C H A P T E R 2

ANALYZING PROBLEMS

Analyze the following 10 problem specifications. The answers for the Analyzing Problems section are located at the end of the section.

1.

> **Problem specification for Quality Builders**
> Quality Builders wants a program that calculates and displays the area of any rectangle. The area is calculated by multiplying the rectangle's length by its width.

WM-Figure 2-1

2.

> **Problem specification for Toys Are Fun**
> Toys Are Fun is increasing (by a specific percentage) the price of each item it sells. The store manager wants a program that calculates and displays an item's increase amount and its new price.

WM-Figure 2-2

3.

> **Problem specification for Dellso Incorporated**
> At the end of every year, Dellso Incorporated gives each of its employees a bonus, which is a percentage of the employee's current annual salary. The owner wants a program that calculates and displays an employee's bonus amount.

WM-Figure 2-3

4.

> **Problem specification for Mary Hernandez**
> Mary Hernandez wants a program that will calculate and display the average of any two numbers.

WM-Figure 2-4

5.

> **Problem specification for Universal Heating and Cooling**
> Universal Heating and Cooling wants a program that calculates and displays the ending inventory amount, given the beginning inventory amount, the amount sold, and the amount returned.

WM-Figure 2-5

6.

> **Problem specification for the city of Joliet**
> The city of Joliet wants a program that calculates and displays a home owner's annual property tax. Currently, the property tax rate is $1.02 per $100 of a property's assessed value; however, the tax rate changes each year.

WM-Figure 2-6

7.

> **Problem specification for Typing Haven**
> Typing Haven currently charges $.10 per typed envelope and $.25 per typed page, although those prices may change in the future. The company accountant wants a program that will help her prepare a customer's bill. She will enter the number of typed envelopes and the number of typed pages, as well as the current charges per typed envelope and per typed page. The program should calculate and display the amount due for the envelopes, the amount due for the pages, and the total amount due.

WM-Figure 2-7

8.

> **Problem specification for Builders Inc.**
> Builders Inc. wants a program that allows its salesclerks to enter the diameter of a circle and the price of railing material per foot. The program should calculate and display the circumference of the circle and the total price of the railing material. Use 3.14 as the value of pi.

WM-Figure 2-8

9.

> **Problem specification for Everyday Tile**
> Everyday Tile wants a program that allows its salesclerks to enter the length and width (both in feet) of a rectangle and the price of a square foot of tile. The program should calculate and display the area of the rectangle and the total price of the tile.

WM-Figure 2-9

10.

> **Problem specification for Johnson Industries**
> The payroll clerk at Johnson Industries wants a program that calculates and displays an employee's net pay. The clerk will enter the gross pay, as well as the tax amount and insurance amount to deduct from the gross pay.

WM-Figure 2-10

ANSWERS FOR THE ANALYZING PROBLEMS SECTION

1.

Input	Processing	Output
length width	Processing items: none	area

WM-Figure 2-11   Input, processing, and output items for the Quality Builders problem

2.

Input	Processing	Output
current price increase percentage	Processing items: none	increase amount new price

WM-Figure 2-12   Input, processing, and output items for the Toys Are Fun problem

3.

Input	Processing	Output
current annual salary bonus percentage	Processing items: none	bonus amount

WM-Figure 2-13   Input, processing, and output items for the Dellso Incorporated problem

4.

Input	Processing	Output
first number second number	Processing items: none	average

WM-Figure 2-14 Input, processing, and output items for the Mary Hernandez problem

5.

Input	Processing	Output
beginning inventory amount sold amount returned	Processing items: none	ending inventory

WM-Figure 2-15 Input, processing, and output items for the Universal Heating and Cooling problem

6.

Input	Processing	Output
property tax rate assessed value	Processing items: none	annual property tax

WM-Figure 2-16 Input, processing, and output items for the city of Joliet problem

7.

Input	Processing	Output
number of envelopes number of pages envelope charge page charge	Processing items: none	amount due for envelopes amount due for pages total due

WM-Figure 2-17 Input, processing, and output items for the Typing Haven problem

8.

Input	Processing	Output
diameter price per foot	Processing items: none	circumference total price

WM-Figure 2-18 Input, processing, and output items for the Builders Inc. problem

9.

Input	Processing	Output
length in feet width in feet square foot price	Processing items: none	area total price

WM-Figure 2-19 Input, processing, and output items for the Everyday Tile problem

10.

Input	Processing	Output
gross pay tax deduction insurance deduction	Processing items: none	net pay

WM-Figure 2-20 Input, processing, and output items for the Johnson Industries problem

PLANNING ALGORITHMS

The answers for the Planning Algorithms section are located at the end of the section.

