Solutions for Java Illuminated 5th Edition by Anderson

FIFTH EDITION

JAVA™
Illuminated

An Active Learning Approach

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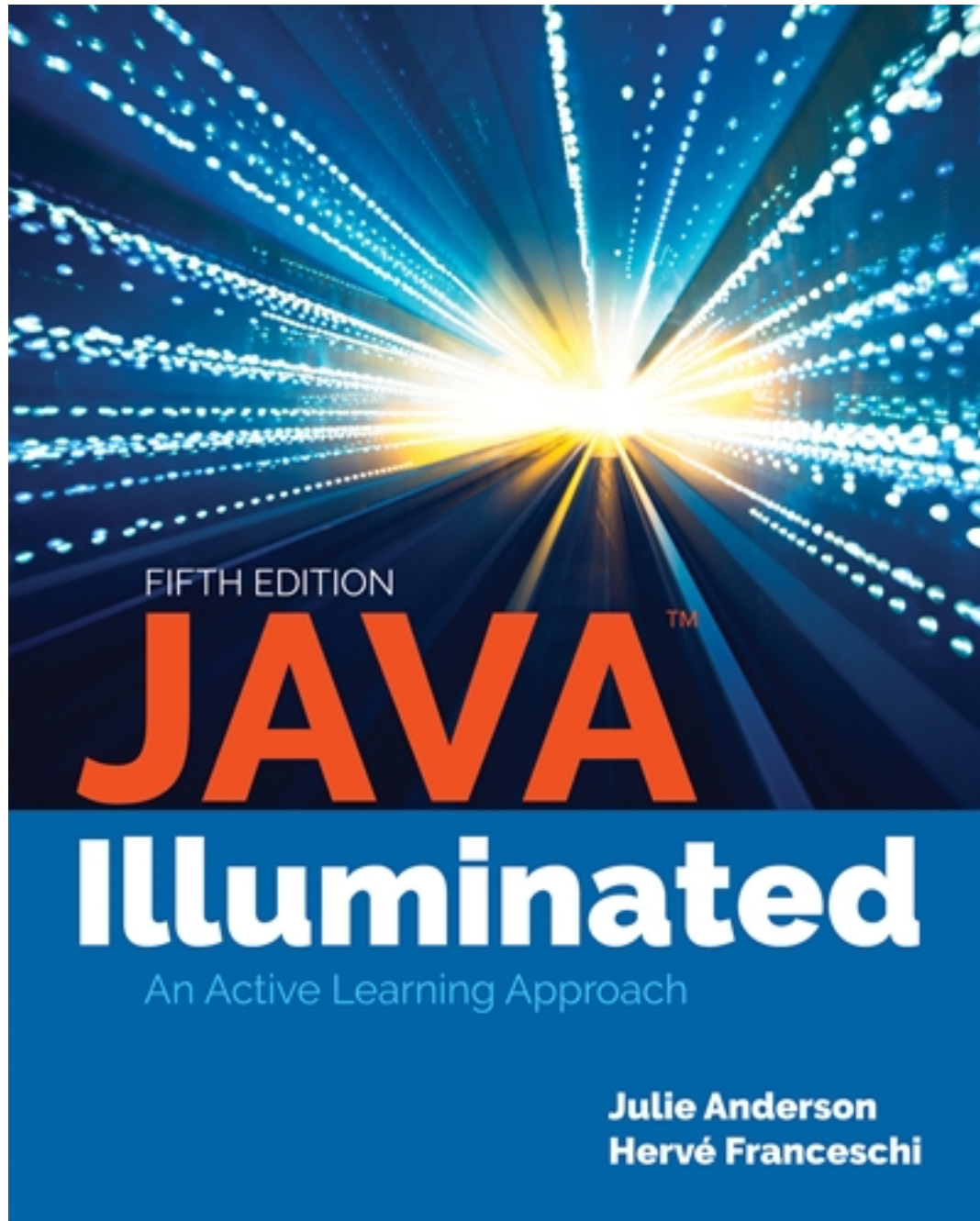
Solutions

1.7 Exercises, Problems, and Projects

1.7.1 Multiple Choice Exercises:

1. Java
2. Linux
3. 24
4. servers
5. is even
6. is odd
7. is a multiple of 4
8. true
9. Windows
10. C
11. .java
12. .class
13. *javac Hello.java*
14. *java Hello*

1.7.2 Converting Numbers

15. 0100 0011
16. 0110 0001 1100
17. 21
18. 3,413
19. 0x15
20. 1101 1000 1111

1.7.3 General Questions

21. 2^7, or 128
22. 2.5 billion
23. 2600 MHz (or 2.6 GHz)
24. with 5 bits, 2^5 or 32 colors; with n bits, 2^n colors
25. red = 51; green = 171; blue = 18
26. 256 shades of grey, including black and white
27. OOP/code reuse, symbolic/easy to use, platform independent
28. *javac*
29. read first number
    read second number
    set product to (first number * second number)
    output product
30. set first total to 0
    set second total to 0
    while there is a number to read, repeat next instruction

```
            if number is greater than or equal to 10
                    add number to first total
            else
                    add number to second total
end while
output first total
output second total
```

