Chapter 6: An Introduction to System Software and Virtual Machines

Solutions to End-of-Chapter Exercises

4. a. LOAD 60
   R: 472
   60: 472
   61: -1
   b. STORE 60
   R: 13
   60: 13
   61: -1
   c. ADD 60
   R: 485
   60: 472
   61: -1
   d. COMPARE 61
   R: 13
   60: 472
   61: -1
   e. IN 61
   R: 13
   60: 472
   61: 50
   f. OUT 61
   R: 13
   60: 472
   61: -1

9. Assume that K, L, M, N have already been given values
   a. LOAD K
      ADD THREE
      STORE K
   .
   THREE: .DATA 3
   K: .DATA ...
   b. LOAD L
      ADD ONE
      SUBTRACT M
      SUBTRACT N
      STORE K
   .
   ONE: .DATA 1
   K: .DATA ...
   L: .DATA ...
   M: .DATA ...
   N: .DATA ...
   c. LOAD TEN
      COMPARE K
      JUMPGT OUTPUT
      JUMP NEXT
   OUTPUT: OUT K
   NEXT: next instruction goes here…
d. LOAD L
COMPARE K
JUMPGT GREATER
OUT L
INCREMENT L
JUMP NEXT
GREATER:
OUT K
INCREMENT K
NEXT: next instruction goes here…

K: .DATA ...
L: .DATA ...

e. LOAD ONE
STORE K
LOAD HUNDRED
REPEAT:
OUT K
INCREMENT K
COMPARE K
JUMPGT NEXT
JUMP REPEAT
NEXT: next instruction goes here…

ONE: .DATA 1
HUNDRED: .DATA 100
K: .DATA ...
12. .BEGIN
CLEAR SUM
CLEAR SUM2
IN N --Read in next value
AGAIN:
LOAD ZERO
COMPARE N
JUMPLT NEG
JUMPEQ DONE --if N = 0, finish up
LOAD SUM --N is a positive number
ADD N --add N to positive sum
STORE SUM
IN N --read next N and repeat
JUMP AGAIN
NEG:
LOAD SUM2 --N is negative
ADD N --add N to negative sum
STORE SUM2
IN N --read next N and repeat
JUMP AGAIN
DONE:
OUT SUM --write positive sum
OUT SUM2 --write negative sum
HALT
SUM: .DATA 0
SUM2: .DATA 0
N: .DATA 0
ZERO: .DATA 0

15. This is how the symbol table will look:

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Address</th>
</tr>
</thead>
<tbody>
<tr>
<td>AGAIN</td>
<td>2</td>
</tr>
<tr>
<td>ANS</td>
<td>7</td>
</tr>
<tr>
<td>X</td>
<td>8</td>
</tr>
<tr>
<td>ONE</td>
<td>9</td>
</tr>
</tbody>
</table>

22.

A batch operating system would be far too slow to handle such modern applications, which require real-time responses. Also, in an application such as an airline reservations system, many users need access to the software at the same time.