Maple Class 3

We will start to do programming this class. The code can be written in any word editor before having Maple reads it.

Example of Maple command to read the code:
read ‘c:/Users/Asus/Google Drive/Aek/Collatz/Collatz.txt‘;

1 Lecture

Some examples to introduce the command `if` and `for`. The last example is our first example of simulation.

1. Find maximum of the set A
   Name of procedure: `MaxA`
   Input: Set A
   Output: The maximum element of set A.
   Example: Input: `MaxA({3,5,-2,9,6});` Output: `9`

2. Split the set into set of even and set of odd number
   Name of procedure: `SplitEO`
   Input: Set A
   Output: The list of set of even numbers and set of odd numbers.
   Example: Input: `SplitEO({3,5,-2,9,6});` Output: `[{-2,6},{3,5,9}]`

3. Find the set of two values in the set A that add to k
   Name of procedure: `TwoAdd`
   Input: Set A and value k
   Output: The set of pairs that add to k.
   Example: Input: `TwoAdd({-1,8,1,9,3,6},7);` Output: `{{-1,8},{6,1}}`

4. Find the list of all Sophie Germain primes, a prime p such that $2p + 1$ is also a prime.
   Name of procedure: `Germain`
   Input: number N
   Output: The list of all Sophie Germain primes less or equal to N.
   Example: Input: `Germain(20);` Output: `[2, 3, 5, 11]`

5. **Particle Traverse**

   Consider a particle that moves long a set of $m + 1$ nodes, labeled $0, 1, \ldots, m$, that arranged around a circle. At each step the particle is equally likely to move one position in either the clockwise or counter-clockwise direction.

Suppose that the particle starts at 0 and continues to move around according to the preceding rules until all the nodes $1, 2, \ldots, m$ have been visited. What is the probability that node $i, i = 1, 2, \ldots, m$, is the last one visited?

We will write two procedures:

Name of procedure: `LastVisited`
Input: number of node m
Output: Node i that was the last node to be visited so that all the nodes have been visited.
Example: Input: `LastVisited(3);` Output: 3

Name of procedure: `ProbTraverse`
Input: number of nodes, m and number of time to do simulation N
Output: The list of probability $p[i]$ that node i are visited last
Example: Input: `ProbTraverse(3, 100);` Output: `[ 29/100, 39/100, 8/25 ]`

2 Homework: Turn in both your maple-code and maple-worksheet

1. Combining two lists by alternatingly taking elements.
   Name of procedure: `AltCombine`
   Input: List A and B
   Output: The list combining two lists by alternatingly taking elements.
   Example: Input: `AltCombine([a,b,c], [1,2,3]);` Output: `[a, 1, b, 2, c, 3]`

2. **Ramanujan's identity**

   Srinivasa Ramanujan is one of the greatest mathematician of the 20^{th} century. The following expression was one of his amazing identities that he sent to G.H. Hardy, by letter, to ask for a job. Use Maple to find the value of this expression.

$$\sqrt{1+2\sqrt{1+3\sqrt{1+\ldots}}}$$

3. **Birthday Problem**

   a) Do the simulation on the following problem:
   In a set of n randomly chosen people, what is the probability that there is some pair of them having the same birthday?

   In your Maple worksheet show: `seq(ProbBirthday(10*i, 2000),i=1..30);`
   where the first input is the number of people, n, and second input is the number of times you run simulation.

   b) **Bonus:** If you find the formula to back up your experiment.