Chapter 1 – Exercise # 35 - Group Project

1. Convert 0xC3E into an octal number

We propose 2 algorithms:

<u>Algorithm A: convert to decimal, then convert to octal</u>

First we convert 0xC3E to its decimal equivalent:

C = 12 and E = 14
$0xC3E = 12 * 16^2 + 3 * 16^1 + 14 * 16^0$
$0xC3E = 12 * 256 + 3 * 16 + 14 * 1$
$0xC3E = 3072 \quad + \quad 48 \quad + \quad 14 \quad = \quad 3134$

Then we convert its decimal equivalent, 3134, to its octal representation.

To do that, we decompose 3134 as a sum of powers of 8 with coefficients between 0 and 7
The powers of 8 are: 1, 8, 64, 512, 4096, …

$3134 \quad = 6 * 512 + 62$
$\qquad = 6 * 512 + 7 * 8 + 6$

$3134 \quad = 6 * 512 + 7 * 8 + 6 * 1$
$\qquad = 6 * 8^3 + 7 * 8^1 + 6 * 8^0$

We find that 3134 is 06076 in the octal system.

Thus, 0xC3E is 06076 in octal representation.

<u>Algorithm B: convert to binary, then convert to octal</u>

First we convert 0xC3E to its binary equivalent:

C = 1100, 3 = 0011, and E = 1110
0xC3E = 1100 0011 1110 = 110000111110

Then we regroup the bits 3 at a time starting from the right

0xC3E = 110 000 111 110

Then we convert to octal

0xC3E = 6 0 7 6 = 6076

Thus, 0xC3E is 06076 in octal representation.

2. Convert 0377 into a hexadecimal number

We propose 2 algorithms:

Algorithm A: convert to decimal, then to hexadecimal

First we convert 0377 to its decimal equivalent

$$
\begin{aligned}
0377 &= 3 * 8^2 + 7 * 8^1 + 7 * 8^0 \\
&= 3 * 64 + 7 * 8 + 7 * 1 \\
&= 192 + 56 + 7 \\
&= 255
\end{aligned}
$$

Then we convert its decimal equivalent, 255, to its hexadecimal representation

To do that, we decompose 255 as a sum of powers of 16 with coefficients between 0 and 15
The powers of 16 are: 1, 16, 256, ...

$$
\begin{aligned}
255 &= 15 * 16 + 15 \\
&= 15 * 16 + 15 * 1 \\
&= 15 * 16^1 + 15 * 16^0
\end{aligned}
$$

Since 15 is F in hexadecimal notation, 255 is 0xFF in the hexadecimal system.

Thus, 0377 is 0xFF in hexadecimal representation.

Algorithm B: convert to binary, then to hexadecimal

Convert to binary

$$0377 = 011\ 111\ 111 = 011111111$$

Then we regroup the bits 4 at a time

$$0377 = 011111111 = 0\ 1111\ 1111 = 1111\ 1111$$

Then we convert to hexadecimal

$$0377 = F\ F = 0xFF$$

3 – How to convert, in general, a hexadecimal number to its octal representation and vice versa.

Again, we propose 2 algorithms:

<u>Algorithm A: convert to decimal, then octal or hexadecimal</u>

Convert a hexadecimal number h to its octal representation<u>:</u>

Step 1: convert h to its decimal representation, d
  Each digit in h represents the coefficient of the corresponding power of 16
  For the ith rightmost digit, the corresponding power of 16 is 16^i
Step 2: convert d to its octal representation, o
  Decompose d into a sum of powers of 8 with coefficients from 0 to 7
  The coefficients represent d in the octal system.

Convert an octal number o to its hexadecimal representation:
Step 1: convert o to its decimal representation, d
  Each digit in o represents the coefficient of the corresponding power of 8
  For the ith rightmost digit, the corresponding power of 8 is 8^i

Step 2: convert d to its hexadecimal representation, h
  Decompose d into a sum of powers of 16 with coefficients from 0 to 15
  The coefficients represent d in the hexadecimal system.

<u>Algorithm B: convert to binary, then to octal or hexadecimal</u>

Convert a hexadecimal number h to its octal representation<u>:</u>

Step 1: convert h to its binary representation, b
  Each digit in h is converted to its 4 bits representation in binary (from 0000 for 0 to 1111 for F)

Step 2: convert b to its octal representation, o
  Regroup the bits by groups of 3, starting from the right, and zero filling if necessary to create 3 bits for the leftmost group. Then convert each group to its octal representation

Convert an octal number o to its hexadecimal representation:

Step 1: convert o to its binary representation, b
  Each digit in o is converted to its 3 bits representation in binary (from 000 for 0 to 111 for 7)

Step 2: convert b to its hexadecimal representation, h
  Regroup the bits by groups of 4, starting from the right, and zero filling if necessary to create 4 bits for the leftmost group. Then convert each group to its hexadecimal representation