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CSC 137

Professor Chang

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Homework #3

6.1

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Location | Instruction | AC | PC | IR |
| 010 | CLA | 0000 | 011 | 7800 |
| 011 | ADD 016 | C1A5 | 012 | 1016 |
| 012 | BUN 014 | C1A5 | 014 | 4014 |
| 013 | HLT | 8184 | 014 | 7001 |
| 014 | AND 017 | 8184 | 015 | 0017 |
| 015 | BUN 013 | 8184 | 013 | 4013 |
| 016 | C1A5 |  |  |  |
| 017 | 93C6 |  |  |  |

6.2

|  |  |  |  |
| --- | --- | --- | --- |
| Location | Instruction | Memory word | AC |
| 100 | 5103 | BSA 103 |  |
| 101 | 7200 | CHA | FFFE A |
| 102 | 7001 | HLT |  |
| 103 | 0000 | 5101 |  |
| 104 | 7800 | CLA | 0000 |
| 105 | 7020 | INC | 0001 |
| 106 | C103 | BUN 103 l |  |

6.7

1. Obtain the address symbol table generated for the program of Table 6-13 during the first pass of the assembler

LOP        105        (100)10 = (10 0000 0000 0110 0100) 2

ADS        10B

PTR        10C        (-100) 10 = (1111 1111 1001 1100) 2 = (FF9C) 16

NBR       10D        (75) 10 = (0000 0000 0001 1100) 2 = (0048) 16

CTR        10E

SUM      10F        (23) 10 = (0000 0000 0001 0111) 2 = (0017) 17

Loc         Hex        Org                       100

100        210B      LDA                       ADS

101        310C      STA                       PTR

102        210D     LDA                       NBR

103        310E      STA                       CTR

104        7800      CLA

105        910C      LOP, ADD            PTR I

106        610C      ISZ                         PTR

107        610E      ISZ                         CTR

108        4105      BUN                      LOP

109        310F      STA                       SUM

10A        7001      HLT

10B        0151 ADS, HEX 150

10C        0000 PTR, HEX 0

10D       FF9C NBR, DEC-100

10E       0000 CTR, HEX 0

10F 0000 SJH, HEX 0

ORG 150

150 004b DEC 150

..

..

..

1B3 0017 DEC 23

END

6.21

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Calling Program |  | Subroutine |  |  |
| BSA | SUB | SUB | HEX | 0 |
| HEX | 17FA / subtrahend | LDA | SUB | I |
| HEX | 2CB5 /Minuend | CMA |  |  |
| HEX | 0 / difference | IN |  |  |
|  |  | ISZ | SUB |  |
|  |  | ADD | SUB | I |
|  |  | ISZ | SUB |  |
|  |  | STA | SUB | I |
|  |  | ISZ | SUB |  |
|  |  | BUN | SUB | I |

#5

Assembly

**Loc        Symbol                                  Description**

100         LDA X                    /Load operand from location X

101         CMA                      /Inverse AC

102         INC                        /increment AC (AC has -Y)

103         ADD Y                    /Add Y to AC (AC = X -Y)

104         SPA                        /Skip if AC is positive

105         BUN JMP               /jmp to do Z = X -Y

106         LDA SUM              /Load operand from location SUM

107         LOP, ADD X           /ADD operand X to AC

108         ISZ Y                      /Increment and skip if zero Y (Y++)

109         BUN LOP               /Branch unconditionally to m

110         STA SUM               /Store AC to Sum

111         BUN END              /Branch unconditionally to m (HLT)

112         JMP, LDA Y           /Load operand from location Y (Subtrahend)

113         CMA                      /complement AC, because (-Y) is negative

114         INC                        /Increment AC

115         STA Y                     / Store AC to Y

116         LDA Y                    /Load operand from location Y (Subtrahend)

117         CMA                      /Complement AC, because -(+Y) is negative

118         INC                        /Increment AC

119         ADD X                    /ADD X (minuend) to AC

120         STA Z                     /Store sum of X-Y into Z

120         STA Z                     /Store sum of X-Y into Z

121         END, HLT               /Halt computer

122         X, DEC 4 /Decimal operand X, Y, Z, SUM are the pseudoinstructions specify address symbol

123         Y, DEC -10             /Decimal operand

124         Z, DEC 0 /Decimal operand

125         SUM, DEC 0          /Sum stored in location SUM

126         END                       /End the Symbolic program

Hex

**Location Hex                       Symbol                 Description**

100                        A122                     LDA X                    /Load operand from location X

101                        7200                     CMA                      /Inverse AC

102                        7020                     INC                        /increment AC (AC has -Y)

103                        9123                     ADD Y                    /Add Y to AC (AC = X -Y)

104                        7010                     SPA                        /Skip if AC is positive

105                        C112                     BUN JMP               /jmp to do Z = X -Y

106                        A125                     LDA SUM              /Load operand from location SUM

107                        9122                     LOP, ADD X           /ADD operand X to AC

108                        E123                      ISZ Y                      /Increment and skip if zero Y (Y++)

109                        C107                     BUN LOP               /Branch unconditionally to m

110                        B125                     STA SUM               /Store AC to Sum

111                        C121                     BUN END              /Branch unconditionally to m (HLT)

112                        A123                     JMP, LDA Y           /Load operand from location Y (Subtrahend)

113                        7200                     CMA                      /complement AC, because (-Y) is negative

114                        7020                     INC                        /Increment AC

115                        B123                     STA Y                     / Store AC to Y

116                        A123                     LDA Y                    /Load operand from location Y (Subtrahend)

117                        7200                     CMA                      /Complement AC, because -(+Y) is negative

118                        7020                     INC                        /Increment AC

119                        9122                     ADD X                    /ADD X (minuend) to AC

120                        B124                     STA Z                     /Store sum of X-Y into Z

121                        7100                     END, HLT               /Halt computer

122                        0000X                   DEC 4