Problem 1

Problem Statement

Consider a game with M levels and N players. The rules are:

- Everyone starts at level 1, and player 1 starts the game. Player n plays after player $n-1$, unless $n=1$, who plays after player N.
- For a player i at level j, the probability to move to the next level is A_{ij}.
- For $n > 1$, no player can stay at the same level. If a player moves to level n, any player at n moves to $n-1$.
- The values of A_{ij} depend on the player's skill and the natural difficulty, both of which are normally distributed with slow variation.

Let

$$P_j = \lim_{N\to\infty} \frac{1}{N} \sum_{j=1}^{i=N} A_{ij}, \quad Q_i = \lim_{M\to\infty} \frac{1}{M} \sum_{i=1}^{i=M} A_{ij}$$

The probabilities P_j and Q_i are modeled as follows:

$$P_j \sim \frac{1}{1+e^{-(P_{j-1}+N(\mu_1,\sigma_1))}}$$

$$Q_i \sim \frac{1}{1+e^{-N(\mu_2,\sigma_2)}}$$

If the player s has the highest chance of winning, create a program to analyze the variation of

$$\lambda = \frac{s}{N}$$

with the parameters of the game.