ECED3403 – Assignment 4

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# Design

## Problem Introduction

This assignment aims to further develop the XM23p emulator. The goal of assignment 4 is to implement the conditional execution instruction, CEX. Because branching can be expensive in an RISC, CEX can be used as an alternative option.

## Design Section

**PSEUDOCODE:**

A small amount of code used or referenced in the pseudocode was documented in previous assignments or labs.

PIPELINE FUNCTION

…

IF odd clock tick

IF bubble is TRUE

cex\_condition == OFF

…

END IF

…

END FUNCTION

DECODE FUNCTION

IF instruction opcode is CEX

SAVE condition

SAVE cex\_true

SAVE cex\_false

END IF

END FUNCTION

EXECUTE0 FUNCTION

IF cex\_condition is TRUE and cex\_false is greater than 0

cex\_false -= 1

RETURN

ELSE IF cex\_condition is FALSE and cex\_true is greater than 0

cex\_true -= 1

RETURN

END IF

SWITCH (opcode)

CASE(CEX)

CALL cex\_execute

BREAK

END SWITCH

END FUNCTION

cex\_set FUNCTION

IF condition is TRUE

SET cex\_condition to TRUE

ELSE

SET cex\_condition to FALSE

END IF

END FUNCTION

cex\_execute FUNCTION

SWITCH(code\_suffix)

CASE(EQ)

CALL cex\_condition with z == 1 condition

BREAK

CASE(NE)

CALL cex\_condition with z == 0 condition

BREAK

CASE(CSHS)

CALL cex\_condition with c == 1 condition

BREAK

CASE(CCLO)

CALL cex\_condition with c == 0 condition

BREAK

CASE(MI)

CALL cex\_condition with n == 1 condition

BREAK

CASE(PL)

CALL cex\_condition with n == 0 condition

BREAK

CASE(VS)

CALL cex\_condition with v == 1 condition

BREAK

CASE(VC)

CALL cex\_condition with v == 0 condition

BREAK

CASE(HI)

CALL cex\_condition with c == 1 and z == 0 condition

BREAK

CASE(LS)

CALL cex\_condition with c == 0 and z == 1 condition

BREAK

CASE(GE)

CALL cex\_condition with n == v condition

BREAK

CASE(LT)

CALL cex\_condition with n != v condition

BREAK

CASE(GT)

CALL cex\_condition with z == 0 and n == v condition

BREAK

CASE(LE)

CALL cex\_condition with z == 1 and n != v condition

BREAK

CASE(TR)

CALL cex\_condition with TRUE condition

BREAK

CASE(FL)

CALL cex\_condition with FALSE condition

BREAK

END SWITCH

END FUNCTION

## Data Dictionary

cex\_condition = [FALSE | TRUE | OFF]

FALSE = 0

TRUE = 1

OFF = 2

cex\_true = {1 [SET | CLEAR] 8}

SET = 1

CLEAR = 0

cex\_false = {0 [SET | CLEAR] 8}

code\_suffix = [EQ | NE | CSHS | CCLO | MI | PL | VS | VC | HI | LS | GE | LT | GT | LE | TR | FL]

EQ = 0

NE = 1

CSHS = 2

CCLO = 3

MI = 4

PL = 5

VS = 6

VC = 7

HI = 8

LS = 9

GE = 10

LT = 11

GT = 12

LE = 13

TR = 14

FL = 15

psw = v + n + z + c

v = [SET | CLEAR]

n = [SET | CLEAR]

z = [SET | CLEAR]

c = [SET | CLEAR]