**Testing Plan**

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# Introduction

This document describes the manner, expected output, and result of each test conducted on the assembler. The assembler will be tested to see that the expected errors are produced and also test that the assembler produces the correct and expected object file output for various object file inputs.

# Object File Assembly

## Test Explanation

The tests following are assembly language files written to produce either correct and expected object file output or appropriate assembler errors describing said error. The assembly files will be written with various lengths and complexity to test the various commands allowed in our assembly language architecture.

## Test Results

### File IO

Call: >java Assembler.Main doesnotexist.asm result.txt

Result: Failed to assemble program due to an IO error.

### Prompt Given Example – Absolute Program

|  |  |
| --- | --- |
| Assembly | Object File |
| Lab2EG .ORIG x30B0  count .FILL #4  Begin LD ACC,count ;R1 <- 4  LEA R0,msg  loop TRAP x22 ;print "hi! "  ADD ACC,ACC,#-1 ;R1--  BRP loop  JMP Next  msg .STRZ "hi! "  Next AND R0,R0,x0 ;R0 <- 0  NOT R0,R0 ;R0 <- xFFFF  ST R0,Array ;M[Array] <-xFFFF  LEA R5,Array  LD R6,=#100 ;R6 <= #100  STR R0,R5,#1  TRAP x25  ACC .EQU #1  ; ----- Scratch Space -----  Array .BLKW #3  .FILL x10  .END Begin | HLab2EG30B00018  T30B00004  T30B122B0  T30B2E0B7  T30B3F022  T30B4127F  T30B502B3  T30B640BC  T30B70068  T30B80069  T30B90021  T30BA0020  T30BB0000  T30BC5020  T30BD903F  T30BE30C3  T30BFEAC3  T30C02CC7  T30C17141  T30C2F025  T30C60010  T30C70064  E30B1 |
| **Result:** | Matches Expected Output |

### Relative Program

|  |  |
| --- | --- |
| Assembly | Object File |
| Test5 .ORIG  count .FILL #4  Begin LD ACC,count ;R1 <- 4  LEA R0,msg  loop TRAP x22 ;print "hi! "  ADD ACC,ACC,#-1 ;R1--  BRP loop  JMP Next  msg .STRZ "hi! "  Next AND R0,R0,x0 ;R0 <- 0  NOT R0,R0 ;R0 <- x####  ST R0,Array ;M[Array] <-x####  LEA R5,Array  LD R6,=#100 ;R6 <= #100  STR R0,R5,#1  TRAP x25  ACC .EQU #1  ; ----- Scratch Space -----  Array .BLKW #3  .FILL x10  .END Begin | HTest500000018  T00000004  T00012200M0  T0002e007M0  T0003f022  T0004127f  T00050203M0  T0006480cM0  T00070068  T00080069  T00090021  T000a0020  T000b0000  T000c5020  T000d9000  T000e3013M0  T000fea13M0  T00102c17M0  T00117141  T0012f025  T00160010  T00170064  E0001 |
| **Result:** | Matches Expected Output |

### Program Using Forward Referencing

|  |  |
| --- | --- |
| Assembly | Object File |
| Test25 .ORIG  Begin ADD R0, R1, Symbol  Symbol .EQU x3  .END x0 |  |
| **Expected:** | Pass |
| **Result:** | Matches Expected Output |

### Program Beginning Execution at Last Memory Address

|  |  |
| --- | --- |
| Assembly | Object File |
| LasMem .ORIG xFFFF  count .FILL #4  Begin LD ACC,count ;R1 <- 4  LEA R0,msg  loop TRAP x22 ;print "hi! "  ADD ACC,ACC,#-1 ;R1--  BRP loop  JMP Next  msg .STRZ "hi! "  Next AND R0,R0,x0 ;R0 <- 0  NOT R0,R0 ;R0 <- xFFFF  ST R0,Array ;M[Array] <-xFFFF  LEA R5,Array  LD R6,=#100 ;R6 <= #100  STR R0,R5,#1  TRAP x25  ACC .EQU #1  ; ----- Scratch Space -----  Array .BLKW #3  .FILL x10  .END Begin |  |
| **Expected:** | Fail |
| **Result:** | Assemble error: Line 20 - Operand value "Begin" (65536) is out of bounds.  Assemble error: Program spans multiple memory pages. Relocate or shrink the program to fit inside one memory page.  Assemble error: Program loads into memory outside the addressable range. |