1. Use the information shown earlier in WM-Figures 2-1 and 2-11 to plan the algorithm for the Quality Builders problem.
2. Use the information shown earlier in WM-Figures 2-2 and 2-12 to plan the algorithm for the Toys Are Fun problem.
3. Use the information shown earlier in WM-Figures 2-3 and 2-13 to plan the algorithm for the Dellso Incorporated problem.
4. Use the information shown earlier in WM-Figures 2-4 and 2-14 to plan the algorithm for the Mary Hernandez problem.
5. Use the information shown earlier in WM-Figures 2-5 and 2-15 to plan the algorithm for the Universal Heating and Cooling problem.
6. Use the information shown earlier in WM-Figures 2-6 and 2-16 to plan the algorithm for the city of Joliet problem.
7. Use the information shown earlier in WM-Figures 2-7 and 2-17 to plan the algorithm for the Typing Haven problem.
8. Use the information shown earlier in WM-Figures 2-8 and 2-18 to plan the algorithm for the Builders Inc. problem.
9. Use the information shown earlier in WM-Figures 2-9 and 2-19 to plan the algorithm for the Everyday Tile problem.
10. Use the information shown earlier in WM-Figures 2-10 and 2-20 to plan the algorithm for the Johnson Industries problem.

ANSWERS FOR THE PLANNING ALGORITHMS SECTION

1.

Input	Processing	Output
length width	Processing items: none Algorithm: 1. enter the length and width 2. calculate the area by multiplying the length by the width 3. display the area	area

WM-Figure 2-21   Input, processing, output, and algorithm for the Quality Builders problem

2.

Input	Processing	Output
current price increase percentage	Processing items: none Algorithm: 1. enter the current price and increase percentage 2. calculate the increase amount by multiplying the current price by the increase percentage 3. calculate the new price by adding the increase amount to the current price 4. display the increase amount and new price	increase amount new price

WM-Figure 2-22   Input, processing, output, and algorithm for the Toys Are Fun problem

3.

Input	Processing	Output
current annual salary bonus percentage	Processing items: none Algorithm: 1. enter the current annual salary and bonus percentage 2. calculate the bonus amount by multiplying the current annual salary by the bonus percentage 3. display the bonus amount	bonus amount

WM-Figure 2-23 Input, processing, output, and algorithm for the Dellso Incorporated problem

4.

Input	Processing	Output
first number second number	Processing items: none Algorithm: 1. enter the first number and second number 2. calculate the average by adding the first number to the second number, and then dividing the sum by 2 3. display the average	average

WM-Figure 2-24 Input, processing, output, and algorithm for the Mary Hernandez problem

5.

Input	Processing	Output

beginning inventory
amount sold
amount returned
	Processing items: none
	
	Algorithm:
	1. enter the beginning inventory, amount sold,
	    and amount returned
	2. calculate the ending inventory by subtracting
	    the amount sold from the beginning inventory,
	    and then adding the amount returned to the result
	3. display the ending inventory
		ending inventory

WM-Figure 2-25 Input, processing, output, and algorithm for the Universal Heating and Cooling problem

6.

Input	Processing	Output

property tax rate
assessed value
	Processing items: none
	
	Algorithm:
	1. enter the property tax rate and assessed value
	2. calculate the annual property tax by dividing the
	    assessed value by 100, and then multiplying
	    the result by the property tax rate
	3. display the annual property tax
		annual property tax

WM-Figure 2-26 Input, processing, output, and algorithm for the city of Joliet problem

7.

Input	Processing	Output
number of envelopes	Processing items: none	amount due for envelopes
number of pages		amount due for pages
envelope charge		total due
page charge		

Algorithm:
1. enter the number of envelopes, number of pages, envelope charge, and page charge
2. calculate the amount due for envelopes by multiplying the number of envelopes by the envelope charge
3. calculate the amount due for pages by multiplying the number of pages by the page charge
4. calculate the total due by adding the amount due for envelopes to the amount due for pages
5. display the amount due for envelopes, the amount due for pages, and the total due

WM-Figure 2-27 Input, processing, output, and algorithm for the Typing Haven problem

8.

Input	Processing	Output
diameter	Processing items: none	circumference
price per foot		total price

Algorithm:
1. enter the diameter and price per foot
2. calculate the circumference by multiplying the diameter by 3.14
3. calculate the total price by multiplying the circumference by the price per foot
4. display the circumference and total price

WM-Figure 2-28 Input, processing, output, and algorithm for the Builders Inc. problem

9.

Input	Processing	Output
length in feet	Processing items: none	area
width in feet		total price
square foot price		

Algorithm:
1. enter the length in feet, width in feet, and square foot price
2. calculate the area by multiplying the length in feet by the width in feet
3. calculate the total price by multiplying the area by the square foot price
4. display the area and total price

WM-Figure 2-29 Input, processing, output, and algorithm for the Everyday Tile problem

10.

