Practice Examples for Lab: Set 9

- 1

The factorial of a number n is denoted as $n!$, and can be defined using the recurrence $n! = (n-1)!$ for $n > 0$ and $0! = 1$. Write a recursive function to compute $n!$.

- 2

The binomial coefficient $\binom{n}{r}$ can be defined recursively as $\binom{n}{r} = \binom{n-1}{r} + \binom{n-1}{r-1}$, for $n, r > 0$ and $\binom{n}{0} = \binom{n}{n} = 1$ for all $n \geq 0$. Write a function to compute $\binom{n}{r}$.

- 3

Consider the recurrence $W_n = W_{n-1} + W_{n-2} + W_{n-3}$, with $W_0 = W_1 = W_2 = 1$. Write a recursive program for printing W_n. Also write a loop based program.

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- 4

Consider an equation $ax + by = c$, where a, b, c are integers, and the unknowns x, y are required to be integers. Such equations are called Diaphontine equations. If $GCD(a, b)$ does not divide c, then the equation does not have any solution. However, the equation will have infinitely many solutions if $GCD(a, b)$ does divide c. Write a program which takes a, b, c as input and prints a solution if $GCD(a, b)$ divides c.

Hint 1: Suppose $a = 1$. Show that in this case an integer solution is easily obtained.

Hint 2: Suppose the equation is $17x + 10y = 4$. Suppose you substitute $y = z - x$. Then you get the new equation $7x + 10z = 4$. Observe that the new equation has smaller coefficients, and given a solution to the new equation you can get a solution to the old one.