### Program Spanning Page Boundary

|  |  |
| --- | --- |
| Assembly | Object File |
| Test6 .ORIG x0E00  count .FILL #4  Begin LD ACC,count ;R1 <- 4  LEA R0,msg  loop TRAP x22 ;print "hi! "  ADD ACC,ACC,#-1 ;R1--  BRP loop  JMP Next  msg .STRZ "hi! "  Next AND R0,R0,x0 ;R0 <- 0  NOT R0,R0 ;R0 <- x0E00  ST R0,Array ;M[Array] <-x0E00  LEA R5,Array  LD R6,=#100 ;R6 <= #100  STR R0,R5,#1  TRAP x25  ACC .EQU #1  ; ----- Scratch Space -----  Array .BLKW #3  .FILL x10  .END Begin |  |
| **Expected:** | Fail |
| **Result:** | Passes Test When it Should Not |

### Incorrect Use of Literal

|  |  |
| --- | --- |
| Assembly | Object File |
| Test3 .ORIG  Begin ADD R0, R1, =#100  .END Begin |  |
| **Expected:** | Fail |
| **Result:** | Assemble error: Line 2 - Could not find definition for operation "ADD" with matching operands. |

### Relative Program Containing Unclosed String

|  |  |
| --- | --- |
| Assembly | Object File |
| Test8 .ORIG  Symbol .EQU x3  Begin .STRZ "unclosed string  .END x0 |  |
| **Expected:** | Fail |
| **Result:** | Assemble error: Line 3 - Detected string operand with unclosed quotation mark. |

### Relative Program Testing .EQU Pseudo-op

|  |  |
| --- | --- |
| Assembly | Object File |
| Test9 .ORIG  Symbol .EQU x3  Begin ADD R0, R1, Symbol  .END x0 | HTest9 00000001  T00001063  E0000 |
| **Expected:** | Pass |
| **Result:** | Matched Expected Output |

### Relative Program Testing Incorrect Use of .EQU Pseudo-op

|  |  |
| --- | --- |
| Assembly | Object File |
| Test11 .ORIG  Symbol .EQU x3, #10  Begin ADD R0, R1, Symbol  .END x0 |  |
| **Expected:** | Fail |
| **Result:** | Assemble error: Line 2 - Incorrect usage of .EQU. Requires a label and one operand. |

### Absolute Program Testing Incorrect Use of .ORIG Pseudo-op

|  |  |
| --- | --- |
| Assembly | Object File |
| Test10 .ORIG R0  Symbol .EQU x3  Begin ADD R0, R1, Symbol  .END x0 |  |
| **Expected:** | Fail |
| **Result:** | Assemble error: Line 1 - Operand of .ORIG must be an immediate value. |

### Relative Program Containing Improper Whitespace Use

|  |  |
| --- | --- |
| Assembly | Object File |
| Test12 .ORIG  Begin ADD R0, R1, #1 ;  ADD R0, R2, #2 ;  .END x0 |  |
| **Expected:** | Fail |
| **Result:** | Assemble error: Line 2 - Incorrect spacing.  Assemble error: Line 3 - Incorrect spacing. |

### Relative Program Using Undefined Symbol

|  |  |
| --- | --- |
| Assembly | Object File |
| Test24 .ORIG  Begin ADD R0, R1, #1  Test .EQU Bear  .END x0 |  |
| **Expected:** | Fail |
| **Result:** | Assemble error: Line 3 - null |

### Relative Program Attempting Symbol Aliasing

|  |  |
| --- | --- |
| Assembly | Object File |
| Test13 .ORIG  Begin ADD R0, R1, #1  Test .EQU Test  .END x0 |  |
| **Expected:** | Fail |
| **Result:** | Assemble error: Line 3 - Cannot alias a symbol to itself. |

### Relative Program Testing Incorrect Use of .FILL Pseudo-op

|  |  |
| --- | --- |
| Assembly | Object File |
| Test14 .ORIG  Begin ADD R0, R1, #1  Test .FILL R2  .END x0 |  |
| **Expected:** | Fail |
| **Result:** | Assemble error: Line 3 - Incorrect operands for .FILL operation. |

### Relative Program Testing Incorrect Use of .STRZ Pseudo-op

|  |  |
| --- | --- |
| Assembly | Object File |
| Test15 .ORIG  Begin ADD R0, R1, #1  Test .STRZ R2  Test2 .STRZ x3  .END x0 |  |
| **Expected:** | Fail |
| **Result:** | Assemble error: Line 3 - Incorrect operand type for .STRZ operation.  Assemble error: Line 4 - Incorrect operand type for .STRZ operation. |

### Relative Program Testing Symbol Redefinition

|  |  |
| --- | --- |
| Assembly | Object File |
| Test17 .ORIG  Begin ADD R0, R1, #1  Test .FILL x2  Test .FILL x2  .END x0 |  |
| **Expected:** | Fail |
| **Result:** | Assemble error: Line 4 - Symbol redefinition is not allowed. |

