

1908 Matlab Assignment 1 2011

Do the first three questions. Include your code, answer the questions and provide some example results.
Due Sunday Feb 6 at 24:00.

For a bonus try to do one of the more difficult questions!

Problem 1

Write a function or script that takes a positive integer and outputs its proper divisors
Sample run

Input: 8
Output: 1 2 4

Problem 2

Many computer games and simulations involve an element of chance. All computers can generate random numbers (more properly called pseudo-random numbers). In Matlab you can use the function **rand(1,1)** to return a random decimal number d where $0 \leq d < 1$, so to generate random integers in the range 1 to n inclusive you can use the function **floor(rand*n)+1**.

- Write a function or script that uses an integer n and simulates the tossing of a fair coin n times, outputting **HEADS** or **TAILS** for each toss.
When stored as an array, **randArray**, can be plotted in a histogram using **hist(randArray)**
- Write a program that simulates the rolling of a pair of six-sided dice a large number of times and outputs the frequency for each of the scores from 2 to 12.
- What does randn do ?

https://homepages.westminster.org.uk/it_new/programming/prob.asp

Problem 3

Simulate a wave

Waves travel with both a wavelength and a frequency in time, these can be plotted in time steps to show a *traveling wave* - and can also be summed with other waves to create interesting *standing waves* and interference patterns. Average values of a standing wave can also be measured in some circumstances and visualized as nodes and anti-nodes. The following steps will help to create and visualize traveling and standing waves. It is left to the student to find and plot average values to see the nodes or antinodes.

- Create an array x of 100 points
- Iterate time for 'n' time steps
- Using $y = A \sin(\beta x - \omega t)$, $\beta = 2\pi/\lambda$, $\omega = 2\pi f$, f - frequency
calculate y at each time step and plot using :
plot(x,y);
pause(0.1);
- Try different values of wavelength, λ , and frequency, ω , and Amplitude, A
- Create and plot a second wave traveling in the opposite direction
- Plot also the sum of both waves
- The second wave can have a different wavelength, frequency, Amplitude, and direction
- Use the help command for any 'axis' or any other problems

More Difficult Problems :

Problem 1

The sum of the squares of the first ten natural numbers is,

$$1^2 + 2^2 + \dots + 10^2 = 385$$

The square of the sum of the first ten natural numbers is,

$$(1 + 2 + \dots + 10)^2 = 55^2 = 3025$$

Hence the difference between the sum of the squares of the first ten natural numbers and the square of the sum is $3025 - 385 = 2640$.

Find the difference between the sum of the squares of the first one hundred natural numbers and the square of the sum.

Answer : 25164150

Problem 2

2520 is the smallest number that can be divided by each of the numbers from 1 to 10 without any remainder.

What is the smallest positive number that is evenly divisible by all of the numbers from 1 to 20?

Answer : 232792560

Problem 3

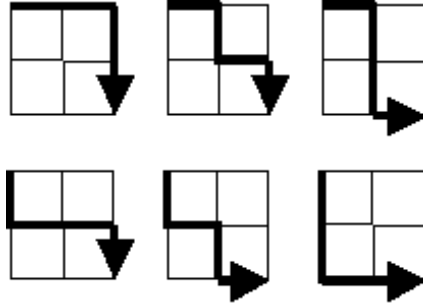
If we list all the natural numbers below 10 that are multiples of 3 or 5, we get 3, 5, 6 and 9. The sum of these multiples is 23.

Find the sum of all the multiples of 3 or 5 below 1000.

Answer : 233168

Problem 4

Starting in the top left corner of a 2×2 grid, there are 6 routes (without backtracking) to the bottom right corner.



How many routes are there through a 20×20 grid?

Answer : 137846528820

Problem 5

Each new term in the Fibonacci sequence is generated by adding the previous two terms. By starting with 1 and 2, the first 10 terms will be:

1, 2, 3, 5, 8, 13, 21, 34, 55, 89, ...

By considering the terms in the Fibonacci sequence whose values do not exceed four million, find the sum of the even-valued terms.

Answer : 4613732

Problem 6

A Pythagorean triplet is a set of three natural numbers, $a < b < c$, for which,

$$a^2 + b^2 = c^2$$

For example, $3^2 + 4^2 = 9 + 16 = 25 = 5^2$.

There exists exactly one Pythagorean triplet for which $a + b + c = 1000$. Find the product abc .

Answer : 31875000

Problem 7

A palindromic number reads the same both ways. The largest palindrome made from the product of two 2-digit numbers is $9009 = 91 \times 99$.

Find the largest palindrome made from the product of two 3-digit numbers.

Answer : 906609

Problem 8

The prime factors of 13195 are 5, 7, 13 and 29.

What is the largest prime factor of the number 600851475143 ?

Answer : 6857

<http://projecteuler.net/>