**COS10004 – Computer System**

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**LAB 8**

8.1.1

MOV R0, #15

STR R0, .WriteUnsignedNum

MOV R0, #msg1

STR R0, .WriteString

HALT

msg1: .ASCIZ “remaining\n”

A screenshot of a program

Description automatically generated

8.1.2.

MOV R0, #15

STR R0, .WriteUnsignedNum

MOV R0, #msg1

STR R0, .WriteString

MOV R0, #msg2

STR R0, .WriteString

LDR R1, .InputNum

HALT

msg1: .ASCIZ "remaining\n"

msg2: .ASCIZ "How many do you want to remove (1-3)?"

A screenshot of a program

Description automatically generated

8.1.3.

MOV R0, #15

STR R0, .WriteUnsignedNum

MOV R1, #msg1

STR R1, .WriteString

MOV R1, #msg2

STR R1, .WriteString

LDR R2, .InputNum

SUB R0, R0, R2

STR R0, .WriteUnsignedNum

MOV R1, #msg1

STR R1, .WriteString

HALT

msg1: .ASCIZ "remaining\n"

msg2: .ASCIZ "How many do you want to remove (1-3)?\n"

A screenshot of a program

Description automatically generated

8.2.1

MOV R0, #15

STR R0, .WriteUnsignedNum

MOV R1, #msg1

STR R1, .WriteString

Loop:

MOV R1, #msg2

STR R1, .WriteString

LDR R2, .InputNum

SUB R0, R0, R2

STR R0, .WriteUnsignedNum

MOV R1, #msg1

STR R1, .WriteString

B Loop

HALT

msg1: .ASCIZ "remaining\n"

msg2: .ASCIZ "How many do you want to remove (1-3)?\n"

A screenshot of a program

Description automatically generated

A screenshot of a program

Description automatically generated

If you enter a number that takes the number of matchsticks remaining beyond 0 (i.e., into negative values), the remaining number will still be calculated as normal, for example we are having 10 matchsticks and we remove -1 matchsticks, then the new number will be 11 matchsticks.

8.2.2

(a) 0 < R2 < 4

(b)

Two assembly instructions could be used to create a branch that only occurs under this condition: BGT and BLT.

BGT: Z clear, N and V the same

BLT: N and V differ

(c) If the first condition is not met (R2 > 0), and R2 is negative then N = 1. If the first condition is not met (R2 > 0), and R2 = 0 then Z = 1.

If the second condition is not met (R2 < 4), and R2 > 4 then C = 1. If the second condition is not met (R2 < 4), and R2 = 4 then both Z = 1 and C = 1.

(d)

MOV R0, #15

STR R0, .WriteUnsignedNum

MOV R1, #msg1

STR R1, .WriteString

Loop:

MOV R1, #msg2

STR R1, .WriteString

LDR R2, .InputNum

start:

CMP R2, #0

BGT else1 // if R2 > 0 then jump to label else1

B invalid1

else1:

CMP R2, #4

BGT invalid1 // if R2 > 3 then jump to label invalid1

BLT cont // if R2 < 4 then jump to label cont

invalid1:

MOV R1, #msg3

STR R1, .WriteString

B start

cont:

SUB R0, R0, R2

STR R0, .WriteUnsignedNum

MOV R1, #msg1

STR R1, .WriteString

B Loop

HALT

msg1: .ASCIZ "remaining\n"

msg2: .ASCIZ "How many do you want to remove (1-3)?\n"

msg3: .ASCIZ "Please input a valid number!\n"

A screenshot of a program

Description automatically generated

8.3.1

(a)

LSL R4, R4, #30

LSR R4, R4, #30

(b)

select:

LDR R4, .Random

LSL R4, R4, #30

LSR R4, R4, #30

CMP R4, #0

BGT conti

B select

conti:

STR R4, .WriteUnsignedNum

HALT

A screenshot of a computer program

Description automatically generated

8.3.2.

MOV R0, #3

select:

LDR R4, .Random

LSL R4, R4, #30

LSR R4, R4, #30

CMP R4, #0

BGT conti

B select

conti:

CMP R4, R0

BGT select

B continue

continue:

STR R4, .WriteUnsignedNum

HALT

8.3.2.

MOV R0, #3

select:

LDR R4, .Random

LSL R4, R4, #30

LSR R4, R4, #30

CMP R4, #0

BGT conti

B select

conti:

CMP R4, R0

BGT select

B continue

contInue:

STR R4, .WriteUnsignedNum

HALT

A screenshot of a program

Description automatically generated

8.4.1.

MOV R0, #15

STR R0, .WriteUnsignedNum

MOV R1, #msg1

STR R1, .WriteString

Loop:

MOV R1, #msg2

STR R1, .WriteString

LDR R2, .InputNum

start:

CMP R2, #0

BGT else1 // if R2 > 0 then jump to label else1

B invalid1

else1:

CMP R2, #4

BGT invalid1 // if R2 > 3 then jump to label invalid1

BLT cont // if R2 < 4 then jump to label cont

invalid1:

MOV R1, #msg3

STR R1, .WriteString

B start

cont1:

CMP R0, R2

BLT invalid1

B cont2

cont2:

SUB R0, R0, R2

STR R0, .WriteUnsignedNum

MOV R1, #msg1

STR R1, .WriteString

MOV R1, #msg5

STR R1, .WriteString

B select

select:

LDR R4, .Random

LSL R4, R4, #30

LSR R4, R4, #30

CMP R4, #0

BGT conti

B select

conti:

CMP R4, R0

BGT select

B continue

continue:

SUB R0, R0, R4

STR R0, .WriteUnsignedNum

MOV R1, #msg1

STR R1, .WriteString

MOV R1, #msg4

STR R1, .WriteString

B Loop

HALT

msg1: .ASCIZ "remaining\n"

msg2: .ASCIZ "How many do you want to remove (1-3)?\n"

msg3: .ASCIZ "Please input a valid number!\n"

msg4: .ASCIZ "It's your turn!\n"

msg5: .ASCIZ "It's computer's turn!\n"

select:

LDR R4, .Random

LSL R4, R4, #30

LSR R4, R4, #30

CMP R4, #0

BGT conti

B select

conti:

CMP R4, R0

BGT select

B continue

//

SUB R0, R0, R4

STR R0, .WriteUnsignedNum

MOV R1, #msg1

STR R1, .WriteString