Object Oriented Programming sheet 3

Problems on Chapter 4

4.30 (Square of Asterisks) Write an application that prompts the user to enter the size of the side of a square, then displays a hollow square of that size made of asterisks. Your program should work for squares of all side lengths between 1 and 20.

4.31 (Palindromes) A palindrome is a sequence of characters that reads the same backward as forward. For example, each of the following five-digit integers is a palindrome: 12321, 55555, 45554 and 11611. Write an application that reads in a five-digit integer and determines whether it is a palindrome. If the number is not five digits long, display an error message and allow the user to enter a new value.

4.32 (Printing the Decimal Equivalent of a Binary Number) Write an application that inputs an integer containing only 0s and 1s (i.e., a binary integer) and prints its decimal equivalent. [Hint: Use the remainder and division operators to pick off the binary number digits one at a time, from right to left. In the decimal number system, the rightmost digit has a positional value of 1 and the next digit to the left a positional value of 10, then 100, then 1000, and so on. The decimal number 234 can be interpreted as 4 * 1 + 3 * 10 + 2 * 100. In the binary number system, the rightmost digit has a positional value of 1, the next digit to the left a positional value of 2, then 4, then 8, and so on. The decimal equivalent of binary 1101 is 1 * 1 + 0 * 2 + 1 * 4 + 1 * 8, or 1 + 0 + 4 + 8 or, 13.]

4.38 (Factorial) The factorial of a nonnegative integer n is written as n! and is defined for values of n greater than or equal to 1 as:

$$n! = n \cdot (n - 1) \cdot (n - 2) \cdot \ldots \cdot 1$$

and for the n value 0 as:

$$n! = 1$$

For example, 5! = 5 · 4 · 3 · 2 · 1, which is 120.

1. Write an application that reads a nonnegative integer and computes and prints its factorial.
2. Write an application that estimates the value of the mathematical constant ***e*** by using the following formula. Allow the user to enter the number of terms to calculate.

$$e = 1 + \frac{1}{1!} + \frac{1}{2!} + \frac{1}{3!} + \cdots$$

3. Write an application that computes the value of $\boldsymbol{e^x}$ by using the following formula. Allow the user to enter the number of terms to calculate.

$$e^{\chi} = 1\frac{\chi}{1!} + \frac{\chi^2}{2!} + \frac{\chi^3}{3!} + \cdots$$

Problems on Chapter 5

5.17 (Calculating Sales) An online retailer sells five products whose retail prices are as follows: Product 1, $2.98; product 2, $4.50; product 3, $9.98; product 4, $4.49 and product 5, $6.87. Write an application that reads a series of pairs of numbers as follows:

1. product number
2. quantity sold

Your program should use a switch statement to determine the retail price for each product. It should calculate and display the total retail value of all products sold. Use a sentinel-controlled loop to determine when the program should stop looping and display the final results.

5.21 (Pythagorean Triples) A right triangle can have sides whose lengths are all integers. The set of three integer values for the lengths of the sides of a right triangle is called a Pythagorean triple. The lengths of the three sides must satisfy the relationship that the sum of the squares of two of the sides is equal to the square of the hypotenuse. Write an application that displays a table of the Pythagorean triples for side1, side2 and the hypotenuse, all no larger than 500. Use a triple-nested for loop that tries all possibilities. This method is an example of “brute-force” computing. You’ll learn in more advanced computer-science courses that for many interesting problems there is no known algorithmic approach other than using sheer brute force.