### Relative Program Testing Literal Use

|  |  |
| --- | --- |
| Assembly | Object File |
| Test18 .ORIG  Begin ADD R0, R1, #1  Test .FILL #-1  .END x0 | HTest1800000002  T00001061  T0001ffff  E0000 |
| **Expected:** | Pass |
| **Result:** | Matches Expected Output |

### Relative Program Testing Incorrect Hex Usage

|  |  |
| --- | --- |
| Assembly | Object File |
| Test19 .ORIG  Begin ADD R0, R1, #1  Test .FILL x0  .END x-3 |  |
| **Expected:** | Fail |
| **Result:** | Assemble error: Line 4 - Cannot parse "-3" as a hex value. |

### Relative Program Testing Incorrect Operands

|  |  |
| --- | --- |
| Assembly | Object File |
| Test20 .ORIG  Begin ADD R-3, R1, #1  Test .FILL x0  .END x0 |  |
| **Expected:** | Fail |
| **Result:** | Assemble error: Operand value "R-3" (-3) is out of bounds. |

### Relative Program Testing .BLKW Pseudo-op

|  |  |
| --- | --- |
| Assembly | Object File |
| Test21 .ORIG  .FILL x0  .FILL x0  Test .BLKW #2  ADD R3, R1, #1  .END x0 | HTest2100000005  T00000000  T00010000  T00041661  E0000 |
| **Expected:** | Pass |
| **Result:** | Matches Expected Output |

### Relative Program Testing Incorrect Immediate Usage

|  |  |
| --- | --- |
| Assembly | Object File |
| Test22 .ORIG  Begin ADD R0, R1, #-17  .END Begin |  |
| **Expected:** | Fail |
| **Result:** | Assemble error: Line 2 - Operand value "-17" is out of bounds. |

### Relative Program Testing Incorrect Immediate Usage

|  |  |
| --- | --- |
| Assembly | Object File |
| Test23 .ORIG  Test .EQU #-17  Begin ADD R0, R1, Test  .END Begin |  |
| **Expected:** | Fail |
| **Result:** | Assemble error: Operand value "Test" (-17) is out of bounds. |

