Chapter 1: An Introduction to Computer Science

Solutions to End-of-Chapter Exercises

Q5.

Step 1: \( carry = 0, c_3 = ??, c_2 = ??, c_1 = ??, \text{ and } c_0 = ?? \)

Step 2: \( i = 0, \text{ all others unchanged} \)

Step 4: \( c_0 = 18, \text{ all others unchanged} \)

Step 5: \( c_0 = 8 \) and \( carry = 1, \text{ all others unchanged} \)

Step 6: \( i = 1, carry = 1, c_3 = ??, c_2 = ??, c_1 = ??, \text{ and } c_0 = 8 \)

Step 4: \( c_1 = 7, \text{ all others unchanged} \)

Step 5: \( carry = 0, \text{ all others unchanged} \)

Step 6: \( i = 2, carry = 0, c_3 = ??, c_2 = ??, c_1 = 7, \text{ and } c_0 = 8 \)

Step 4: \( c_1 = 1, \text{ all others unchanged} \)

Step 5: \( carry = 0, \text{ all others unchanged} \)

Step 6: \( i = 3, carry = 0, c_3 = ??, c_2 = 1, c_1 = 7, \text{ and } c_0 = 8 \)

Step 7: \( c_3 = 0, c_2 = 1, c_1 = 7, \text{ and } c_0 = 8 \)

Step 8: Print out 0178.

Q8. It is not effectively computable if \( b^2 - 4ac < 0 \) (since we cannot take the square root of a negative number) or if \( a = 0 \) (since we cannot divide by 0).

Q10. (a) Trace:

Step 1: \( I = 32, J = 20, \text{ and } R = ?? \)

Step 2: \( I = 32, J = 20, \text{ and } R = 12 \)

Step 3: \( I = 20, J = 12, \text{ and } R = 12 \)
Step 2: $I = 20, J = 12, \text{ and } R = 8$

Step 3: $I = 12, J = 8, \text{ and } R = 8$

Step 2: $I = 12, J = 8, \text{ and } R = 4$

Step 3: $I = 8, J = 4, \text{ and } R = 4$

Step 2: $I = 8, J = 4, \text{ and } R = 0$

Step 4: Print $J = 4$

(b) At Step 2 we are asked to divide $I = 32$ by $J = 0$, which cannot be done. We can fix the problem by adding a step between Step 1 and Step 2 that says: If $J = 0$, then print “ERROR: division by 0” and Stop.


Given: Two positive numbers $a$ and $b$

Wanted: A number $c$ which contains the result of multiplying $a$ and $b$

Step 1: Set the value of $c$ equal to 0

Step 2: Set the value of $i$ equal to $b$

Step 3: Repeat steps 4 and 5 until the value of $i$ is 0

Step 4: Set the value of $c$ to be $c + a$

Step 5: Subtract 1 from $i$

Step 6: Print out the final answer $c$

Step 7: Stop

This algorithm assumes that we know how to add two multiple-digit numbers together. We may assume this because we have the algorithm from the book which does exactly that.
Chapter 2: Algorithm Discovery and Design

Solutions to End-of-Chapter Exercises

Q1. (a) Set the value of \( \text{area} \) to \( \frac{1}{2} b \times h \)

(b) Set the value of \( \text{interest} \) to \( I \times B \)

Set the value of \( \text{FinalBalance} \) to \( (1 + I) \times B \)

(c) Set the value of \( \text{FlyingTime} \) to \( M/\text{AvgSpeed} \)

Q4. Algorithm:

Step 1: Get values for \( P \) and \( Q \)

Step 2: Set the value of \( \text{Subtotal} \) to \( P \times Q \)

Step 3: Set the value of \( \text{TotalCost} \) to \( (1.06) \times \text{Subtotal} \)

Step 4: Print the value of \( \text{TotalCost} \)

Q5.

(a)

If \( y \neq 0 \) then

Print the value of \( \frac{x}{y} \)

Else

Print the message “Unable to perform the division.”

(b)

If \( r \geq 1.0 \), then

Set the value of \( \text{Area} \) to \( \pi \times r^2 \)

Set the value of \( \text{Circum} \) to \( 2 \times \pi \times r \)

Else

Set the value of \( \text{Circum} \) to \( 2 \times \pi \times r \)

Q10. The tricky part is in steps 6 through 9. If you use no more than 1000 kilowatt hours in the month then you get charged \$0.06 for each. If you use more than 1000, then you get charged \$0.06 for the first 1000 hours and \$0.08 for each of the remaining hours. There are \( M_i - 1000 \) remaining hours, since \( M_i \) is the number of hours in the \( i \)th month. Also, remember that \( KWBegin_i \)
and $KW_{End_i}$ are meter readings, so we can determine the total kilowatt-hours used for the whole year by subtracting the first meter reading ($KW_{Begin_1}$) from the last ($KW_{End_{12}}$).

Step 1: Set the value of $i$ to 1

Step 2: Set the value of $AnnualCharge$ to 0

Step 3: While $i \leq 12$ do

Step 4: Get the value of $KW_{Begin_i}$ and $KW_{End_i}$

Step 5: Set the value of $M_i$ to $KW_{End_i} - KW_{Begin_i}$

Step 6: If $M_i \leq 1000$ then

Step 7: Set $AnnualCharge$ to $AnnualCharge + (.06M_i)$

Step 8: Else

Step 9: Set $AnnualCharge$ to $AnnualCharge + (.06)1000$

$+ (.08)(M_i - 1000)$

Step 10: Set the value of $i$ to $i + 1$

End of While loop

Step 11: Print the value of $AnnualCharge$

Step 12: If $(KW_{End_{12}} - KW_{Begin_1}) < 500$, then

Step 13: Print the message “Thank you for conserving electricity.”