For $\gamma_i(p) = \frac{p_i h_i}{n_0 + \sum_{j \neq i} p_j h_j}$

(a) The game G is a non cooperative game where each user is an independent player ~~wh~~ with their own objective function, which is to maximise their SINR

$$G = [M, A, \{\log(p_i^{max} - p_i)\}_{i \in M}]$$

(b) The action set A is the set of power levels that each user can choose to transmit at, subject to a power constraint.

$$A = \{p : f_i(\gamma_i(p)) \geq \gamma_i^{thres}, p_i \in [0, p_i^{max}] \ \forall i \in M.$$

(c) Potential function $Z(p)$ is a function that maps the set of action A to a real number, representing the total utility or payoff of all players. In this case, the ~~$Z(p)$~~ $\rightarrow$

$$Z(p) = \cancel{\sum_i \gamma_i(p)} \sum_{i \in M} \log(p_i^{max} - p_i)$$

(d) Constraint of optimization

The optimization problem is to find Nash Equilibrium of the game. The constraint is the total power constraint which limit sum power levels of all users to fixed value of P_{max}.

$$f_i(\gamma_i(p)) \geq \gamma_i^{thresh}$$

(e) Variable

The variables are

$$p_i \in [0, p_i^{max}]$$