### Relative Program Using Maximum Symbols, Literals, and Source Records

|  |  |
| --- | --- |
| Assembly | Object File |
| Test26 .ORIG  Sym00 .EQU x3  Sym01 .EQU x3  Sym02 .EQU x3  Sym03 .EQU x3  Sym04 .EQU x3  Sym05 .EQU x3  Sym06 .EQU x3  Sym07 .EQU x3  Sym08 .EQU x3  Sym09 .EQU x3  Sym10 .EQU x3  Sym11 .EQU x3  Sym12 .EQU x3  Sym13 .EQU x3  Sym14 .EQU x3  Sym15 .EQU x3  Sym16 .EQU x3  Sym17 .EQU x3  Sym18 .EQU x3  Sym19 .EQU x3  Sym20 .EQU x3  Sym21 .EQU x3  Sym22 .EQU x3  Sym23 .EQU x3  Sym24 .EQU x3  Sym25 .EQU x3  Sym26 .EQU x3  Sym27 .EQU x3  Sym28 .EQU x3  Sym29 .EQU x3  Sym30 .EQU x3  Sym31 .EQU x3  Sym32 .EQU x3  Sym33 .EQU x3  Sym34 .EQU x3  Sym35 .EQU x3  Sym36 .EQU x3  Sym37 .EQU x3  Sym38 .EQU x3  Sym39 .EQU x3  Sym40 .EQU x3  Sym41 .EQU x3  Sym42 .EQU x3  Sym43 .EQU x3  Sym44 .EQU x3  Sym45 .EQU x3  Sym46 .EQU x3  Sym47 .EQU x3  Sym48 .EQU x3  Sym49 .EQU x3  Sym50 .EQU x3  Sym51 .EQU x3  Sym52 .EQU x3  Sym53 .EQU x3  Sym54 .EQU x3  Sym55 .EQU x3  Sym56 .EQU x3  Sym57 .EQU x3  Sym58 .EQU x3  Sym59 .EQU x3  Sym60 .EQU x3  Sym61 .EQU x3  Sym62 .EQU x3  Sym63 .EQU x3  Sym64 .EQU x3  Sym65 .EQU x3  Sym66 .EQU x3  Sym67 .EQU x3  Sym68 .EQU x3  Sym69 .EQU x3  Sym70 .EQU x3  Sym71 .EQU x3  Sym72 .EQU x3  Sym73 .EQU x3  Sym74 .EQU x3  Sym75 .EQU x3  Sym76 .EQU x3  Sym77 .EQU x3  Sym78 .EQU x3  Sym79 .EQU x3  Sym80 .EQU x3  Sym81 .EQU x3  Sym82 .EQU x3  Sym83 .EQU x3  Sym84 .EQU x3  Sym85 .EQU x3  Sym86 .EQU x3  Sym87 .EQU x3  Sym88 .EQU x3  Sym89 .EQU x3  Sym90 .EQU x3  Sym91 .EQU x3  Sym92 .EQU x3  Sym93 .EQU x3  Sym94 .EQU x3  Sym95 .EQU x3  Sym96 .EQU x3  Sym97 .EQU x3  Sym98 .EQU x3  Sym99 .EQU x3  Lit00 .EQU #3  Lit01 .EQU #3  Lit02 .EQU #3  Lit03 .EQU #3  Lit04 .EQU #3  Lit05 .EQU #3  Lit06 .EQU #3  Lit07 .EQU #3  Lit08 .EQU #3  Lit09 .EQU #3  Lit10 .EQU #3  Lit11 .EQU #3  Lit12 .EQU #3  Lit13 .EQU #3  Lit14 .EQU #3  Lit15 .EQU #3  Lit16 .EQU #3  Lit17 .EQU #3  Lit18 .EQU #3  Lit19 .EQU #3  Lit20 .EQU #3  Lit21 .EQU #3  Lit22 .EQU #3  Lit23 .EQU #3  Lit24 .EQU #3  Lit25 .EQU #3  Lit26 .EQU #3  Lit27 .EQU #3  Lit28 .EQU #3  Lit29 .EQU #3  Lit30 .EQU #3  Lit31 .EQU #3  Lit32 .EQU #3  Lit33 .EQU #3  Lit34 .EQU #3  Lit35 .EQU #3  Lit36 .EQU #3  Lit37 .EQU #3  Lit38 .EQU #3  Lit39 .EQU #3  Lit40 .EQU #3  Lit41 .EQU #3  Lit42 .EQU #3  Lit43 .EQU #3  Lit44 .EQU #3  Lit45 .EQU #3  Lit46 .EQU #3  Lit47 .EQU #3  Lit48 .EQU #3  Lit49 .EQU #3  Begin ADD R1, R1, Sym00  ADD R1, R1, Sym01  ADD R1, R1, Sym02  ADD R1, R1, Sym03  ADD R1, R1, Sym04  ADD R1, R1, Sym05  ADD R1, R1, Sym06  ADD R1, R1, Sym07  ADD R1, R1, Sym08  ADD R1, R1, Sym09  ADD R1, R1, Sym10  ADD R1, R1, Sym11  ADD R1, R1, Sym12  ADD R1, R1, Sym13  ADD R1, R1, Sym14  ADD R1, R1, Sym15  ADD R1, R1, Sym16  ADD R1, R1, Sym17  ADD R1, R1, Sym18  ADD R1, R1, Sym19  ADD R1, R1, Sym20  ADD R1, R1, Sym21  ADD R1, R1, Sym22  ADD R1, R1, Sym23  ADD R1, R1, Sym24  ADD R1, R1, Sym25  ADD R1, R1, Sym26  ADD R1, R1, Sym27  ADD R1, R1, Sym28  ADD R1, R1, Sym29  ADD R1, R1, Sym30  ADD R1, R1, Lit00  ADD R1, R1, Lit01  ADD R1, R1, Lit02  ADD R1, R1, Lit03  ADD R1, R1, Lit04  ADD R1, R1, Lit05  ADD R1, R1, Lit06  ADD R1, R1, Lit07  ADD R1, R1, Lit08  ADD R1, R1, Lit09  ADD R1, R1, Lit10  ADD R1, R1, Lit11  ADD R1, R1, Lit12  ADD R1, R1, Lit13  ADD R1, R1, Lit14  ADD R1, R1, Lit15  ADD R1, R1, Lit16  .END x0 | HTest2600000030  T00001263  T00011263  T00021263  T00031263  T00041263  T00051263  T00061263  T00071263  T00081263  T00091263  T000a1263  T000b1263  T000c1263  T000d1263  T000e1263  T000f1263  T00101263  T00111263  T00121263  T00131263  T00141263  T00151263  T00161263  T00171263  T00181263  T00191263  T001a1263  T001b1263  T001c1263  T001d1263  T001e1263  T001f1263  T00201263  T00211263  T00221263  T00231263  T00241263  T00251263  T00261263  T00271263  T00281263  T00291263  T002a1263  T002b1263  T002c1263  T002d1263  T002e1263  T002f1263  E0000 |
| **Expected:** | Pass |
| **Result:** | Matches Expected Output |