Input	Processing	Output
gross pay tax deduction insurance deduction	Processing items: none Algorithm: 1. enter the gross pay 2. calculate the net pay by subtracting the tax deduction and insurance deduction from the gross pay 3. display the net pay	net pay

WM-Figure 2-30   Input, processing, output, and algorithm for the Johnson Industries problem

DESK-CHECKING ALGORITHMS

The answers for the Desk-Checking Algorithms section are located at the end of the section.

1. Desk-check the Quality Builders algorithm shown earlier in WM-Figure 2-21. Use 15 as the length and 10 as the width, and then use 4 as the length and 20 as the width.
2. Desk-check the Toys Are Fun algorithm shown earlier in WM-Figure 2-22. Use 100 as the current price and 10% (.1) as the increase percentage, and then use 5 as the current price and 3% (.03) as the increase percentage.
3. Desk-check the Dellso Incorporated algorithm shown earlier in WM-Figure 2-23. Use 45000 as the current annual salary and 10% (.1) as the bonus percentage, and then use 20000 as the current annual salary and 4% (.04) as the bonus percentage.
4. Desk-check the Mary Hernandez algorithm shown earlier in WM-Figure 2-24. Use 25 as the first number and 50 as the second number, and then use 9 as the first number and 36 as the second number.
5. Desk-check the Universal Heating and Cooling algorithm shown earlier in WM-Figure 2-25. Use 15 as the beginning inventory, 3 as the number sold, and 2 as the number returned, and then use 260 as the beginning inventory, 100 as the number sold, and 3 as the number returned.
6. Desk-check the city of Joliet algorithm shown earlier in WM-Figure 2-26. Use $1.02 per $100 of assessed value as the property tax rate and 150000 as the assessed value, and then use $2 per $100 of assessed value as the property tax rate and 265000 as the assessed value.
7. Desk-check the Typing Haven algorithm shown earlier in WM-Figure 2-27. Use 100 as the number of envelopes, 100 as the number of pages, .10 as the envelope charge, and .25 as the page charge. Then use 10 as the number of envelopes, 15 as the number of pages, .20 as the envelope charge, and .30 as the page charge
8. Desk-check the Builders Inc. algorithm shown earlier in WM-Figure 2-28. Use 35 as the diameter and 2 as the price per foot, and then use 7 as the diameter and 3 as the price per foot.
9. Desk-check the Everyday Tile algorithm shown earlier in WM-Figure 2-29. Use 10 as the length, 6 as the width, and 5 as the price, and then use 20 as the length, 10 as the price, and 3 as the width.
10. Desk-check the Johnson Industries algorithm shown earlier in WM-Figure 2-30. Use 500 as the gross pay, 125 as the tax deduction, and 59 as the insurance deduction. Then use 250 as the gross pay, 50 as the tax deduction, and 10 as the insurance deduction.

ANSWERS FOR THE DESK-CHECKING ALGORITHMS SECTION

1.

length	width	area
~~15~~	~~10~~	~~150~~
4	20	80

WM-Figure 2-31   Desk-check table for the Quality Builders problem

2.

current price	increase percentage	increase amount	new price
~~100~~	~~.1~~	~~10~~	~~110~~
5	.03	.15	5.15

WM-Figure 2-32   Desk-check table for the Toys Are Fun problem

3.

current annual salary	bonus percentage	bonus amount
~~45000~~	~~.1~~	~~4500~~
20000	.04	800

WM-Figure 2-33   Desk-check table for the Dellso Incorporated problem

4.

first number	second number	average
~~25~~	~~50~~	~~37.5~~
9	36	22.5

WM-Figure 2-34   Desk-check table for the Mary Hernandez problem

5.

beginning inventory	amount sold	amount returned	ending inventory
~~15~~	~~3~~	~~2~~	~~14~~
260	100	3	163

WM-Figure 2-35   Desk-check table for the Universal Heating and Cooling problem

6.

property tax rate	assessed value	annual property tax
~~1.02~~	~~150000~~	~~1530~~
2	265000	5300

WM-Figure 2-36   Desk-check table for the city of Joliet problem

7.

number of envelopes	number of pages	envelope charge	page charge
~~100~~	~~100~~	~~.10~~	~~.25~~
10	15	.20	.30

amount due for envelopes	amount due for pages	total due
~~10~~	~~25~~	~~35~~
2	4.50	6.50

WM-Figure 2-37   Desk-check table for the Typing Haven problem

8.

diameter	price per foot	circumference	total price
~~35~~	~~2~~	~~109.9~~	~~219.80~~
7	3	21.98	65.94

WM-Figure 2-38   Desk-check table for the Builders Inc. problem

9.

length in feet	width in feet	square foot price	area	total price
~~10~~	~~6~~	~~5~~	~~60~~	~~300~~
20	10	3	200	600

WM-Figure 2-39 Desk-check table for the Everyday Tile problem

10.

gross pay	tax deduction	insurance deduction	net pay
~~500~~	~~125~~	~~59~~	~~316~~
250	50	10	190

WM-Figure 2-40 Desk-check table for the Johnson Industries problem