**Testing Plan**

Team BEERZ – Lab 2

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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 |
| Test36 .ORIG  Begin ADD R0, R1, Symbol  Symbol .EQU x3  .END x0 | HTest3600000001  T00001063  E0000 |
| **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 x0FF0  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 <- x0FF0  ST R0,Array ;M[Array] <-x0FF0  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: Program spans multiple memory pages. Relocate or shrink the program to fit inside one memory page. |

### 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 Testing Literal Usage

|  |  |
| --- | --- |
| Assembly | Object File |
| Test28 .ORIG  Test .EQU x3  Begin LD R0, =xFFFFFFFF  .END Begin | HTest2800000002  T00002001M0  T0001ffff  E0000 |
| **Expected:** | Pass |
| **Result:** | Matched Expected Output |

### Relative Program Testing Incorrect Literal Usage

|  |  |
| --- | --- |
| Assembly | Object File |
| Test29 .ORIG  Test .EQU x3  Begin LD R0, =x0FFFFFFF  .END Begin |  |
| **Expected:** | Fail |
| **Result:** | Assemble error: Line 3 - Operand 268435455 out of bounds. |

### Relative Program Containing Blank Line

|  |  |
| --- | --- |
| Assembly | Object File |
| Test30 .ORIG  Test .EQU x3  Begin LD R0, =x1  .END Begin |  |
| **Expected:** | Fail |
| **Result:** | Assemble error: Line 5 - Could not find definition for operation "" with matching operands. |

### Relative Program Containing Multiple .ORIG

|  |  |
| --- | --- |
| Assembly | Object File |
| Test31 .ORIG  .ORIG x30b0  Test .EQU x3  Begin LD R0, =x1  .END Begin |  |
| **Expected:** | Fail |
| **Result:** | Assemble error: Line 2 - Multiple .ORIG instructions are not allowed.  Assemble error: Line 2 - .ORIG instruction must be first non-comment line. |

### Relative Program Containing Multiple .END

|  |  |
| --- | --- |
| Assembly | Object File |
| Test32 .ORIG  Test .EQU x3  Begin LD R0, =x1  .END Begin  .END Test |  |
| **Expected:** | Fail |
| **Result:** | Assemble error: Line 5 - Multiple .END instructions are not allowed. |

### Relative Program Testing Out-of-Order .ORIG

|  |  |
| --- | --- |
| Assembly | Object File |
| Test .EQU x3  Test33 .ORIG  Begin LD R0, =x1  .END Begin |  |
| **Expected:** | Fail |
| **Result:** | Assemble error: Line 2 - .ORIG instruction must be first non-comment line. |

### Relative Program Missing .ORIG and .END

|  |  |
| --- | --- |
| Assembly | Object File |
| Test .EQU x3  Begin LD R0, =x1 |  |
| **Expected:** | Fail |
| **Result:** | Assemble error: Program is missing .ORIG and/or .END instructions. |

### Relative Program Testing Out-of-Range Symbol

|  |  |
| --- | --- |
| Assembly | Object File |
| Test35 .ORIG  Test .EQU x30b0  Begin ADD R0, R1, Test  .END Begin |  |
| **Expected:** | Fail |
| **Result:** | Assemble error: Operand value "Test" (12464) is out of bounds. |

