

### Practice Problems Set – 3

#### Topics Covered: Loop Statements

1

*(Count positive and negative numbers and compute the average of numbers)* Write a program that reads an unspecified number of integers, determines how many positive and negative values have been read, and computes the total and average of the input values (not counting zeros). Your program ends with the input 0. Display the average as a floating-point number. Here is a sample run:

```
Enter an integer, the input ends if it is 0: 1 2 -1 3 0 ↵Enter
The number of positives is 3
The number of negatives is 1
The total is 5
The average is 1.25
```

```
Enter an integer, the input ends if it is 0: 0 ↵Enter
No numbers are entered except 0
```

2	<p>(<i>Conversion from miles to kilometers</i>) Write a program that displays the following table (note that 1 mile is 1.609 kilometers):</p> <table> <tr> <th>Miles</th><th>Kilometers</th></tr> <tr> <td>1</td><td>1.609</td></tr> <tr> <td>2</td><td>3.218</td></tr> <tr> <td>...</td><td></td></tr> <tr> <td>9</td><td>14.481</td></tr> <tr> <td>10</td><td>16.090</td></tr> </table>	Miles	Kilometers	1	1.609	2	3.218	...		9	14.481	10	16.090
Miles	Kilometers												
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2	3.218												
...													
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3	<p>(<i>Financial application: compute future tuition</i>) Suppose that the tuition for a university is \$10,000 this year and increases 5% every year. Write a program that computes the tuition in ten years and the total cost of four years' worth of tuition starting ten years from now.</p>												
4	<p>(<i>Compute the greatest common divisor</i>) Another solution for Listing 4.9 to find the greatest common divisor of two integers <b>n1</b> and <b>n2</b> is as follows: First find <b>d</b> to be the minimum of <b>n1</b> and <b>n2</b>, then check whether <b>d</b>, <b>d-1</b>, <b>d-2</b>, ..., <b>2</b>, or <b>1</b> is a divisor for both <b>n1</b> and <b>n2</b> in this order. The first such common divisor is the greatest common divisor for <b>n1</b> and <b>n2</b>. Write a program that prompts the user to enter two positive integers and displays the gcd.</p>												
5	<p>(<i>Display pyramid</i>) Write a program that prompts the user to enter an integer from <b>1</b> to <b>15</b> and displays a pyramid, as shown in the following sample run:</p>												

	<div>Enter the number of lines: 7 <input type="button" value="Enter"/></div> <div>1 2 1 2 3 2 1 2 3 4 3 2 1 2 3 4 5 4 3 2 1 2 3 4 5 6 5 4 3 2 1 2 3 4 5 6 7 6 5 4 3 2 1 2 3 4 5 6 7</div>																												
6	<p>(Display four patterns using loops) Use nested loops that display the following patterns in four separate programs:</p> <table><tr><td>Pattern A</td><td>Pattern B</td><td>Pattern C</td><td>Pattern D</td></tr><tr><td>1</td><td>1 2 3 4 5 6</td><td>1</td><td>1 2 3 4 5 6</td></tr><tr><td>1 2</td><td>1 2 3 4 5</td><td>2 1</td><td>1 2 3 4 5</td></tr><tr><td>1 2 3</td><td>1 2 3 4</td><td>3 2 1</td><td>1 2 3 4</td></tr><tr><td>1 2 3 4</td><td>1 2 3</td><td>4 3 2 1</td><td>1 2 3</td></tr><tr><td>1 2 3 4 5</td><td>1 2</td><td>5 4 3 2 1</td><td>1 2</td></tr><tr><td>1 2 3 4 5 6</td><td>1</td><td>6 5 4 3 2 1</td><td>1</td></tr></table>	Pattern A	Pattern B	Pattern C	Pattern D	1	1 2 3 4 5 6	1	1 2 3 4 5 6	1 2	1 2 3 4 5	2 1	1 2 3 4 5	1 2 3	1 2 3 4	3 2 1	1 2 3 4	1 2 3 4	1 2 3	4 3 2 1	1 2 3	1 2 3 4 5	1 2	5 4 3 2 1	1 2	1 2 3 4 5 6	1	6 5 4 3 2 1	1
Pattern A	Pattern B	Pattern C	Pattern D																										
1	1 2 3 4 5 6	1	1 2 3 4 5 6																										
1 2	1 2 3 4 5	2 1	1 2 3 4 5																										
1 2 3	1 2 3 4	3 2 1	1 2 3 4																										
1 2 3 4	1 2 3	4 3 2 1	1 2 3																										
1 2 3 4 5	1 2	5 4 3 2 1	1 2																										
1 2 3 4 5 6	1	6 5 4 3 2 1	1																										

