metrhths epanalhpsewn

addi x11, x11, 1

lui x12, 0

addi x12, x12, 7 # metrhths (7 osa kai ta stoixeia tou A)

loop\_array\_C:

lw x13, 0(x8) # fortwsh stoixeiou apo to Array A

lw x14, 0(x9) # fortwsh stoixeiou apo to Array A

sub x14, x13, x14 # afairesh tou x14 apo to x13

sw x14, 0(x10) # apothikeush ths diaforas sto Array B

addi x8, x8, 4 # epomeno stoixeio tou Array A

addi x9, x9, 4 # epomeno stoixeio tou Array B

addi x10, x10, 4 # epomeno stoixeio tou Array C

sub x12, x12, x11 # diafora twn 2 counters kai an to x12=/0 tote epanalambanw to loop

blt x0, x12, loop\_array\_C

**ΑΣΚΗΣΗ 8**

**ΑΣΚΗΣΗ 9**

### bubblesort ###

lui x8, 0x0000 ## address pou tha xrhsimopoihsoume gia na kanoume

addi x8 ,x8, 0x100 ## apothikeush twn stoixeiwn

## array stoixeiwn###

lui x1, 0x0000

addi x1, x1, 0x04

sb x1, 0(x8)

lui x2, 0x0000

addi x2, x2, 0x01

sb x2, 4(x8)

lui x3, 0x0000

addi x3, x3, 0x00

sb x3, 8(x8)

lui x4, 0x0000

addi x4, x4, 0x016

sb x4, 12(x8)

lui x5, 0x0000

addi x5, x5, 0x05

sb x5, 16(x8)

## counters ##

lui x10 , 0x0000 ##counter

lui x11, 0x0000

addi x11,x11, 0x05 ## posa stoixeia exei to array

#lui x6, 0x0000 # arr[i]

#lui x7, 0x0000 # arr[i+1]

loop:

lui x6, 0x0000 # arr[i]

lui x7, 0x0000 # arr[i+1]

lw x6, 0(x8)

lw x7, 4(x8)

blt x6, x7 , no\_swap

# swap elements

sw x7 , 0(x8)

sw x6 , 4(x8)

#addi x8 , x8 , 4

addi x11, x11, -1

bne x11, x10, loop

no\_swap:

sw x6 , 0(x8)

sw x7 , 4(x8)

addi x8 , x8 , 4

#addi x11, x11, -1

bne x11, x10 , loop

**ΑΣΚΗΣΗ 10**

1. ερώτημα

sub x1, x1, x1

addi x1, x1, 0x20

sub x2, x2, x2

addi x2, x2, 1

sub x3, x1, x2

lui x4, 0x57390

sll x5, x4, x2

srl x6, x4, x3

or x4, x6, x5

1. ερώτημα

lui x8 , 0x000 # dieuthunsh mnhmhs apo opou ksekiname na apothikeuoume

addi x8 ,x8, 0x300

lui x1,0x12345

addi x1,x1,0x5678

lui x2,0x23456

addi x2,x2,0x6789

lui x3,0x11345

addi x3,x3,0x5678

lui x4,0x13345

addi x4,x4,0x5678

lui x5,0x14345

addi x5,x5,0x5678

lui x6,0x15345

addi x6,x6,0x5678

# apothikeush twn timwn stis dieuthunseis

sw x1, 0(x8)

sw x2, 4(x8)

sw x3, 8(x8)

sw x4, 12(x8)

sw x5, 16(x8)

sw x6, 20(x8)

# array b gia olisthiseis #

lui x8 , 0x0000 # edw einai apothikeumena ta stoixeia mas

addi x8, x8 , 0x300

lui x9 , 0x0000

addi x9 ,x9, 0x7 # poses olisthiseis theloume

lui x20, 0x0000 # apo edw ksekiname na apothikeuoume ta nea stoixeia

addi x20, x20 , 0x400

lui x10, 0 # counter epanalhpsewn

addi x10 , x10 , 1

lui x11, 0

addi x11, x11, 6 # 6 einai sta stoixeia tou array

kyklikh\_olisthisi:

lw x12, 0(x8) # fortwsh ths lekshs

sll x12, x1, x9

sub x13, x1, x9

srl x14, x1, x11

or x1, x12 , x14

sw x1, 0(x20)

addi x8, x8, 4

addi x20 , x20 , 4

sub x11, x11, x10

blt x0 , x11, kyklikh\_olisthisi

**ΑΣΚΗΣΗ 11**

lui x1,0xf0f0f #loading random word

addi x1,x1,0xf0f0

sw x1,0x300(x0)

lui x2,0xa0a0a

addi x2,x2,0xa0a0

sw x2,0x304(x0)

addi x10,x10,0x002

addi x9,x9,0x002

addi x12,x12,32

addi x6,x6,30

start: #rotation

beq x8,x10,end

lw x1,0x300(x7)

sll x2,x1,x9

srl x3,x2,x9

sub x4,x1,x3

srl x5,x4,x6

add x11,x5,x2

sw x11,0x400(x7)

addi x7,x7,0x004 #next address

addi x8,x8,0x001 #counter+1

jal x0,start

end: