# Exercise 3 Answers

1. T = Taken, NT = Not Taken, CBD = Cannot Be Determined

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **BPL** | **BMI** | **BNE** | **BEQ** | **BVC** | **BVS** | **BCC** | **BCS** |
| a | T | NT | NT | T | T | NT | CBD | CBD |
| b | T | NT | T | NT | T | NT | CBD | CBD |
| c | NT | T | T | NT | T | NT | CBD | CBD |
| d | NT | T | T | NT | T | NT | CBD | CBD |
| e | T | NT | NT | T | T | NT | NT | T |
| f | NT | T | T | NT | T | NT | NT | T |
| g | T | NT | T | NT | T | NT | NT | T |
| h | NT | T | T | NT | NT | T | T | NT |
| i | NT | T | T | NT | NT | T | T | NT |
| j | T | NT | T | NT | NT | T | T | NT |
| k | NT | T | T | NT | T | NT | NT | T |
| l | NT | T | T | NT | NT | T | NT | T |
| m | T | NT | NT | T | T | NT | T | NT |



|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **BHI** | **BHS** | **BLS** | **BLO** | **BGT** | **BGE** | **BLE** | **BLT** | **BNE** | **BEQ** |
| a | T | T | NT | NT | NT | NT | T | T | T | NT |
| b | T | T | NT | NT | T | T | NT | NT | T | NT |
| c | NT | NT | T | T | T | T | NT | NT | T | NT |
| d | T | T | NT | NT | NT | NT | T | T | T | NT |
| e | T | T | NT | NT | T | T | NT | NT | T | NT |
| f | NT | NT | T | T | NT | NT | T | T | T | NT |
| g | NT | T | T | NT | NT | T | T | NT | NT | T |
| h | T | T | NT | NT | T | T | NT | NT | T | NT |
| i | T | T | NT | NT | NT | NT | T | T | T | NT |



|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Trace** | **Code**  **Line** | **PC** | **A** | **B** | **N** | **Z** | **V** | **C** |
| 1 | 1 | 1001 | 00 | - | 0 | 1 | 0 | 0 |
| 2 | 2 | 1004 | 00 | - | 0 | 1 | 0 | 0 |
| 3 | 3 | 1006 | 00 | 3 | 0 | 0 | 0 | 0 |
| 4 | 4 | 1008 | 00 | 3 | 0 | 0 | 0 | 0 |
| 5 | 5 | 100A | 0C | 3 | 0 | 0 | 0 | 0 |
| 6 | 6 | 100B | 0C | 2 | 0 | 0 | 0 | 0 |
| 7 | 7 | 1006 | 0C | 2 | 0 | 0 | 0 | 0 |
| 8 | 4 | 1008 | 0C | 2 | 0 | 0 | 0 | 0 |
| 9 | 5 | 100A | 18 | 2 | 0 | 0 | 0 | 0 |
| 10 | 6 | 1008 | 18 | 1 | 0 | 0 | 0 | 0 |
| 11 | 7 | 1006 | 18 | 1 | 0 | 0 | 0 | 0 |
| 12 | 4 | 1008 | 18 | 1 | 0 | 0 | 0 | 0 |
| 13 | 5 | 100A | 24 | 1 | 0 | 0 | 0 | 0 |
| 14 | 6 | 100B | 24 | 0 | 0 | 1 | 0 | 0 |
| 15 | 7 | 1006 | 24 | 0 | 0 | 1 | 0 | 0 |
| 16 | 4 | 100D | 24 | 0 | 0 | 1 | 0 | 0 |
| 17 | 8 | 1010 | 24 | 0 | 0 | 0 | 0 | 0 |
| 18 | 9 | - | - | - | - | - | - | - |