7

(Display numbers in a pyramid pattern) Write a nested **for** loop that prints the following output:

```

          1
        1 2 1
      1 2 4 2 1
    1 2 4 8 4 2 1
  1 2 4 8 16 8 4 2 1
1 2 4 8 16 32 16 8 4 2 1
1 2 4 8 16 32 64 128 64 32 16 8 4 2 1
```

8

(Financial application: loan amortization schedule) The monthly payment for a given loan pays the principal and the interest. The monthly interest is computed by multiplying the monthly interest rate and the balance (the remaining principal). The principal paid for the month is therefore the monthly payment minus the monthly interest. Write a program that lets the user enter the loan amount, number of years, and interest rate and displays the amortization schedule for the loan. Here is a sample run:

Loan Amount: 10000

Number of Years: 1

Annual Interest Rate: 7

Monthly Payment: 865.26

Total Payment: 10383.21

Payment#	Interest	Principal	Balance
1	58.33	806.93	9193.07
2	53.62	811.64	8381.43
...			
11	10.0	855.26	860.27
12	5.01	860.25	0.01

9

(Compute  $e$ ) You can approximate  $e$  using the following series:

$$e = 1 + \frac{1}{1!} + \frac{1}{2!} + \frac{1}{3!} + \frac{1}{4!} + \dots + \frac{1}{i!}$$

Write a program that displays the  $e$  value for  $i = 10000, 20000, \dots$ , and  $100000$ . (Hint: Because  $i! = i \times (i - 1) \times \dots \times 2 \times 1$ , then

$$\frac{1}{i!} \text{ is } \frac{1}{i(i-1)!}$$

Initialize  $e$  and  $item$  to be 1 and keep adding a new  $item$  to  $e$ . The new item is the previous item divided by  $i$  for  $i = 2, 3, 4, \dots$ )



10

(*Display calendars*) Write a program that prompts the user to enter the year and first day of the year and displays the calendar table for the year on the console. For example, if the user entered the year **2013**, and **2** for Tuesday, January 1, 2013, your program should display the calendar for each month in the year, as follows:

January 2013						
Sun	Mon	Tue	Wed	Thu	Fri	Sat
		1	2	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29	30	31		
⋮						
December 2013						
Sun	Mon	Tue	Wed	Thu	Fri	Sat
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30	31				

(Statistics: compute mean and standard deviation) In business applications, you are often asked to compute the mean and standard deviation of data. The mean is simply the average of the numbers. The standard deviation is a statistic that tells you how tightly all the various data are clustered around the mean in a set of data. For example, what is the average age of the students in a class? How close are the ages? If all the students are the same age, the deviation is 0.

Write a program that prompts the user to enter ten numbers, and displays the mean and standard deviations of these numbers using the following formula:

$$mean = \frac{\sum_{i=1}^n x_i}{n} = \frac{x_1 + x_2 + \dots + x_n}{n} \quad deviation = \sqrt{\frac{\sum_{i=1}^n x_i^2 - \frac{\left(\sum_{i=1}^n x_i\right)^2}{n}}{n - 1}}$$

Here is a sample run:

```
Enter ten numbers: 1 2 3 4.5 5.6 6 7 8 9 10 
The mean is 5.61
The standard deviation is 2.99794
```