RISK LATTE

# Assignment #1

Develop a **multi-layered Artificial Neural Network (ANN)** for solving a (non-singular) definite integral (where the integral has an upper limit and a lower limit) and implement that in (a) Python (b) C++ and (c) Microsoft Excel/VBA. The program's input-output should be such that the user can input any function together with an upper limit and a lower limit and the program should output the numerical value of the definite integral.

sir, it means that first we generate definite integral result from ANN, and generated result is verified by the methods as explained below.
is my interpatation right?

Compare the values of the definite integrals thus evaluated with the values of the same definite integrals estimated using:

i. The Chaotic Firefly Algorithm (evolutionary computing)
ii. Analytic methods outlined below:

Analytic approximation to Definite Integrals

(a) The hyperbolic tan approximation

$$\int_a^b f(x)dx \approx 2\tanh\left(\frac{h}{2}f\left(\frac{a+b}{2}\right)\right); \qquad h = b - a$$

(b) The following midpoint approximation

$$\int_a^b f(x)dx \approx hf\left(\frac{a+b}{2}\right); \qquad h = b - a$$

**NOTE**: The **hyperbolic tan** rule above is an extremely robust and efficient estimator of definite integrals, including the very difficult definite integrals which cannot be approximated using the simple numerical schemes.

For your easy reference, attached is an Excel spreadsheet with VBA code for estimating definite integrals using the Chaotic Firefly Algorithm.

Background Research:

- Artificial Neural Networks and Deep Learning
- Key Ideas in Evolutionary Computing
- Chaotic Firefly Algorithm