Problems from session 1 & 2

01 Write a program that asks the user to input 10 integers, and then prints the largest odd number that was entered. If no odd number was entered, it should print a message to that effect.

02 Write a multiplication game program for kids. The program should give the player ten randomly generated multiplication questions to do. After each, the program should tell them whether they got it right or wrong and what the correct answer is.

```
Question 1: 3 x 4 = 12
Right!
Question 2: 8 x 6 = 44
Wrong.  The answer is 48.
...
...
Question 10: 7 x 7 = 49
Right.
```

03 Write a program that asks the user to enter a value n, and then computes $(1+\frac{1}{2}+\frac{1}{3}+\cdots+\frac{1}{n})-\ln(n)$. The ln function is `log` in the `math` module.

04 A number is called a *perfect number* if it is equal to the sum of all of its divisors, not including the number itself. For instance, 6 is a perfect number because the divisors of 6 are 1, 2, 3, 6 and $6 = 1+2+3$. As another example, 28 is a perfect number because its divisors are 1, 2, 4, 7, 14, 28 and $28 = 1+2+4+7+14$. However, 15 is not a perfect number because its divisors are 1, 3, 5, 15 and $15 \neq 1+3+5$. Write a program that finds all four of the perfect numbers that are less than 10000.

05 Write a Python program to count the number of characters (character frequency) in a string.

Sample String : ‘google.com'
Expected Result : {'g': 2, 'o': 3, 'l': 1, 'e': 1, '.': 1, 'c': 1, 'm': 1}

06 The numerical values of coins have been arranged so that the *greedy algorithm* will result in the smallest number of coins when making change. This means that the largest valued coin is tried first, and as many of those coins are used as possible. Then the next smaller denomination coin is used, and so on until the pennies are dealt out. So for 84 cents in change, a 50-cent piece could be used (leaving 34 cents), then a 25-cent piece (leaving 9 cents), a 5 cent piece (leaving 4 cents), and 4 pennies. If no 50-cent piece was available, then 25-cent pieces would be used in its place: 3 quarters, followed by a nickel and four pennies. Write a program that reads a number between 1 and 99 that is an amount of change to be given and prints the coin values that would be used.

07 Calculate an approximation to pi. There is an infinite series called the *Gregory-Leibniz* series that sums to pi. Of course it can never reach the exact value because there is no such thing, but it can compute as many digits as are desired. The series is:

$$\Pi = 4/1 - 4/3 + 4/5 - 4/7 + 4/9 - 4/11 \ldots.$$

Write a program that calculates the result of the first 15 terms of this series. How many digits of pi are correct? Add six more terms. How many digits are correct now?

08 Another series that can calculate pi is the *Nilakantha* series. It is a little more complicated to calculate, but gets close to pi much faster than does the *Gregory-Leibniz* series of Exercise 9. The *Nilakantha* series is:

$$\Pi = 3 + 4/(2*3*4) - 4/(4*5*6) + 4/(6*7*8) - 4/(8*9*10) \ldots$$

Calculate the first 15 terms of this series. How many digits of pi are correct?

09 Pascal's triangle is an arrangement of numbers in rows and columns such that each number in a row is the sum of the two numbers above it. An example is:

1

1 1

1 2 1

1 3 3 1

1											1							
2										1		1						
3									1		2		1					
4								1		3		3		1				
5							1		4		6		4		1			
6						1		5		10		10		5		1		
7					1		6		15		20		15		6		1	
8				1		7		21		35		35		21		7		1
9			1		8		28		56		70		56		28		8		1

10 Write a Python program to create a Caesar encryption.

Note : In cryptography, a Caesar cipher, also known as Caesar's cipher, the shift cipher, Caesar's code or Caesar shift, is one of the simplest and most widely known encryption techniques. It is a type of substitution cipher in which each letter in the plaintext is replaced by a letter some fixed number of positions down the alphabet. For example, with a left shift of 3, D would be replaced by A, E would become B, and so on. The method is named after Julius Caesar, who used it in his private correspondence.