ECED3403 – Assignment 4

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# Design

## Problem Introduction

This assignment aims to further develop the XM23p emulator. As of before assignment 4, the emulator can only perform sequential operations, one of the basic coding structures. The goal of assignment 4 is to implement two additional coding structures, conditionals and repetition. This will be accomplished by creating 9 new branching instructions, which modify the flow of control by modifying the program counter.

## Design Section

**PSEUDOCODE:**

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

DECODE FUNCTION

IF instruction opcode is BL

SAVE 13 bit offset

ELSE IF instruction opcode is between BEQ and BRA

SAVE 10 bit offset

END IF

END FUNCTION

EXECUTE1 FUNCTION

SWITCH (opcode)

CASE(BL)

CALL bl\_execute

BREAK

CASE(BEQ)

CALL beq\_execute

BREAK

CASE(BNE)

CALL bne\_execute

BREAK

CASE(BC)

CALL bc\_execute

BREAK

CASE(BNC)

CALL bnc\_execute

BREAK

CASE(BN)

CALL bn\_execute

BREAK

CASE(BGE)

CALL bge\_execute

BREAK

CASE(BLT)

CALL blt\_execute

BREAK

CASE(BRA)

CALL bra\_execute

BREAK

END SWITCH

END FUNCTIION

bl\_execute FUNCTION

SAVE PC to LR

SAVE offset to PC

END FUNCTION

beq\_execute FUNCTION

PC <- Z = 1 ? PC + offset : PC

END FUNCTION

bne\_execute FUNCTION

PC <- Z = 0 ? PC + offset : PC

END FUNCTION

bc\_execute FUNCTION

PC <- C = 1 ? PC + offset : PC

END FUNCTION

bnc\_execute FUNCTION

PC <- C = 0 ? PC + offset : PC

END FUNCTION

bn\_execute FUNCTION

PC <- N = 1 ? PC + offset : PC

END FUNCTION

bge\_execute FUNCTION

PC <- (n ^ v) = 0 ? PC + offset : PC

END FUNCTION

blt\_execute FUNCTION

PC <- (n ^ v) = 1 ? PC + offset : PC

END FUNCTION

bra\_execute

PC <- PC + offset

END FUNCTION

## Data Dictionary

offset = {16 [SET | CLEAR] 16}

SET = 1

CLEAR = 0

lr = {16 [SET | CLEAR] 16}