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

|  |  |
| --- | --- |
| Assembly | Object File |
| Test37 .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  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, Sym31  ADD R1, R1, Sym32  ADD R1, R1, Sym33  ADD R1, R1, Sym34  ADD R1, R1, Sym35  ADD R1, R1, Sym36  ADD R1, R1, Sym37  ADD R1, R1, Sym38  ADD R1, R1, Sym39  ADD R1, R1, Sym40  ADD R1, R1, Sym41  ADD R1, R1, Sym42  ADD R1, R1, Sym43  ADD R1, R1, Sym44  ADD R1, R1, Sym45  ADD R1, R1, Sym46  ADD R1, R1, Sym47  ADD R1, R1, Sym48  ADD R1, R1, Sym49  LD R0, =#100  ADD R1, R0, Sym00  LD R0, =#101  ADD R1, R0, Sym00  LD R0, =#102  ADD R1, R0, Sym00  LD R0, =#103  ADD R1, R0, Sym00  LD R0, =#104  ADD R1, R0, Sym00  LD R0, =#105  ADD R1, R0, Sym00  LD R0, =#106  ADD R1, R0, Sym00  LD R0, =#107  ADD R1, R0, Sym00  LD R0, =#108  ADD R1, R0, Sym00  LD R0, =#109  ADD R1, R0, Sym00  LD R0, =#110  ADD R1, R0, Sym00  LD R0, =#111  ADD R1, R0, Sym00  LD R0, =#112  ADD R1, R0, Sym00  LD R0, =#113  ADD R1, R0, Sym00  LD R0, =#114  ADD R1, R0, Sym00  LD R0, =#115  ADD R1, R0, Sym00  LD R0, =#116  ADD R1, R0, Sym00  LD R0, =#117  ADD R1, R0, Sym00  LD R0, =#118  ADD R1, R0, Sym00  LD R0, =#119  ADD R1, R0, Sym00  LD R0, =#120  ADD R1, R0, Sym00  LD R0, =#121  ADD R1, R0, Sym00  LD R0, =#122  ADD R1, R0, Sym00  LD R0, =#123  ADD R1, R0, Sym00  LD R0, =#124  ADD R1, R0, Sym00  LD R0, =#125  ADD R1, R0, Sym00  LD R0, =#126  ADD R1, R0, Sym00  LD R0, =#127  ADD R1, R0, Sym00  LD R0, =#128  ADD R1, R0, Sym00  LD R0, =#129  ADD R1, R0, Sym00  LD R0, =#130  ADD R1, R0, Sym00  LD R0, =#131  ADD R1, R0, Sym00  LD R0, =#132  ADD R1, R0, Sym00  LD R0, =#133  ADD R1, R0, Sym00  LD R0, =#134  ADD R1, R0, Sym00  LD R0, =#135  ADD R1, R0, Sym00  LD R0, =#136  ADD R1, R0, Sym00  LD R0, =#137  ADD R1, R0, Sym00  LD R0, =#138  ADD R1, R0, Sym00  LD R0, =#139  ADD R1, R0, Sym00  LD R0, =#140  ADD R1, R0, Sym00  LD R0, =#141  ADD R1, R0, Sym00  LD R0, =#142  ADD R1, R0, Sym00  LD R0, =#143  ADD R1, R0, Sym00  LD R0, =#144  ADD R1, R0, Sym00  LD R0, =#145  ADD R1, R0, Sym00  LD R0, =#146  ADD R1, R0, Sym00  LD R0, =#147  ADD R1, R0, Sym00  LD R0, =#148  ADD R1, R0, Sym00  LD R0, =#149  ADD R1, R0, Sym00  .END x0 | HTest37000000c8  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  T00301263  T00311263  T00322096M0  T00331223  T00342097M0  T00351223  T00362098M0  T00371223  T00382099M0  T00391223  T003a209aM0  T003b1223  T003c209bM0  T003d1223  T003e209cM0  T003f1223  T0040209dM0  T00411223  T0042209eM0  T00431223  T0044209fM0  T00451223  T004620a0M0  T00471223  T004820a1M0  T00491223  T004a20a2M0  T004b1223  T004c20a3M0  T004d1223  T004e20a4M0  T004f1223  T005020a5M0  T00511223  T005220a6M0  T00531223  T005420a7M0  T00551223  T005620a8M0  T00571223  T005820a9M0  T00591223  T005a20aaM0  T005b1223  T005c20abM0  T005d1223  T005e20acM0  T005f1223  T006020adM0  T00611223  T006220aeM0  T00631223  T006420afM0  T00651223  T006620b0M0  T00671223  T006820b1M0  T00691223  T006a20b2M0  T006b1223  T006c20b3M0  T006d1223  T006e20b4M0  T006f1223  T007020b5M0  T00711223  T007220b6M0  T00731223  T007420b7M0  T00751223  T007620b8M0  T00771223  T007820b9M0  T00791223  T007a20baM0  T007b1223  T007c20bbM0  T007d1223  T007e20bcM0  T007f1223  T008020bdM0  T00811223  T008220beM0  T00831223  T008420bfM0  T00851223  T008620c0M0  T00871223  T008820c1M0  T00891223  T008a20c2M0  T008b1223  T008c20c3M0  T008d1223  T008e20c4M0  T008f1223  T009020c5M0  T00911223  T009220c6M0  T00931223  T009420c7M0  T00951223  T00bb0089  T00ba0088  T00bd008b  T00bc008a  T00bf008d  T00be008c  T00c1008f  T00c0008e  T00b30081  T00b20080  T00b50083  T00b40082  T00b70085  T00b60084  T00b90087  T00b80086  T00c20090  T00c30091  T00c40092  T00c50093  T00c60094  T00c70095  T00980066  T00990067  T00960064  T00970065  T00a0006e  T00a1006f  T009e006c  T009f006d  T009c006a  T009d006b  T009a0068  T009b0069  T00a90077  T00a80076  T00a70075  T00a60074  T00a50073  T00a40072  T00a30071  T00a20070  T00b1007f  T00b0007e  T00af007d  T00ae007c  T00ad007b  T00ac007a  T00ab0079  T00aa0078  E0000 |
| **Expected:** | Pass |
| **Result:** | Matches Expected Output |