|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Trace** | **Line** | **PC** | **A** | **X** | **Y** | **N** | **Z** | **V** | **C** |
| 1 | 1 | 1003 | - | 3000 | - | 0 | 0 | 0 | - |
| 2 | 2 | 1008 | - | 3000 | - | 0 | 0 | 0 | - |
| 3 | 3 | 100B | - | 3000 | 0003 | 0 | 0 | 0 | - |
| 4 | 4 | 100D | - | 3000 | 0003 | 0 | 0 | 0 | - |
| 5 | 5 | 100F | 64 | 3000 | 0003 | 0 | 0 | 0 | - |
| 6 | 6 | 1010 | 64 | 3001 | 0003 | 0 | 0 | 0 | - |
| 7 | 7 | 1012 | 64 | 3001 | 0003 | 0 | 0 | 0 | 0 |
| 8 | 8 | 1017 | 64 | 3001 | 0003 | 0 | 0 | 0 | 0 |
| 9 | 10 | 1018 | 64 | 3001 | 0002 | 0 | 0 | 0 | 0 |
| 10 | 11 | 100B | 64 | 3001 | 0002 | 0 | 0 | 0 | 0 |
| 11 | 4 | 100D | 64 | 3001 | 0002 | 0 | 0 | 0 | 0 |
| 12 | 5 | 100F | 44 | 3001 | 0002 | 0 | 0 | 0 | 0 |
| 13 | 6 | 1010 | 44 | 3002 | 0002 | 0 | 0 | 0 | 0 |
| 14 | 7 | 1012 | 44 | 3002 | 0002 | 1 | 0 | 0 | 1 |
| 15 | 8 | 1014 | 44 | 3002 | 0002 | 1 | 0 | 0 | 1 |
| 16 | 9 | 1017 | 44 | 3002 | 0002 | 0 | 0 | 0 | 1 |
| 17 | 10 | 1018 | 44 | 3002 | 0001 | 0 | 0 | 0 | 1 |
| 18 | 11 | 100B | 44 | 3002 | 0001 | 0 | 0 | 0 | 1 |
| 19 | 4 | 100D | 44 | 3002 | 0001 | 0 | 0 | 0 | 1 |
| 20 | 5 | 100F | 54 | 3002 | 0001 | 0 | 0 | 0 | 1 |
| 21 | 6 | 1010 | 54 | 3003 | 0001 | 0 | 0 | 0 | 1 |
| 22 | 7 | 1012 | 54 | 3003 | 0001 | 0 | 0 | 0 | 0 |
| 23 | 8 | 1017 | 54 | 3003 | 0001 | 0 | 0 | 0 | 0 |
| 24 | 10 | 1018 | 54 | 3003 | 0000 | 0 | 1 | 0 | 0 |
| 25 | 11 | 100B | 54 | 3003 | 0000 | 0 | 1 | 0 | 0 |
| 26 | 4 | 101D | 54 | 3003 | 0000 | 0 | 1 | 0 | 0 |
| 27 | 12 | - | - | - | - | - | - | - | - |

4.

a. The assembly code is shown on the right for reference

|  |  |  |
| --- | --- | --- |
| **Address** | **Machine Code** | **Assembly Code** |
| 1000 | 87 | CLRA |
| 1001 | 79 | CLR $2000 |
| 1002 | 20 |
| 1003 | 00 |
| 1004 | C6 | LDAB #3 |
| 1005 | 03 |
| 1006 | 27 | BEQ 5 |
| 1007 | 05 |
| 1008 | 8B | ADDA #$C |
| 1009 | 0C |
| 100A | 53 | DECB |
| 100B | 20 | BRA -7 |
| 100C | F9 |
| 100D | 7A | STAA $2001 |
| 100E | 20 |
| 100F | 01 |
| 1010 | 3F | SWI |

b.

|  |  |  |
| --- | --- | --- |
| **Address** | **Machine Code** | **Assembly Code** |
| 1000 | CE | LDX #$3000 |
| 1001 | 30 |
| 1002 | 00 |
| 1003 | 18 | MOVB #0, $2000 |
| 1004 | 0B |
| 1005 | 00 |
| 1006 | 20 |
| 1007 | 00 |
| 1008 | CD | LDY #3 |
| 1009 | 00 |
| 100A | 03 |
| 100B | 27 | BEQ 13 |
| 100C | 0D |
| 100D | A6 | LDAA 0,X |
| 100E | 00 |
| 100F | 08 | INX |
| 1010 | 81 | CMPA #69 |
| 1011 | 45 |
| 1012 | 22 | BHI 3 |
| 1013 | 03 |
| 1014 | 72 | INC $2000 |
| 1015 | 20 |
| 1016 | 00 |
| 1017 | 03 | DEY |
| 1018 | 20 | BRA -15 |
| 1019 | F1 |
| 101A | 3F | SWI |